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Impact of Financial Leverage on Financial Sustainability: A Case Study of Microfinance Institutes in China

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Abstract

This scholarly article delves into the evolving landscape of microfinance in China, specifically focusing on microcredit and its impact on small enterprise entrepreneurs. Approximately 30% of China's population faces barriers in accessing traditional banking services due to issues like geographical constraints and limited credit history. The study concentrates on economically disadvantaged regions, particularly along the coastal provinces, using qualitative data methods. Through online focus groups with local microcredit executives and interviews with digital product management experts, the research highlights the vital role of microcredit in empowering micro-entrepreneurs in marginalized communities. However, challenges such as credit qualification regulations hinder its widespread adoption. The study underscores the importance of digital transformation in microfinance and advocates for comprehensive digitization strategies to enhance financial service accessibility for underserved communities. It also emphasizes the crucial role of regulatory policies in promoting financial inclusion. The unique aspect of this review lies in its in-depth analysis of the Chinese microfinance landscape, incorporating firsthand insights from practitioners and digital experts. The findings have significant implications for policymakers and practitioners in China and beyond, aiming to improve access to financial services.

Subject Areas

Economics

*First author and corresponding author.

Keywords

Microfinance, China, Digitization, Financial Inclusion, Financial Leverage, Financial Sustainability

1. Introduction

This review embarks on a journey to explore the multifaceted landscape of microfinance in China, shedding light on the remarkable impact of microcredit on small business proprietors. Our exploration is kindled by the stark reality that nearly 30% of China's population finds itself excluded from the realm of traditional banking services. Diverse factors, spanning geographical remoteness, income disparities, constrained credit histories, and documentation constraints, contribute to this pervasive exclusion. Our quest is to delve deeper into the domain of financial inclusion by placing a magnifying glass on microfinance activities within economically challenged pockets of China, particularly its coastal provinces [1].

Intriguingly, our investigative voyage is powered by two distinct methods. First, we convene online focus groups featuring local microcredit executives, many of whom call bustling urban centers like Shanghai home. Within these discussions, we capture firsthand narratives of individuals navigating financial transactions in precarious contexts. Additionally, we engage in enlightening conversations with Chinese digital product management experts. Our data-gathering arsenal also includes in-depth interviews with seasoned subject-matter experts. Given the intricate nature of microfinance operations and the formidable hurdles to financial inclusion within China, we go for a qualitative research methodology. Our dedicated analysis of the amassed data culminates in a compelling revelation—microcredit emerges as a lifeline for micro-entrepreneurs, particularly those situated within marginalized communities [2].

However, this formidable financial ally faces significant roadblocks, encompassing stringent credit qualification regulations and the weighty financial burdens that accompany them [3].

The illumination provided by our findings is twofold. Firstly, they underscore the paramount importance of digital transformation within the microfinance sphere, heralding a host of potential advantages. Secondly, our results spotlight the pivotal role of regulatory policies in propelling financial inclusion. The uniqueness of this review lies in its thorough scrutiny of the Chinese microfinance ecosystem, fortified by the invaluable perspectives of microfinance practitioners and digital product connoisseurs. The outcomes of this have substantial implications for both policymakers and practitioners, not only within China but also on a global scale. These individuals are driven by a shared goal of expanding the accessibility of financial services (see **Figure 1**).

In the present era, numerous scholarly pursuits have embarked on the endeavor to unravel the manner in which the digitalization of financial services in the

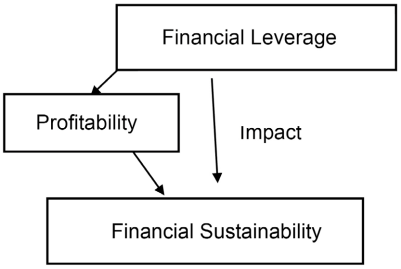

Figure 1. Navigating the financial landscape: unraveling the dynamics of financial leverage, profitability, and financial sustainability.

banking sector can foster the attainment of financial inclusivity (see **Figure 2**). Theoretical frameworks have been forged through insightful case studies, with a particular spotlight on East Africa's transformational journey. The surge of mobile phone technology in the African continent has ushered in rapid advancements in mobile banking, effectively extending financial services to unbanked individuals, especially in rural hinterlands where traditional banking infrastructure remains sparse [4].

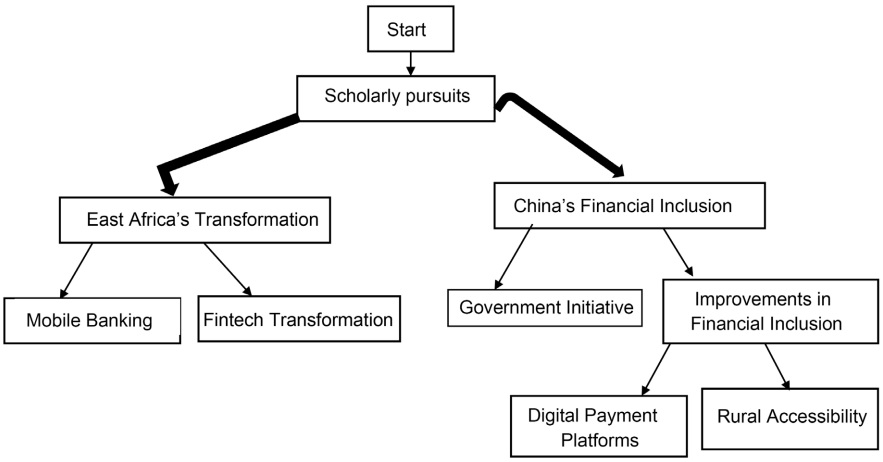

Figure 2. Charting the course of progress: from scholarly pursuits to East Africa's transformation—exploring the factors driving financial inclusion and accessibility.

Kenya, an East African nation, emerges as a trailblazer in mobile banking penetration, courtesy of its substantial contributions to enhancing financial inclusion within Sub-Saharan Africa. Digitization stands as a formidable agent of change in society today, transcending beyond financial services to revolutionize operational dynamics and interaction paradigms within production processes [5].

The financial industry's digital transformation, commonly referred to as Fintech, has reshaped the contours of financial services by providing users access to an array of services, ranging from elementary balance inquiries to intricate transactions. The resultant shift has redefined the parameters for evaluating service quality and accessibility [6].

Digitization's role in financial inclusion cannot be overstated. Its potential to address the financial needs of society's most vulnerable strata is manifest. Digitization paves the path for these individuals to access regulated financial institutions, rendering financial services safer, more affordable, and more convenient. Nevertheless, promoting financial inclusion via digitization is not devoid of challenges, with issues like digital device accessibility, skill gaps in mobile application use, and basic financial literacy emerging as critical determinants [7].

China, a global economic powerhouse, grapples with varying levels of financial inclusion across regions and demographics. Despite notable advancements in the expansion of digital financial services, specifically the widespread adoption of digital payment platforms such as Alipay and WeChat Pay, there are still persistent obstacles in ensuring equitable access to fundamental financial services, particularly in rural areas and among economically disadvantaged populations [8].

To address these obstacles, the Chinese government has undertaken numerous endeavors to promote financial inclusivity. These endeavors encompass the extension of digital financial services, enhanced availability of credit for Small and Medium Enterprises (SMEs), and a concentrated emphasis on financial literacy, particularly in rural regions [9]. Despite the hurdles, China has witnessed considerable improvements in financial inclusion. The proliferation of digital payment platforms has significantly augmented accessibility, even in regions where conventional banking services remain elusive [10]. Consequently, China is poised to continue its trajectory towards enhanced financial inclusion.

2. Literature Review

2.1. Microfinance Institutes in China

Microfinance plays a pivotal role in addressing the financial requirements of individuals and small enterprises frequently overlooked by conventional banking avenues. Given China's extensive population and diverse economic panorama, it harbors a distinct microfinance ecosystem [11] [12]. Within China's microfinance sector, there exist various stakeholders, including microcredit firms and microfinancing guarantee entities. These institutions share the common objective of bridging the financial divide by extending modest loans and financial assistance to microentrepreneurs and individuals who may not meet the conventional banking requisites. To attain a holistic grasp of the microfinance milieu, it is imperative to underscore the significant actors and delineate their respective roles within the sector. Microcredit enterprises, for instance, specialize in disbursing microloans to entrepreneurs and small business proprietors, empowering them to invest in their enterprises and generate income [13].

Conversely, microfinancing guarantee companies assume a pivotal role in risk mitigation. They furnish lenders with guarantees, thereby elevating the probability of loans being extended to micro-entrepreneurs who may lack adequate collateral or a substantial credit history. A nuanced comprehension of the distinctive functions of these participants allows us to fathom the intricacies of China's

microfinance domain. Financial Leverage and Its Impact on Sustainability: Within the microfinance realm, financial leverage entails the utilization of borrowed capital, frequently in the form of debt, to magnify financial activities and investments [14].

2.2. Financial Leverage and Sustainability

Financial leverage and sustainability constitute a pivotal facet of our investigation. Grasping how microfinance institutions in China harness financial leverage and the repercussions it exerts on their sustainability forms the crux of our exploration. Our study acknowledges the pivotal role played by profitability in the intricate interplay between financial sustainability and capital leverage. Nevertheless, the precise mechanisms through which profitability mediates this interrelationship remain enigmatic. Our objective is to elucidate the nuanced dynamics involving financial sustainability, profitability, and capital leverage within the microfinance landscape of China [15]. The shared objective of global society is sustainable development. The 2030 Agenda for Sustainable Development underscores "No Poverty" and "Zero Hunger" as its central goals, intricately connected to the broader objectives of "Decent Work and Economic Growth Industry" and "Innovation and Infrastructure". China has exhibited a substantial commitment to attaining its No Poverty targets, employing a targeted strategy known as Jingzhunfupin. This approach involves precise poverty identification, support, management, and tracking, leading to China successfully reaching its poverty alleviation goal by 2021, marking a noteworthy achievement [16]. In response to the evolving landscape of poverty, research has shifted from a singular emphasis on income poverty to multidimensional poverty and from a macroscopic perspective to microscopic individual behavior analysis. Cross-disciplinary integration, encompassing sociology, psychology, and public management, has enriched and deepened poverty research. Pioneering studies explore the interconnectedness between "No Poverty" and other Sustainable Development Goals (SDGs). For instance, researchers scrutinize the alignment of climate targets with global poverty eradication, while others investigate the impacts and synergies of achieving various poverty eradication goals on air quality in China. These cutting-edge studies provide valuable insights into integrating poverty reduction with resource and environmental concerns, addressing aspects such as energy inequity and carbon emissions. Summarizing research on diverse poverty realities and academic backgrounds should furnish both theoretical and empirical guidance to expedite global poverty elimination [17]. Previous literature reviews on poverty reduction often concentrated on specific sub-themes. Noteworthy examples include researchers, who explored urban poverty, foreign aid, microfinance, and related topics, investigating the causes, policies, and mechanisms of poverty and poverty reduction. However, a notable characteristic of these reviews is their manual synthesis of articles, restricting the scope of literature analyzed and resulting in an incomplete understanding of poverty research. The manual review of specific fields within poverty reduction

creates a research gap, necessitating a more comprehensive analysis to delineate the broader academic knowledge in this domain, despite the abundance of existing research [18]. On a positive note, the evolution of analytical technology has led to the widespread adoption of bibliometrics for generating representative summaries of key findings, finding application across various fields. In the realm of poverty studies, researchers utilized bibliometric methods to review thousands of papers on poverty and inequality in Latin America. Given the aforementioned issues, our aim is to broaden the scope of the literature and conduct a systematic bibliometric analysis to provide a preliminary overview of the research agenda on poverty reduction [19]. This paper encompasses an analysis of publications, keywords, citations, and networks of co-authors, co-words, and co-citations, presenting the research landscape, hotspots, and evolution over time. Utilizing R language and VOS viewer software for data processing and visualization, our contributions unfold in three main aspects. Firstly, employing the bibliometric method, we collectively review thousands of papers, ensuring alignment with the latest developments in poverty alleviation amid the rapid growth in literature. Secondly, we clarify core and peripheral research areas and their interconnections, aiming to address the trend towards scientific specialization and promote communication and collaboration between disciplines, thereby mitigating segmentation between individual studies. Thirdly, we provide insightful implications for future research directions, emphasizing the importance of discipline integration, intergenerational poverty, and heterogeneous research [20]. The structure of this article unfolds in the following manner: "Methodology and Initial Statistics" outlines the methodology and initial statistics, while "Bibliometric Analysis and Network Analysis" delves into the bibliometric analysis and network visualization. Subsequent sections present discussions and conclusions. Despite undertaking an extensive literature review, our bibliometric analysis has several limitations. Firstly, a fraction of the literature is inevitably lost due to the criteria of keywords and titles used to precisely focus the search results on our subject. While the Web of Science core collection, on which our study relies, has some limitations in coverage, we prioritize the quality over quantity of literature, resulting in a potentially incomplete representation of research comprehensiveness. Secondly, while we can identify recent research status, accurately pinpointing the frontier poses challenges. Network mapping involves selecting a minimum occurrence threshold for including corresponding authors, keywords, and citations into the network. This threshold may overlook essential data, such as new hotspots or citations that take several years to gain widespread use and study [21].

Moreover, an increased focus on intergenerational poverty is imperative, requiring an extension of the observation time span and questionnaire investigations. Existing work, such as the research on the anti-poverty potential of advances in irrigation technologies, emphasizes the need for ongoing efforts. Similarly, research reveals that Conditional Cash Transfers (CCTs) can disrupt the intergenerational cycle of poverty through investments in human capital. Nev-

ertheless, substantial work remains to prevent the next generation from falling back into poverty during this turbulent period. The role of education in breaking the cycle of intergenerational poverty or falling into the poverty trap should be emphasized, with questions arising about the effectiveness of different types of education (quality education vs. vocational skill education), efficient allocation of educational resources, and the need for psychological intervention for poor students to mitigate the impact of their family background and foster confidence [22]. Furthermore, investigating strategies to lift specific economically disadvantaged areas out of poverty is also of great significance, necessitating ongoing research efforts. Moreover, the alleviation of poverty must consider individual or group-specific characteristics to some extent. Implementing a uniform, large-scale poverty alleviation policy is impractical. Rigorous randomized controlled trials are employed to reveal the diverse impact of poverty alleviation programs. For instance, researchers compared the differences between monthly transfers and one-time lump-sum transfers. There is a need to enhance research subdivision on the effects of poverty reduction programs. Envisioning the creation of a predictive model to anticipate the overall effects of various policies on poverty reduction in different regions could lead to an optimized "No Poverty" strategy in the future [23]. Lastly, exploring whether poverty reduction will conflict with or complement other Sustainable Development Goals (SDGs) may become a popular direction. Regarding the literature review, two aspects can be improved. The first involves merging with other databases to assess the trade-off between quality and quantity. Subsequent literature reviews need to explore how to better integrate manual literature collation and bibliometrics, particularly in the context of extensive topics. Poverty reduction is a focal point in welfare economics and development economics, representing a timeless and enduring subject that has gained recent prominence. Studies on poverty reduction in the 21st century typically center on specific poverty alleviation projects or policies in developing countries. Researchers investigate various aspects, including the precise identification and coverage of the target audience in the design and implementation process, the effectiveness of poverty reduction projects, the mechanisms contributing to their success, and the causes of their failure. This paper aims to summarize the quantity, growth trajectory, citations, and geographic distribution of poverty reduction literature, map the intellectual structure, and highlight emerging key areas in the research domain using the bibliometric method. The VOS viewer software and the R language are employed to analyze 2,459 articles published since 2000 [24]. Lastly, in the analysis of co-keywords, four distinct clusters delineate the research focuses in each region. In Africa, poverty reduction is closely linked to concerns about basic livelihood and ecology. Studies in China and India predominantly center on the economic conditions of the impoverished. The South Asia region serves as a hub for experiments with microcredit programs, while Latin America's literature frequently delves into interconnected issues of poverty traps and environmental challenges. Our findings also yield insights for future research directions. There may be a need to explore

interdisciplinary integration. Attention to intergenerational and urban poverty is essential. Further investigation into the diverse design of poverty alleviation strategies is warranted. Exploring whether poverty reduction might conflict with other Sustainable Development Goals (SDGs) and conducting scenario simulations could emerge as a significant avenue. While our study uncovers valuable insights, it underscores the necessity for additional exploration to precisely identify research frontiers [25]. However, there are crucial challenges to overcome, emphasizing the importance of the interrelationship between sectors, actors, and countries that have lesser and greater economic development. Additionally, it can be pointed out the strong interdependencies between the failure or delay to implement one goal and how it will have repercussion in the other goals. Consequently, due to these interrelationships' complexity, it is valuable for researchers to assess the status of the SDG research, for instance by mapping the existing knowledge or creating new knowledge to contribute to achieving the goals defined by the United Nations and also allow the overcoming of previous partial approaches to sustainable development. A simple query performed through Web of Science (WoS) using the keywords "Sustainable Development Goal" performed on October 1, 2022 resulted in 37,937 records. This demonstrates the great interest in the SDG as an object of research in recent years. Given these numbers, it is relatively difficult to map and identify the status of SDG research because of their infinity. Other issues deal with subjectivity, transparency, and delay in the literature review process [26].

A broad view of a research area is important for obtaining valuable and impartial prospects for future research developments. Thus, a comprehensive review is needed to facilitate the integration of the contributions to provide a critical perspective. Bibliometric analysis is a statistical technique applied to examine the scientific production in a field of research. It allows studying the evolution of knowledge on a given topic during a certain period of time based on data publication. It combines two main procedures: 1) the performance analysis and 2) science mapping. The performance analysis is established on indicators that provide data about the amount and impact of the research through the application of several techniques, such as citation analysis, counting publications, and word frequency analysis by a unit of analysis. Science mapping is a graphic representation of how different scientific elements are interrelated. It shows the impact, structural, and dynamic organization of a knowledge topic, a field of research, a group of researchers, or a document, based on relation indicators. Science mapping allows finding insights into patterns of a knowledge area that would be difficult to identify using traditional research review methods [27]. Furthermore, science mapping analysis can be used to show or uncover some invisible key elements in a specific interest area. Although many bibliometric studies have been found in the field of SDGs research, most of them focus on specific disciplines, such as SDG and the business sector, education, and poverty, and few bibliometric studies cover the SDG general aspects and its evolution. Nevertheless, some interesting bibliometric studies of SDG trends are worth mentioning. Pre-

vious bibliometric studies have reported that research related to the SDGs is focused mainly on health, climate change, food, energy, and sanitation. Controversially, the present research found that academic research on SDGs 8, 9, and 11, which were considered poorly researched and lacking in consolidated literature, obtained greater evidence, despite the number of occurrences and citations that can lead to an erroneous conclusion. This result is very important, as it is possible to observe the rapid growth and the importance of technology to achieve the goals, aiming at profitability and economic growth, in addition to pursuing environmental benefits. The third cluster is composed of a miscellaneous of SDG. However, regarding the occurrences of keywords, the keyword health is central and is the most used keyword in this cluster with 37 occurrences, followed by water, cities, indicators, and sanitation [28].

Furthermore, in regard to the ANC of the keywords, life-cycle assessment, waste management, tourism, and industry presented the higher scores. This result indicates that the most influential keywords in this cluster are related to economic growth, industry, innovation, and production, which are also linked to health conditions and the reduction of impacts on the planet, explaining the occurrence of the keywords, such as emission and environmental impacts that are also part of this cluster. The keywords food security, agriculture, and food are the most used keywords in the fourth cluster and are associated with SDG 2. Bioenergy and waste-water are also present in the fourth cluster and can be also linked to the agricultural and/or food production. Some keywords could be attributed to SDG 15, such as land and soil [29].

However, they possibly refer to land cultivation and therefore, are aiming at higher agricultural productivity, and thus, they were also classified as SDG 2. Furthermore, trade-offs and stakeholders were among the most evident keywords according to the ANC, and are related to the difficulties of implementing the SDG, being the only cluster where the 5Ps category partnership was found. This result indicates that applied research aiming at the implementation of the SDG is being developed. The most prominent keyword in the fifth cluster is climate change, with 53 occurrences, followed by ecosystem, adaptation, biodiversity, and gender. This cluster is well-defined and its issues can be assigned mainly to SDGs 13 and 15, and consequently to the 5Ps category, planet. Furthermore, regarding the ANC, it was noted that this cluster presented the lowest ANC, indicating the inferior relevance of the topic among the review articles studied. No review articles related to marine water (SDG 14) were found. Some authors also include freshwater in SDG 14, as being "life below water." However, in the official document, the 2030 agenda only includes marine life. Many authors disagree with this distribution, which also causes some disagreements in the classification of SDG 6 on 5Ps, such as people or planet [30]. Researchers addressed this issue in his paper and proposed a relative distribution of the 5 Ps among the 17 SDGs according to the targets, whereas for SDG 6, about 40% corresponded to planet and 31% to people. Therefore, the lack of review articles on SDG 14 indicates a research gap in this field. The sixth and last cluster in-

cludes the keywords, Electricity, greenhouse-gas, emissions, renewable energy, and barriers, developing countries that can be attributed to the SDGs 7, 10, and 13. International collaborative studies between developing countries and high-income countries were reported previously. These collaborations are important for understanding the dynamics that affect developing countries due to the mixed and complicated impacts on achievement of SDG. In this cluster, the most frequent keyword was developing countries; however, the ones with the highest ANC were electricity and greenhouse-gas emission, while developing countries were the ones with the lowest ANC, indicating assuredly that the number of citations is not an adequate method for measuring subject relevance. In addition, the SDG 16, peace, justice, and strong institutions, showed to be a major gap in the research on SDG literature reviews [31]. This topic is directly related to society, policies and governments, and plea for global peace. The targets also aim to reduce violence, corruption, bribe, exploitation, trafficking, torture, abuse, illicit arms, and organized crime, and also develop international cooperation, participatory, and inclusive decision-making, inclusive. Armed conflicts pose serious threats within the reach of the SDGs. As an example, the Russian-Ukrainian armed conflict is a dramatic world event that, in addition to the loss of life, impacts the environment, economy, and society. Both in countries directly involved, as well as in other countries, especially in developing countries, which are more vulnerable to the economic crisis. The negative regional and global impact could weaken the ability of many nations to achieve the SDGs by 2030, and could even make them unattainable [32].

3. Methodology

This investigation utilizes a quantitative research methodology to delve into the connection between the attributes of Microfinance Institutions (MFIs) and their monetary performance, with particular attention to the influence of leverage and organizational structure. The data employed consists of descriptive statistics gathered from a subset of MFIs, classified into low-leverage and high-leverage groups, as well as nonprofit and for-profit MFIs. The primary aim is to investigate how variations in these MFI attributes influence key financial indicators.

3.1. Data Collection and Analysis

The dataset for this investigation encompasses 800 MFIs, each categorized based on their leverage (low or high) and organizational type (nonprofit or for-profit), here is number of each category, Low leverage nonprofit MFIs; 85, Low leverage for profit MFIs; 85, High leverage nonprofit MFIs; 115, High leverage for profit MFIs; 470. Descriptive statistics for various financial and operational variables, including operational sustainability, average loan per borrower, gross loan portfolio, total equity, debt to equity ratio, total expense ratio, cost per borrower, the proportion of women borrowers, number of borrowers, years in operation, and financial self-sufficiency, the data source of these statistics is taken from industry

reports, financial statements and operational records of microfinancing institutions.

To assess the significance of the observed differences in mean values among distinct MFI categories, statistical analysis techniques will be employed. Specifically, one-way Analysis of Variance (ANOVA) tests will be conducted to determine the significance of mean differences between low-leverage and high-leverage MFIs, as well as between nonprofit and for-profit MFIs, for each variable. This analysis will employ two significance thresholds, precisely 1% and 5%, to determine the statistical importance of observed mean disparities. A significance level of 1% will indicate a substantial statistical importance, while a significance level of 5% will suggest a moderate statistical relevance.

The anticipated outcomes of this investigation are poised to provide valuable perspectives on how leverage and organizational structure impact the financial performance of Microfinance Institutions (MFIs).

These insights hold the potential to benefit policymakers, practitioners, and stakeholders in the microfinance sector by enhancing their comprehension of the factors that underpin the prosperity and endurance of MFIs.

Table 1 presents analysis of the key metrics for Microfinance Institutions (MFIs) segmented by different categories (All MFIs, Low disclosure, High disclosure, Nonprofit, and For profit).

3.2. Model and Empirical Results

The focus of the study is to examine the impact of financial sustainability on the depth of outreach, where depth of outreach is measured using the average size of loans. A lower average loan size indicates a deeper outreach.

3.3. Model Specification

The depth of outreach is measured using the following equation:

Table 1. Leverage (low or high) MFIs.

All variables	All MFIs	Low disclosure	High disclosure	Nonprofit	For profit
Operational sustainability	1.2000	1.1590	1.2180	1.1730	1.2400
Average loan per borrower	0.7300	0.8800	0.6600	0.6000	0.9350
Gross loan portfolio	25.0000	17.0000	30.0000	12.0000	46.0000
Total equity	6.0000	2.3000	7.5000	4.0000	8.7000
Debt to equity ratio	7.5000	12.0000	5.6000	7.6000	7.8000
Total expense ratio	0.2500	0.2400	0.2570	0.2480	0.2550
Cost per borrower	0.2500	0.2400	0.2570	0.2480	0.2550
Number of borrowers	70,000	60,000	80,000	50,000	90,000
Years in operation	12.10	11.80	12.20	13.20	10.50
Financially self-sufficient	580	160	420	330	250
N	800	220	580	500	300

$$\ln(ALBG_i) = \beta_0 + \beta_1 * FSS_i + \beta_2 * \ln(GLP_i) + \beta_3 * \ln(TEQ_i) + \beta_4 * DER_i + \beta_5 * TER_i + \beta_6 * \ln(CPB_i) + \beta_7 * WBR_i + \varepsilon_i$$

where:

- $\ln(ALBG_i)$ represents the natural logarithm of the Average Loan Balance per Borrower divided by Gross National Income.
- FSS_i is a dummy variable that equals 1 if the firm is financially self-sufficient (i.e. Operational Self-Sufficiency is 100%), and 0 otherwise.
- $\ln(GLP_i)$ is the natural logarithm of Gross Loan Portfolio in US Dollars.
- $\ln(TEQ_i)$ is the natural logarithm of Total Equity in US Dollars.
- DER_i represents the Debt to Equity Ratio.
- TER_i is the Total Expense Ratio.
- $\ln(CPB_i)$ is the natural logarithm of the Cost of Loan per Borrower.
- WBR_i represents the number of Women Borrowers as a fraction of the Total Number of Borrowers.
- ε_i is the error term.

3.4. Model Estimation

The study initially faces the endogeneity problem, as depth of outreach depends on financial performance, and financial performance may also depend on outreach. To address this, a Logit model is estimated where financial performance is a function of outreach. Subsequently, a three-Stage Least Squares (3SLS) model is estimated to handle the endogeneity issue.

In this model, both outreach and financial performance are included as dependent variables. The 3SLS estimation takes into account the potential endogeneity between outreach and financial performance. Several diagnostic tests are conducted; Shapiro-Wilk W test is used to check for normality of residuals. Diagnostic plots are generated for visual inspection of normality. Cameron and Trivedi's decomposition of IM-test and the Breusch-Pagan/Cook-Weisberg test are used to check for heteroscedasticity. Diagnostic plots of residuals are examined for any indications of heteroscedasticity.

Table 2 presents the estimated coefficients and t-statistics for five different variations of the model, including the full sample, low disclosure firms, and high disclosure firms. A dummy variable is included to distinguish between not-for-profit and for-profit MFIs. The coefficients and t-statistics provide insights into the relationship between financial sustainability and the depth of outreach, considering various control variables and different subsets of MFIs. Adjusted R^2 values indicate the goodness-of-fit of the models.

3.5. Logit Model Specification

The Logit model to estimate the impact of different factors on financial self-sustainability for MFIs is specified as follows:

$$P(FSS_i) = \beta_0 + \beta_1 \ln(GLP_i) + \beta_2 \ln(TEQ_i) + \beta_3 DER_i + \beta_4 TER_i + \beta_5 LLR_i + \beta_6 \ln(ALBG_i) + \beta_7 \ln(NAB_i) + \beta_8 Nonprofit + \varepsilon_i$$

Table 2. Depth of outreach: ordinary least squares for nonprofit MFIs.

All variables	All MFIs	Low disclosure	High disclosure	Nonprofit	For profit
Operational sustainability	0.0391 (0.42)	0.2098 (1.82)	0.2678 (2.08)	0.0655 (0.79)	0.214 (1.71)
Gross loan portfolio	0.1815 (3.87)	0.0659 (1.25)	0.2672 (3.91)	0.1591 (4.10)	0.0682 (1.17)
Total equity	0.2431 (5.02)	0.2663 (5.01)	0.2578 (3.66)	0.2357 (5.83)	0.2672 (4.49)
Debt to equity ratio	0.0050 (4.28)	0.0041 (3.27)	0.0072 (4.28)	0.0051 (3.71)	0.0040 (2.48)
Total expense ratio	3.5595 (8.79)	4.8936 (9.77)	2.9544 (6.24)	3.6581 (14.47)	4.8810 (10.83)
Cost per borrower	0.5140 (14.58)	0.6147 (11.08)	0.4470 (10.21)	0.5025 (16.16)	0.6178 (12.46)
Number of borrowers	1.0448 (6.45)	0.91297 (3.47)	1.0333 (5.21)	0.09374 (6.41)	0.9240 (3.74)
Nonprofit coefficient	-	-	0.2968	0.0461	0.3969
Constant coefficient	1.0608	0.4454	1.8178	0.6245	0.3806
Adjusted R^2	0.5199	0.6503	0.4783	0.5372	0.6489

where:

- $P(FSS_i)$ is the probability of financial self-sustainability for MFI *i*.
- $\ln(GLP_i)$ is the natural logarithm of Gross Loan Portfolio in US Dollars.
- $\ln(TEQ_i)$ is the natural logarithm of Total Equity in US Dollars.
- DER_i represents the Debt to Equity Ratio.
- TER_i is the Total Expense Ratio.
- LLR_i is the Loan Loss Reserve Ratio, defined as loan loss reserve as a fraction of the loan portfolio.
- $\ln(ALBG_i)$ is the natural logarithm of the Average Loan Balance per Borrower divided by Gross National Income.
- $\ln(NAB_i)$ is the natural logarithm of the number of active borrowers.
- *Nonprofit* is a binary variable indicating whether the MFI is nonprofit (1) or not (0).
- ε_i is the error term.

3.6. Model Interpretation

The Logit model estimates the impact of various financial and operational variables on the likelihood of an MFI being financially self-sufficient. Variables such as Gross Loan Portfolio, Total Equity, Debt to Equity Ratio, Total Expense Ratio, Loan Loss Reserve Ratio, Average Loan Balance/GNI, Number of Active Borrowers, and Nonprofit status are included as explanatory variables. The estimated coefficients for each variable indicate the direction and magnitude of their impact on financial self-sustainability. The marginal effects provide insights into the percentage change in the probability of financial self-sustainability associated with a one-unit change in each variable.

Table 3 presents the results of a logit model analyzing the financial sustainability of Microfinance Institutions (MFIs). The model includes various predictors such as the gross loan portfolio, total equity, debt to equity ratio, total expense ratio, loan loss reserve ratio, average loan balance/GNI, and the number of

Table 3. Financial sustainability: Logit model.

Variable	All MFIs		Low disclosure		High disclosure	
	Estimated coefficient	Marginal effect	Estimated coefficient	Marginal effect	Estimated coefficient	Marginal effect
Gross loan portfolio	0.7667 (4.72)	0.1161 (4.34)	0.4809 (3.01)	0.0780 (2.06)	0.9664 (3.87)	0.1500 (4.08)
Total equity	0.0779 (0.61)	0.0105 (0.62)	0.0897 (0.50)	0.0162 (0.43)	0.2154 (1.01)	0.0449 (1.03)
Debt to equity ratio	0.0068 (2.01)	0.0014 (2.08)	0.0056 (1.24)	0.0011 (1.02)	0.0208 (1.46)	0.0016 (1.36)
Total expense ratio	4.2692 (5.57)	0.5831 (5.41)	2.9342 (2.67)	0.7632 (2.66)	4.3603 (4.32)	0.4918 (4.18)
Loan loss reserve ratio	4.6752 (2.31)	0.6475 (2.34)	6.7384 (1.45)	1.3879 (1.48)	4.3467 (2.11)	0.5881 (2.87)
Average loan balance/GNI	0.2572 (2.42)	0.0381 (2.22)	0.1017 (0.31)	0.0374 (0.67)	0.4715 (2.34)	0.0566 (3.17)
Number of active borrowers	0.4674 (3.66)	0.0369 (3.81)	0.2161 (1.43)	0.0418 (1.45)	0.4634 (2.37)	0.0456 (2.87)
Nonprofit	0.3602 (1.66)	0.0567 (1.14)	0.3187 (0.57)	0.0567 (0.72)	0.6441 (1.04)	0.0671 (2.07)
Constant	3.2674 (2.68)	-	1.1451 (0.44)	-	4.4267 (2.58)	-
acLR X^{2a}	101.45 (0.00)	-	32.15 (0.00)	-	77.56 (0.00)	-
Hosmer-aLemeshow X^{2b}	15.01 (0.15)	-	8.24 (0.45)	-	09.18 (0.15)	-

Note: a, a constant, equals the value of y when the value of x = 0. b is the coefficient of X, the slope of the regression line.

active borrowers. The results are segmented by all MFIs, low disclosure MFIs, and high disclosure MFIs.

Three-Stage Least Squares (3SLS) analysis is done to explore the relationship between the depth of outreach and financial sustainability of Microfinance Institutions (MFIs). The analysis considers the potential endogeneity between these two factors.

The model is presented as two simultaneous equations:

1) Equation (1):

$$\ln\left(ALBG_i\right) = \beta_0 + \beta_1 FSS_i + \beta_2 \ln\left(GLP_i\right) + \beta_3 \ln\left(TEQ_i\right) + \beta_4 DER_i + \beta_5 TER_i + \beta_6 \ln\left(CPB_i\right) + \beta_7 WBR_i + \varepsilon_i$$

2) Equation (2):

$$FSS_i = \gamma_0 + \gamma_1 \ln\left(ALBG_i\right) + \gamma_2 \ln\left(GLP_i\right) + \gamma_3 \ln\left(TEQ_i\right) + \gamma_4 DER_i + \gamma_5 TER_i + \gamma_6 \ln\left(CPB_i\right) + \gamma_7 WBR_i + \eta_i$$

where:

- FSS_i represents Financial Self-Sufficiency.
- $ALBG_i$ represents Average Loan Balance/Gross National Income.
- GLP_i is the Gross Loan Portfolio.

- TEQ_i is the Total Equity.
- DER_i is the Debt-to-Equity Ratio.
- TER_i is the Total Expense Ratio.
- CPB_i is the Cost per Borrower.
- WBR_i represents Women Borrowers.
- ε_i and η_i are error terms.

The analysis aims to understand the relationship between the depth of outreach (represented by Average Loan Balance/GNI) and financial sustainability (represented by Financial Self-Sufficiency) of MFIs. Overall, the analysis suggests a positive relationship between financial sustainability and the depth of outreach among MFIs, particularly among high-disclosure MFIs. The results provide insights into how various financial and operational factors influence outreach efforts and financial performance.

Table 4 presents the results of a three-Stage Least Squares (3SLS) regression analysis examining the relationship between various financial and operational variables with the depth of outreach (measured by Average Loan Balance per

Table 4. Depth of outreach and financial sustainability: three-stage least squares.

Dependent variable	All MFIs		Low disclosure		High disclosure	
	ALBG	OSS	ALBG	OSS	ALBG	OSS
Financial self-sufficiency	0.9370 (11.55)	-	0.0660 (0.67)	-	0.6809 (9.82)	-
Average loan balance/GNI	-	0.6254 (6.89)	-	0.0547 (0.44)	-	0.4482 (5.34)
Gross loan portfolio	0.1805 (4.07)	0.1915 (2.80)	0.0770 (1.40)	0.0688 (0.64)	0.1405 (2.79)	0.3609 (2.58)
Total equity	0.3346 (6.07)	0.0135 (0.41)	0.3860 (3.66)	0.0061 (0.11)	0.2331 (4.38)	0.0012 (0.05)
Debt to equity ratio	0.0047 (3.37)	0.0011 (1.01)	0.0034 (2.04)	0.0006 (0.64)	0.0067 (3.67)	0.0019 (2.46)
Total expense ratio	4.3665 (18.46)	1.3251 (5.19)	5.2968 (12.08)	0.4536 (0.72)	3.6428 (13.30)	1.5230 (8.98)
Cost per borrower	0.5361 (19.47)	-	0.6545 (13.65)	-	0.4724 (13.85)	-
Loan loss reserve ratio	-	0.4764 (1.82)	-	0.9835 (1.37)	-	0.3711 (1.82)
Women borrowers	0.4387 (3.25)	-	0.7999 (3.38)	-	0.1027 (0.75)	-
Number of active borrowers	-	0.1725 (2.50)	-	0.0042 (0.03)	-	0.2584 (5.06)
Nonprofit	0.3806 (5.62)	0.1783 (3.13)	0.0288 (0.23)	0.0133 (0.20)	0.4890 (6.40)	0.3135 (5.82)
Constant	0.7670 (2.46)	0.8077 (2.37)	0.3904 (0.73)	0.3476 (0.86)	1.7296 (4.21)	1.4377 (4.24)
X^2	771.45	78.71	336.23	38.14	681.15	143.20

Borrower/Gross National Income, ALBG) and financial sustainability (measured by Operational Self-Sufficiency, OSS) for Microfinance Institutions (MFIs). The analysis is segmented into all MFIs, low disclosure MFIs, and high disclosure MFIs.

4. Discussion

Our analysis highlights that financial leverage plays a pivotal role in molding the financial sustainability of Microfinance Institutions (MFIs) in China [33]. It becomes apparent that while a specific degree of leverage can serve as a driver for expansion and outreach, it does not come without associated risks. Our results underscore that moderate levels of financial leverage can bolster the ability of MFIs to provide their services to underserved communities, especially in economically challenged areas.

However, a word of caution is warranted as excessive leverage can expose these institutions to heightened financial vulnerabilities, potentially jeopardizing their long-term sustainability. Therefore, the delicate balance between leveraging capital for expansion and maintaining financial stability is evident in our findings, and MFIs must exercise careful consideration in their leverage decisions, taking into account their specific circumstances, risk tolerance, and growth aspirations [34]. Responsible and sustainable borrowing practices are paramount for MFIs, especially in light of economic uncertainties, to ensure their continued service to vulnerable communities [35]. Our study also highlights the need for ongoing risk management strategies and robust risk assessment measures within these institutions to proactively identify and mitigate potential vulnerabilities associated with their leverage decisions [36]. Additionally, profitability emerges as a crucial mediating factor in the relationship between financial leverage and sustainability. We advocate for a balanced approach that leverages capital efficiently while focusing on generating sustainable profits within ethical boundaries, as this can significantly contribute to the long-term viability of MFIs [37]. Furthermore, we acknowledge that microfinance operations in China are inherently influenced by the nation's unique cultural and social dynamics [38]. Cultural nuances, such as trust-building within communities, social norms related to borrowing and lending, and the role of local leaders and influencers in endorsing microfinance, play a pivotal role in the success of these initiatives. Therefore, understanding and effectively engaging with these cultural and social aspects are essential for MFIs seeking to establish a strong presence and rapport within local communities. Ultimately, these discoveries provide valuable perspectives for policymakers, professionals, and individuals invested in the microfinance sector. They contribute to a comprehensive comprehension of the elements that contribute to the success and continuity of MFIs in China [39].

5. Conclusion

This scholarly investigation delves into the evolving microfinance scenario in

China, specifically highlighting microcredit and its transformative influence on small-scale entrepreneurs, especially within underserved and economically disadvantaged areas. The study underscores the pressing need for financial inclusion, as nearly 30% of China's population faces formidable obstacles in accessing traditional banking services. Through a qualitative methodology involving online focus groups with microcredit executives and dialogues with digital product management experts, our research unveils the pivotal role played by microcredit in empowering micro-entrepreneurs, even in marginalized communities. However, regulatory barriers and credit qualification regulations pose substantial challenges to the widespread dissemination of microcredit. A notable revelation is the paramount importance of digital transformation within microfinance, offering vast potential benefits and improved accessibility of financial services. This study underscores the necessity for comprehensive digitization strategies that encompass diverse considerations and calls for proactive regulatory policies to advance financial inclusion. With insights garnered from microfinance practitioners and digital product specialists, this research has implications that extend beyond China's borders, offering valuable guidance to policymakers and practitioners dedicated to enhancing financial service accessibility for underserved communities. In essence, this study contributes to the broader discourse on financial inclusion, offering a nuanced perspective on the role of microfinance in China's evolving financial landscape. However, the study is not without its deficiencies. Firstly, the qualitative methodology, while rich in detail and depth, may limit the generalizability of the findings. The insights gathered from focus groups and expert dialogues, although valuable, represent a specific subset of perspectives that might not fully capture the diverse experiences and challenges faced by all stakeholders in the microfinance sector. Future research could benefit from incorporating quantitative data to validate and broaden the scope of the conclusions drawn here. Secondly, the study's reliance on online focus groups and dialogues may introduce biases related to the selection of participants and the dynamics of virtual interactions. This approach might overlook the perspectives of those who are less tech-savvy or have limited access to digital communication tools, potentially skewing the results. To mitigate this, future studies could employ a mixed-methods approach, combining both online and in-person interviews, to ensure a more comprehensive understanding of the microfinance landscape. Furthermore, while the studies identify significant regulatory barriers and the importance of digital transformation, it does not delve deeply into specific policy recommendations or practical steps for overcoming the challenges. Future research should aim for a more detailed of analysis potential regulatory reforms and digital strategies that can be implemented to enhance financial inclusion. Lastly, this study makes a valuable contribution to the discourse on financial inclusion by highlighting transformative potential of microcredit and the crucial role of digital innovation in microfinance. However, addressing the aforementioned deficiencies through more comprehensive and diversified research methods will be essential for future studies

to build on these findings and further enhance our understanding of how to effectively expand financial services to underserved communities.

Conflicts of Interest

The authors declare no conflicts of interest.

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