Studies in Economics and Finance

Economics and financial sustainability in microfinancing: do investment flows toward developing countries, rural areas, microenterprises and female borrowers foster institutionalization?

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Abstract

Purpose – The long-term sustainability of microfinancing institutions (MFIs) is essential for poverty reduction. This study aims to empirically evaluate whether contemporary microfinance economics supports the institutionalization of MFIs, which are crucial for the socioeconomic development of marginalized communities.

Design/methodology/approach – This research examines the flow of funds from wealthy economic areas (high-income countries, richer urban areas and capital-rich corporations) to poorer regions (low-income countries, poorer rural areas, female borrowers and financially constrained microenterprises) as a proxy for microfinance economics. Financial sustainability and institutionalization are assessed through return on assets and operational self-sufficiency. The study also considers credit risk as a key independent variable. Using panel data analysis of 333 MFIs from the USA and India, covering 2008–2018, sourced from the Microfinance Information Exchange data set on the World Bank website, this paper analyzes these dynamics.

Findings – Results show that credit risks negatively affect the financial sustainability of MFIs in both developed and developing countries. Contrary to expectations, the development status of a nation positively moderates the impact of credit risks on financial sustainability. In developing countries, intra-nation investments do not yield additional returns for MFIs or interact with credit risks. However, the economics of microfinance support the institutionalization of MFIs in these regions.

Originality/value – This study provides valuable empirical evidence on the relationship between microfinance economics and institutionalization, addressing a critical need in the microfinancing sector.

Keywords Financial sustainability, World poverty, Microfinancing, Institutionalization, Female borrowers

Paper type Research paper

1. Introduction

Microfinance, as an idea, was originally conceived to provide financial services to the impoverished (Brau and Woller, 2004). It aims to promote economic self-sufficiency and social dignity among underserved rural borrowers (Yunus, 2007). Currently, microfinance institutions (MFIs) worldwide focus on enhancing financial access for marginalized

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populations (Cull *et al.*, 2007; Cull and Morduch, 2018; Fadikpe *et al.*, 2022). Ensuring the long-term sustainability of these institutions is essential, as contemporary discussions emphasize their institutionalization (Conning, 1999; Cull *et al.*, 2007; Fadikpe *et al.*, 2022; Navin and Sinha, 2021; Singh, 2023b). Institutionalization involves managing profitability for self-reliance, enabling MFIs to serve marginalized communities without donor reliance (Fadikpe *et al.*, 2022; Hartarska and Nadolnyak, 2007; Kibyegon Josphat and Joseph, 2018). This is increasingly critical given the challenges of high operational costs, decreasing subsidies and rising competition (D'Espallier *et al.*, 2013a; Kar and Swain, 2014; Singh, 2023a). MFIs that minimize costs are better positioned for long-term success (Caudill *et al.*, 2009), and scholars advocate for attracting investments rather than donations for sustainability (Fadikpe *et al.*, 2022; Singh, 2023b). Financial sustainability, encompassing profitability and operational self-sufficiency, is crucial for microfinance institutions to meet the needs of low-income individuals (Copestake, 2007; Armendáriz and Morduch, 2010; Elsafi *et al.*, 2020; Yunus, 2007). Therefore, understanding the factors that contribute to MFI institutionalization in a dynamic microfinance landscape is essential.

The principle of "diminishing marginal returns" underpins arguments for MFI institutionalization (Armendáriz and Morduch, 2010). This principle posits that smaller enterprises should yield higher returns on investment than larger ones, allowing them to offer higher interest rates (Armendáriz and Morduch, 2010). Ideally, this investment flow should benefit investors, provide affordable finance to the poor and support MFIs' institutionalization. The law of diminishing marginal utility theoretically explains microfinance sector institutionalization, suggesting that investment from high-income to low-income economies should be driven by profit motives, not philanthropy (Armendáriz and Morduch, 2010).

Investments should ideally flow from wealthier urban areas to poorer rural borrowers and from larger corporations to smaller microenterprises (Cotler and Woodruff, 2008). Furthermore, investments should target female borrowers, who historically face greater economic challenges and whose diverse perspectives can enhance financial returns (Agier and Szafarz, 2013; Yunus, 2007; Sahay *et al.*, 2021). Thus, investments moving from richer to poorer economic sectors should theoretically promote microfinance institutionalization.

However, the investment flow from high-income to low-income countries involves significant financial risks. Despite the diminishing marginal returns principle, credit risks can undermine investors' profit motives. Developing countries often face higher risks due to weaker governance (Sabir *et al.*, 2019), which can increase credit risks for MFIs and impact investors' returns (Singh, 2023a). This can challenge the profit-driven model of microfinance. Managing credit risks is crucial for MFIs when evaluating investments in urban versus rural areas, larger firms versus microenterprises and male versus female borrowers (Yunus).

Microfinance often involves relaxed lending terms, including inadequate collateral and group lending schemes (Lassoued, 2017, 2022). The high-risk, high-return maxim may not always apply in this context. Therefore, examining how investment flows impact institutionalization and credit risk management in microfinance is vital. This study aims to test whether the principle of diminishing marginal returns applies to the microfinance sector's institutionalization. The objectives are:

- *OBJ 1*: To test if the movements of investments from developed to developing countries support the institutionalization of microfinancing institutions. To do so, the study uses the development stage as a moderator between credit risks and the financial sustainability of microfinancing institutions;
- *OBJ 2*: To test if the movement of investments from urban to rural areas (within a country, developing or developed) moderates the relationship between credit risks and the institutionalization of microfinancing institutions;

- *OBJ 3*: To test if the movement of investments toward microenterprises (within a country, developing or developed) supports the institutionalization of microfinancing institutions. It uses the percentage share of the gross loan portfolio allocated to microenterprises as a moderator between credit risks and financial sustainability; and
- *OBJ 4*: To test if the movement of investments from male to female borrowers (within a country, developing or developed) moderates the relationship between credit risks and financial sustainability and supports the institutionalization of microfinancing institutions.

The above objectives fill strong gaps in MFI literature. While the extant literature discusses the institutionalization of MFIs and their social impact (Fadikpe *et al.*, 2022; Singh, 2023b), there remains a notable gap in studies that provide statistical evidence on how the economics of microfinance can boost financial sustainability and drive institutionalization. The current study addresses this gap by examining how investments are conceptualized in the above-stated objectives.

The study uses data from the USA (a developed economy) and India (a developing economy), analyzing an unbalanced panel of 333 MFIs from 2008 to 2018. The findings indicate that credit risks negatively affect MFIs' financial sustainability in both developed and developing countries. Contrary to the marginal utility principle, a nation's development level positively moderates the relationship between credit risks and profitability. This suggests that credit risks increase as investments move from developed to developing nations, which does not favor institutionalization. However, intra-nation investment flows impact financial sustainability differently. In developed countries, investments from urban to rural areas, toward microenterprises and female borrowers do not significantly affect returns or credit risks. In developing countries, investments in rural areas, microenterprises and female borrowers positively impact financial sustainability by moderating credit risks. This implies that the diminishing marginal returns principle effectively supports microfinance institutionalization in developing nations.

The study provides practical, policy and social insights. Investors focusing solely on profit may find MFIs in developed nations safer. In developing countries, investments from affluent to poorer areas can enhance returns and reduce credit risks. Socially, this approach can significantly impact poverty alleviation and promote self-reliance in underserved populations (Elsafi *et al.*, 2020). The study contributes to understanding the modern economics of microfinance and offers guidance for both MFIs and investors.

The paper is organized as follows: Section 2 reviews the literature, theoretical framework and hypotheses. Section 3 details the data and methodology. Section 4 presents data analysis and results. Section 5 discusses the findings and implications. Section 6 concludes the study.

2. Theoretical background and literature review

2.1 Theoretical background

Initially, microfinance institutions (MFIs) were heavily reliant on philanthropic donors, government subsidies and support from nongovernmental organizations (Fadikpe *et al.*, 2022). However, with the decline of these funding sources and increased competition, the focus has shifted toward institutionalization and self-sufficiency. Muhammad Yunus's establishment of the Grameen Bank in Bangladesh in 1976 marked a pivotal moment in this shift (Navin and Sinha, 2021). As a result, the concept of microfinance has evolved to emphasize profit-making and financial sustainability over mere dependence on external support (Singh, 2023b). Despite this shift, MFIs continue to uphold their social mission of

providing financial inclusion and supporting marginalized communities. Yunus's model, while often debated, remains a cornerstone in the fight against global poverty.

Advocates of the institutionalization of microfinance argue that improving financial sustainability is crucial for effectively reducing poverty (Christen and Drake, 2002). The financial stability of MFIs is seen as essential for accessing resources and enhancing capabilities (Armendáriz and Morduch, 2010; Waddock and Graves, 1997). Consequently, there is a consensus that MFIs should prioritize self-sufficiency to ensure long-term viability (Singh, 2023b). To achieve operational self-sufficiency, MFIs need to minimize operational costs and generate sufficient revenue (Navin and Sinha, 2021; Fadikpe *et al.*, 2022). However, some scholars argue that the pursuit of profit can lead to mission drift, where MFIs shift focus from their social objectives to profit-making (Copestake, 2007; Dorfleitner *et al.*, 2017; Vanroose and D'Espallier, 2013). This perspective supports the welfarist approach, which advocates for continued philanthropic support alongside profit-seeking activities, often providing loans at subsidized rates (Morduch, 2000, 2009).

Conversely, another group of scholars suggests that MFIs must balance their social and financial objectives (Armendáriz and Morduch, 2010). This study adopts the institutionalization approach for several reasons. First, it examines whether investments shifting from wealthier to poorer economic areas can generate financial returns, suggesting a preference for profit-making over philanthropy (Armendáriz and Morduch, 2010). Second, the study considers the importance of credit risk management, as financial literature establishes a clear link between risks and returns (Adelopo *et al.*, 2022). The study aims to determine whether investments in poorer areas generate higher returns or increase credit risks, thus necessitating an institutionalization approach for thorough investigation.

Despite its merits, the institutionalization approach faces criticism. Critics argue that enabling low-income individuals to run businesses does not automatically result in profits (Copestake, 2007; Dorfleitner *et al.*, 2017; Vanroose and D'Espallier, 2013). Some suggest that microfinance merely makes the poor investable for financial intermediaries without significantly altering their economic status (Aitken, 2015; Mader, 2015). The commercialization of microfinance, leading to mission drift, remains a significant concern (Copestake, 2007). Nevertheless, these criticisms underscore the importance of examining the economics of microfinance, as investigated in this study. Institutional structures, essential for facilitating investment flows, provide additional supervision and legal protection for clients and their deposits (Cull *et al.*, 2007). Such structures are crucial for MFIs. The institutionalization approach prioritizes financial sustainability while aiming to achieve social impact (Fersi and Boujelbène, 2023; Wijesiri *et al.*, 2015).

Further, MFIs are typically smaller institutions that operate on a microlevel, providing small loans to the poor. Therefore, MFIs are more sensitive to the effects of diminishing returns as they scale up their operations. Therefore, institutionalization can be linked to the flow of investments and the principle of diminishing marginal returns. It signifies that smaller investments yield higher returns, making them attractive to investors seeking profit (Armendáriz and Morduch, 2010). Therefore, in microfinancing arena, investments flowing from wealthier economic regions (high-income countries, richer urban areas and capital-rich corporations) to poorer regions (low-income countries, poorer rural areas, female borrowers and financially constrained microenterprises) should impact the financial sustainability of MFIs effect institutionalization.

2.2 Nation's development and the institutionalization of microfinancing institutions

The law of marginal returns posits that investments should flow from wealthier developed countries to less developed nations with profit-making intentions (Armendáriz and Morduch,

2010). This principle suggests that poorer populations are willing to pay higher costs of capital, providing opportunities for investors to achieve greater profits (Garrette and Karnani, 2010). Microfinance aims to assist the poor in becoming self-reliant through access to finance, with both lenders and borrowers expected to benefit. Scaling this concept globally, investments from developed nations to developing countries, such as from the USA to India, present potential profit-making opportunities for MFI investors.

However, this assumes other factors remain constant. One critical factor is financial risk, which includes losses in financial markets due to economic and financial fluctuations (Jorion and Khoury, 1996). Credit risk, in particular, is a significant concern for MFIs, as it arises when borrowers default on their loans or interest payments. Credit risk in MFIs is amplified by relaxed lending requirements and insufficient collateral (Jabbouri and Almustafa, 2021; Lassoued, 2022; Schiehll and Martins, 2016; Singh, 2023a). National governance also plays a crucial role in determining credit risks and profitability (Godlewski, 2011). Effective governance encompasses the legal, institutional and judicial frameworks of a country (Kaufmann *et al.*, 2011; Skaaning, 2010), which affects financial firms' credit risks and performance.

In developing economies, often criticized for weak national governance (Kumar and Singh, 2013; Singh and Rastogi, 2022), credit risks can undermine profit-making opportunities. Government credit programs in these nations frequently face high default rates (Burgess and Pande, 2005), making loan control and recovery challenging. Such risks can impact financial sustainability (Athanasoglou *et al.*, 2008). Institutionalization involves the transfer of best practices and good governance frameworks from developed to developing countries. Investments from the USA, a developed economy, to India, a developing economy, are not only financial but also include the transfer of knowledge and institutional practices that are likely to curtail risks and support the long-term sustainability of MFIs in India. Therefore, testing the impact of investments from developed to developing nations requires examining how national development moderates the relationship between credit risks and financial sustainability. This analysis will help determine if profit-making opportunities from such investments offset associated credit risks and benefit both MFIs and their investors. Hence, the following hypothesis is proposed:

H1. Nation's development (DEV) moderates the relationship between credit risks and the financial sustainability of MFIs.

2.3 Lending to rural borrowers and the institutionalization of microfinancing institutions

Rural lending is a vital component of microfinance portfolios, especially in emerging economies (Puhazhendhi and Satyasai, 2000). This category includes various loan types extended to rural borrowers (Chakrabarty and Erin Bass, 2015). According to the law of marginal returns, investing in poorer rural areas from wealthier urban areas can present profit-making opportunities for MFIs (Armendáriz and Morduch, 2010), provided credit risks are managed effectively (Singh, 2023b). However, credit risks in urban versus rural settings can differ due to varying local business conditions, development levels and cultural factors (Platteau, 2015). While national governance impacts credit risks at the country level, local conditions also play a role. Thus, controlling for national governance alone may not fully address the credit risk differences between urban and rural areas.

The movement of investments from urban to rural areas will benefit the microfinance sector if it creates additional profits that outweigh the associated credit risks. This implies that rural lending should positively affect MFIs' financial sustainability and mitigate the

adverse effects of credit risks. Based on these considerations, the study posits the following hypotheses:

H2a. Rural borrowing positively impacts the financial sustainability of MFIs, ceteris paribus.

H2b. Rural borrowing moderates the relationship between credit risks and the financial sustainability of MFIs.

2.4 Lending to microenterprises and the institutionalization of microfinancing institutions

Lending to microenterprises forms an essential segment of MFIs' gross loan portfolio studies (Agier and Szafarz, 2013; Yunus, 2007; Sahay *et al.*, 2021). This segment of loans caters to the financial requirements for producing or trading services, including purchasing. The segment falls under the broader category of enterprise lending (see Table 1). An increasing share of lending to microenterprises is considered an excellent social and financial sustainability indicator for MFIs. In the finance literature, lending to microenterprises is considered a high-risk, high-profit avenue (Liu *et al.*, 2020). However, microenterprises, usually criticized for their capital deficiency issues (Kulkarni and Chirputkar, 2014), remain an essential segment for MFIs. The law of diminishing marginal returns states that the marginal returns from investments in microenterprises are higher than those for larger enterprises (Armendáriz and Morduch, 2010). This creates opportunities for MFIs and their investors to generate more returns by investing their money in microenterprises instead of larger enterprises. However, investing in microenterprises is considered riskier than investing in larger and established enterprises from a financial standpoint (Thaker *et al.*, 2013). Therefore, decisions to lend money to microenterprises instead of larger enterprises require consideration of the interplay between opportunities of marginal profits and associated credit risks (credit risks of lending to microenterprises may be higher than lending to larger corporations). For such movement of money to be beneficial for the MFIs, lending to microenterprises should not only impact financial sustainability positively but also moderate the linkage between credit risks and financial sustainability. Based on such assumptions, arguments and expectations, the study considers the two variations of the following hypothesis, *H3*

H3a. Lending to microenterprises positively impacts MFIs' financial sustainability, ceteris paribus.

H3b. Lending to microenterprises moderates the relationship between credit risks and the financial sustainability of MFIs.

However, it must be acknowledged that Chikalipah (2018) argues that smaller MFIs, and by extension, smaller microenterprises, face higher risks due to the lack of collateral. It is also likely that the size of microenterprises negatively moderates the relationship between credit risks and financial sustainability, particularly in developing countries where collateral is scarce. Therefore, careful consideration is essential to testing the above-stated hypothesis.

2.5 Lending to female borrowers and the institutionalization of microfinancing institutions

Younas clearly and strongly points out that poverty is more of a women's issue than men's (Yunus, 2007). Therefore, lending credit facilities to destitute female borrowers to operate skill-based entrepreneurial activities has always remained an essential segment of microfinancing (Datta and Sahu, 2021; D'espallier *et al.*, 2013b; Fernando, 1997). This

Table 1. Variables

Variable	Abbreviation	Measurement	Data source
Return on assets	ROA	(Net operating income−taxes)/average total assets	MIX data set on world bank website
Operational self-sufficiency	OSS	Financial revenue/(financial expense + net impairment loss + operating expense)	
Loan loss rate	LLR	(Write-offs−value of loans recovered)/average gross loan portfolio	
Loan write-off rate	WR-OFF	Value of loans written-off/average gross loan portfolio	
Development state of the economy	DEV	DEV = 1 for USA; DEV = 0 for India	
Loans to rural borrowers	RUR-B	(All outstanding principals due for all outstanding client loans. This includes current, delinquent, and renegotiated loans, but not loans that have been written off. Segmentation based on geographic location. Located in rural areas)/average gross loan portfolio	
Loans to microenterprises	MICRO	(All outstanding principals due for all outstanding client loans. This includes current, delinquent, and renegotiated loans, but not loans that have been written off. Segmentation based on loan product. Loans that finance the activities of a business. Loans that finance the production or trade of goods and services, including the purchase of productive assets, for an individual's microenterprise whether or not the microenterprise is legally registered)/ average gross loan portfolio	
Percentage of loans to female borrowers	FEM-B	(All outstanding principals due for all outstanding client loans. This includes current, delinquent, and renegotiated loans, but not loans that have been written off. Segmentation based on gender. Loans to female gender)/average gross loan portfolio	
Capital adequacy ratio	CAR	Total equity/total assets	
Size of microfinancing institution	SIZ	Natural logarithm of gross loan portfolio	
Provision for loan impairment	PIL	An allowance for the risk of losses in the gross loan portfolio due to default	
Gross domestic product	ΔGDP	GDP growth rate of a nation	Macrotrends website
National-level governance index	NGI	Summation of the following six indicators (voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, control of corruption). Combination of these indicators are used by (Jabbouri and Almustafa, 2021; Kaufmann *et al.*, 2011)	Worldwide governance indicators

Notes: The definitions of the variables related to MFIs is as per the MIX data set on the World Bank website
Data sources:
• https://datacatalog.worldbank.org/search/dataset/0038647/MIX-Market
• https://databank.worldbank.org/source/worldwide-governance-indicators
• www.macrotrends.net/
Source: Author's own work

segment of loans caters to the financial requirements of female borrowers, catering to several types of needs, such as education, sometimes marriage and most importantly, entrepreneurship, to run small businesses (Datta and Sahu, 2021). Therefore, lending to women entrepreneurs strongly indicates MFIs' social self-reliance. For MFIs, as the literature suggests, listening to female borrowers is also beneficial from a financial standpoint, as well. For example, having more female borrowers also reduces the financial risk for financial institutions such as banks (Armendáriz and Morduch, 2010). Female borrowers are more trustworthy (Aggarwal *et al.*, 2015) and reliable than men regarding repaying their loans (Aggarwal *et al.*, 2015; Khandker *et al.*, 1995). Profit-maximizing for lending institutions by lending to women is expected. Evidence suggests that female borrowers exhibit better repayment rates than male borrowers (Abdullah and Quayes, 2016; Aggarwal *et al.*, 2015; Chikalipah, 2018; D'Espallier *et al.*, 2013b; Jianakoplos and Bernasek, 1998; Yunus, 2007).

In addition, one of the reasons is that women are considered excellent risk managers (Singh, 2023a); the diversity of thought processes that women entrepreneurs bring leads to better decision-making, risk minimization and increased profitability (Sahay *et al.*, 2021). Grameen Bank's case signifies that a customer base that is 95% women borrowers improves social impacts and curtails financial risks for the bank (Armendáriz and Morduch, 2010). These inferences should equally apply to female borrowers of MFIs. In addition, microfinance institutions must, therefore, purposefully increase credit facilities to women to foster MFIs' sustainability (Fadikpe *et al.*, 2022). One argument even states that a larger share of female borrowers (scaled by total customer base) curtails the credit risks for lending institutions (Armendáriz and Morduch, 2010). It is also said that women are more risk-averse than men (Jianakoplos and Bernasek, 1998), making them excellent risk managers for borrowed loans.

It is argued that MFIs serving more women borrowers are more likely to adopt ethical codes (Chakrabarty and Bass, 2014), and governance at the national level influences credit risks (Chakrabarty and Bass, 2014; Singh, 2023a) at the firm level by creating a stable economic environment conducive to investment. Further, Yunus (Yunus, 2007) claims that female borrowers make better use of MFIs loans than men, for poverty and hunger are more women's issues than men's (Yunus, 2007). Perhaps, therefore, Mohamed Younas found strong economic and social reasoning to consider female borrowers indispensable to Grameen Bank's customer base. In fact, most of the microfinancing customers are female borrowers (Agier and Szafarz, 2013). Therefore, lending to female entrepreneurs should not only impact their financial sustainability positively but also moderate the linkage between credit risks and financial sustainability. Based on such assumptions, arguments and expectations, the study considers the two variations of the following hypothesis, *H4*.

H4a. Lending to female borrowers positively impacts MFIs' financial sustainability, ceteris paribus.

H4b. Lending to female borrowers moderates the relationship between credit risks and the financial sustainability of MFIs.

3. Data and methodology

3.1 Sample selection and data

The study examines 245 microfinance institutions (MFIs) from India, a developing economy, and 322 MFIs from the USA, a developed economy. This sample is drawn from a global population of 3,313 MFIs whose data is available on the "MIX data set" hosted by the World Bank (Lassoued, 2022). This data set is unbalanced panel data. The USA's MFIs make up the largest share of the MIX data set, while Indian MFIs form the second-largest share. Therefore,

MFIs from both countries are considered representative of their respective populations. Data spanning 11 fiscal years (2008–2018) was collected, comprising 144 Indian MFIs and 190 US MFIs. This data underwent preparation through statistical techniques, including outlier treatment (winsorizing at 1%) and Box and Cox (1964) transformations (natural log transformations on regressors), to mitigate skewness and kurtosis and ensure variables fell within an acceptable range.

The MIX data set is one of the most comprehensive repositories of MFI data (Lassoued, 2022). Although it contains data from 1999 to 2020, this study uses data up to 2018 due to preparation constraints. The absence of more recent global data is a technical limitation. Nevertheless, substantial effort was invested in data preparation to enhance robustness. National governance variables (NGI) are sourced from the World Bank's Worldwide Governance Indicators, while macroeconomic variables, such as the economic growth rate (ΔGDP), are obtained from the Microtrends website.

3.2 Variables

Financial sustainability of MFIs is a critical concern, particularly given the unique challenges they face, such as high operational costs, limited access to capital and the need to balance social and financial objectives. Two widely used MFIs financial sustainability (Singh, 2023a, 2023b) variables for MFIs are selected: return on assets (ROA) and operational self-sufficiency (OSS). ROA measures return-generating ability, while OSS indicates the MFIs' capacity to cover operational costs through revenue (Copestake, 2007). ROA measures the profitability of an MFI relative to its total assets, indicating how efficiently the institution is using its resources to generate income (Bogan, 2012). OSS, on the other hand, measures whether an MFI is operationally self-sufficient, indicating financial self-sufficiency (Remer and Kattilakoski, 2021). Further, given that high returns often come with high risks, the study also considers two credit risk measures: loan loss rates (LLR) and loan write-offs.

The study uses a binary variable (DEV) to distinguish between developed (USA) and developing economies (India), with "1" for the USA and "0" for India. The development stage of each country is used as a moderator to assess its impact on the relationship between credit risks and financial sustainability. By comparing MFIs in the USA and India, the study examines how different stages of national development influence the institutionalization of MFIs. Variables such as RUR-B, MICRO and FEM-B represent the percentage of MFI loans directed toward rural borrowers, microenterprises and female borrowers, respectively. The study controls for MFI-specific variables like capital adequacy ratio (CAR), MFI Size (SIZ), provision for loan impairments (PIL) and macroeconomic variables including GDP and NGI (Kaufmann *et al.*, 2011; Lassoued, 2022; Singh, 2023b). NGI may influence foreign direct investment flows, particularly if funds are allocated to developed rather than developing countries (Sabir *et al.*, 2019). Adequate control variables are included to address endogeneity and mitigate omitted variable bias (Wooldridge, 2013).

3.3 Specification of models

Panel data statistical models rely on specific assumptions and tests. Pooled ordinary least squares (OLS) is a straightforward approach but does not account for entity-fixed effects (Baltagi, 2008; Wooldridge, 2013). The choice between fixed and random effects models is critical in panel data analysis, particularly when analyzing MFIs operating in different countries with varying environments. Given the focus of the study objectives on understanding the within-country variations over time, the fixed-effects model appears to be more appropriate. Further, fixed effects estimation adjusts for entity-fixed effects and controls for endogeneity potentially arising from omitted time-invariant variables. However,

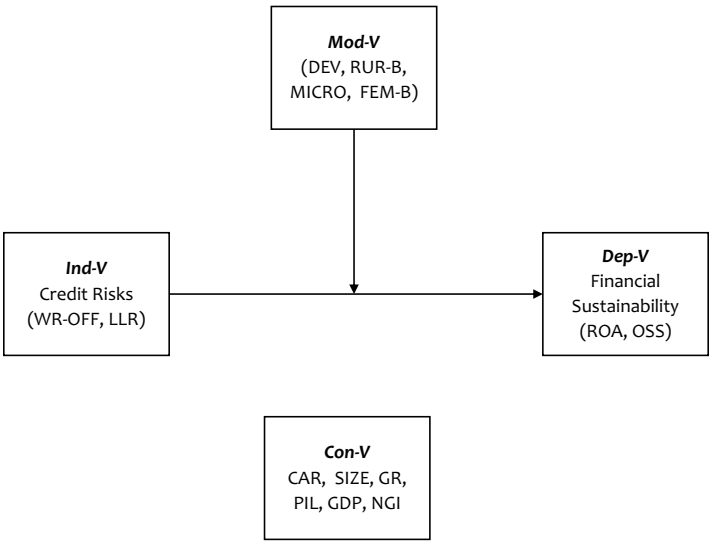
the preference for fixed effects over random effects often hinges on the Hausman test results (see Tables 4–6). Debate exists on whether the Hausman test is sufficient or necessary for fixed effects estimation. Although the study indicates significant fixed effects (see F statistics in Tables 4–6) and significant Hausman $\chi 2$ statistics in most cases, insignificant Hausman $\chi 2$ statistics suggest that fixed and random effects coefficients may not differ significantly, allowing for both estimates to be reported (Studentmund, 2019). Though the choice between fixed and random effects models "remains vague and sometimes contradictory" (Clark and Linzer, 2015), the study considers fixed effects model to sample data characteristics and the theoretical aspects. The data of this study contains significant heterogeneity across the sampled MFIs in terms of time-invariant characteristics like firm-specific factors. These factors, if not adequately accounted for, may cause omitted variable bias, a key concern that the fixed model can address. Further, in such cases, theory on panel data econometrics signifies that because random effects models do not "induce sufficiently high variance reduction to offset the bias," the fixed-effects are preferred (Clark and Linzer, 2015). Thus, despite debates on the Hausman test's role, the study specifies fixed effects models to test the relationships. The conceptual model for the study is depicted in Figure 1.

The fixed effects models for the study are specified, in general, as follows:

$$Dep - V_{it} = \alpha + \beta_1 Ind - V_{it} + \beta_2 Mod - V_{it} + \beta_3 (Ind - V_{it} \times Mod - V_{it}) + \gamma Con - V_{it} + \mu_i + \varepsilon_{it}$$

where:

Dep-V = dependent variable(s);
Ind-V = independent variable(s);
Mod-V = moderation variable(s);
Con-V = control variable(s);



Source: Author's own work

Figure 1. Conceptual model

μ_i = fixed effects;
ε_{it} = stochastic error term, iid ~ N (0, σ^2); and
β, γ = regression coefficients.

4. Data analysis and results

4.1 Summary statistics

The summary statistics for the samples (USA and India) are presented in Table 2. The table is divided into two panels: Panel A, which contains the summary statistics for 190 MFIs from the USA, and Panel B, which belongs to 144 Indian MFIs. Interesting statistics include that the financial sustainability (ROA, OSS) of MFIs from the USA is higher than that of the Indian MFIs, on average. Similarly, the values of risk variables (LLR, WR-OFF) are higher for MFIs in the USA. On average, a higher percentage of the gross loan portfolio in India is directed toward rural borrowers, microenterprises and female borrowers compared to the USA.

These summary statistics generate two essential economic aspects. First, given that the USA is considered developed compared to India, it is evident that the urban–rural divide for a developing nation is larger than that of a developed country, and hence, the summary statistics align. Moreover, India is a developing economy, and the share of microenterprises (and startups) is growing, making microenterprises a vital avenue for MFIs to lend. The

Table 2. Descriptive statistics

Variables	Observations	Mean	SD	Min.	Max.
Panel A: developed nation – USA					
ROA	707	0.016	0.075	−0.860	0.330
OSS	728	1.168	0.388	−0.430	6.200
WR-OFF	693	0.025	0.128	0.000	3.110
LLR	718	0.034	0.389	−0.090	9.890
MICRO	748	0.814	3.116	0.000	0.850
FEM-B	747	0.542	0.206	0.040	1.000
RUR-B	748	0.447	0.299	0.000	1.000
CAR	734	0.295	0.316	−3.510	1.480
SIZE	735	16.87	1.690	11.77	21.10
GRW	731	16.57	1.699	11.40	20.84
PIL	729	0.043	0.103	−0.040	1.870
GDP	748	2.228	0.505	−2.600	2.950
NGI	748	7.473	0.078	7.320	7.630
Panel B: developing nation – India					
ROA	351	0.013	0.065	−0.640	0.260
OSS	364	1.131	0.262	−0.120	2.360
WR-OFF	335	0.009	0.058	0.000	0.920
LLR	349	0.008	0.057	−0.040	0.920
MICRO	370	0.958	1.860	0.000	0.362
FEM-B	368	0.961	0.128	0.000	1.000
RUR-B	370	0.733	2.457	0.000	47.48
CAR	365	0.243	0.192	−1.040	1.000
SIZE	365	16.08	1.897	12.26	21.55
GRW	361	15.73	1.964	9.520	21.30
PIL	357	0.017	0.060	0.000	0.960
GDP	370	7.334	1.249	3.090	8.500
NGI	370	−1.499	0.361	−2.000	−0.740

Source: Author's own work

statistics on loans offered to microenterprises coincide with the argument. Finally, it is a good indication that the percentage of female borrowers of MFIs is very high, somewhere indicating that the MFIs are on their social mission of bringing equity, for which they were initially started by Muhammad Yunus in Bangladesh. Second, the summary statistics align with the famous microfinance argument that more than 95% of female borrowers repay the MFIs loans (Yunus, 2007). Perhaps, extending the argument, rural borrowers and microenterprises are better at repaying the loans, and hence, the loan loss rate and write-offs in India are lower than that of the USA.

4.2 Correlations

Table 3 presents the pairwise correlation coefficients between the variables. As expected, the correlation between the dependent variables, ROA and OSS, is positively significant for both the nations, USA (0.649*, * $p < 0.10$) and India (0.798*, $p < 0.10$), as both of these represent the financial sustainability of MFIs. However, a significant correlation between the two independent variables (LLR and WR-OFF) requires attention in the case of both nations, USA (0.967*, $p < 0.10$) and India (0.992*, $p < 0.10$). Therefore, the variance inflation factors (VIFs) are calculated first by including all regressors in the same equation. As evident from Table 3, the VIFs for LLR and WR-OFF for the USA are > 15, and for India are > 54. Therefore, these variables are tested in separate equations, as evident from Tables 4, 5 and 6. Further, the VIF values for all other regressors (or any combinations of regressors) are < 2 [see Table 3, VIF(a) and VIF(b) values], which is acceptable and rules out the concerns of multicollinearity (Studentmund, 2019).

4.3 Regression analysis and diagnostics

Panel data fixed estimation is conducted. The diagnostics suggest that heteroscedasticity is significant in all cases, whereas first-order serial correlation is significant in some cases. Therefore, robust standard errors, clustered at the MFI level, are estimated to compute correct t-statistics (Wooldridge, 2013).

4.4 Regression results

4.4.1 Movement of investments from developed to developing economies. The econometric results in Table 3 indicate that the variable LLR is negatively significant on ROA [−0.015**, $p < 0.05$] (see model [1]) and OSS [−0.057***, $p < 0.01$] (see model [2]). In addition, the interaction variable LLR x DEV is positively significant on ROA [0.011*, $p < 0.10$] and OSS [0.055**, $p < 0.05$]. It should be noted that the coefficients of the interaction variable (LLR × DEV) are less than the coefficients of LLR on ROA and OSS. Statistically, the results indicate that overall, the impact of credit risks is negatively significant on financial sustainability for both developed and developing nations; however, the effect size is larger in developing nations. The state for development does curtail the adverse effects of credit risks on the financial sustainability of MFIs. Surprisingly, this signifies that the impact of credit risks subdues the positive financial effects of movements of investments from developed to developing nations. Thus, the findings discourage the movement of investments from developed to developing nations.

However, it must be acknowledged that national development should impact the institutionalization of MFIs. Higher levels of governance, economic stability and well-established regulatory frameworks in developed countries foster an environment that reduces credit risk. Conversely, developing countries are likely to face challenges such as weaker governance and economic instability, which increase credit risks.

Table 3. Pairwise correlations and VIFs

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	*VIF*	*VIF(a)*	*VIF(b)*
Panel A: developed Nation – USA															
(1) ROA	1.000														
(2) OSS	0.649*	1.000													
(3) LLR	−0.170*	−0.078	1.000										*15.33*	*1.15*	–
(4) WR-OFF	−0.136*	−0.082	0.967*	1.000									*15.61*	–	*1.14*
(5) RUR-B	0.074	0.021	−0.066	−0.108*	1.000								*1.14*	*1.08*	*1.10*
(6) MICRO	0.000	−0.083*	0.004	0.026	−0.049	1.000							*1.06*	*1.06*	*1.05*
(7)FEM-B	−0.039	−0.116*	−0.026	−0.010	0.211*	0.141*	1.000						*1.17*	*1.17*	*1.18*
(8) CAR	0.191*	0.264*	0.128*	0.116*	−0.013	−0.056	−0.022	1.000					*1.30*	*1.29*	*1.27*
(9) SIZE	0.109*	0.005	−0.268*	−0.229*	−0.036	−0.130*	−0.133*	−0.443*	1.000				*1.48*	*1.47*	*1.45*
(10) PIL	−0.136*	−0.139*	0.203*	0.217*	−0.021	0.052	−0.143*	−0.062	0.080*	1.000			*1.12*	*1.12*	*1.13*
(11) GDP	−0.024	−0.038	−0.016	−0.011	0.039	−0.050	0.032	0.033	0.007	0.052	1.000		*1.03*	*1.03*	*1.02*
(12) NGI	0.026	0.060	0.046	0.009	0.026	0.109*	−0.040	0.020	−0.106*	0.020	−0.027	1.000	*1.04*	*1.04*	*1.06*
Panel B: developing nation – India															
(1) ROA	1.000														
(2) OSS	0.798*	1.000													
(3) LLR	−0.413*	−0.327*	1.000										*54.59*	*1.39*	–
(4) WR-OFF	−0.414*	−0.329*	0.992*	1.000									*54.94*	–	*1.38*
(5) RUR-B	0.069	0.034	−0.048	−0.042	1.000								*1.13*	*1.13*	*1.13*
(6) MICRO	−0.055	−0.107*	0.014	0.011	0.032	1.000							*1.80*	*1.80*	*1.78*
(7)FEM-B	0.101	−0.098	−0.238*	−0.230*	0.153*	0.138*	1.000						*1.89*	*1.89*	*1.87*
(8) CAR	0.167*	0.252*	0.344*	0.335*	0.038	−0.063	−0.018	1.000					*1.29*	*1.27*	*1.27*
(9) SIZE	−0.027	0.085	0.043	0.034	−0.129*	−0.017	−0.107*	−0.045	1.000				*1.16*	*1.13*	*1.11*
(10) PIL	−0.206*	−0.157*	0.231*	0.238*	−0.040	0.017	−0.069	0.021	−0.066	1.000			*1.15*	*1.15*	*1.16*
(11) GDP	0.198*	0.207*	−0.109	−0.098	−0.032	−0.041	0.061	−0.026	0.131*	−0.056	1.000		*1.33*	*1.32*	*1.33*
(12) NGI	0.092	0.118*	−0.135	−0.137	−0.046	−0.106*	0.119*	0.069	0.068	0.092	0.403*	1.000	*1.35*	*1.35*	*1.37*

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$
Source: Author's own work

Table 4. Movements for funds between developed and developing economies

Variables	[1] ROA	[2] OSS	[3] ROA	[4] OSS
LLR	−0.015** [0.005]	−0.057*** [0.020]		
LLR x DEV	0.011* [0.006]	0.055** [0.023]		
WR-OFF			−0.013*** [0.004]	−0.061*** [0.018]
WR-off x DEV			0.009* [0.005]	0.052* [0.021
CAR	0.030*** [0.009]	0.129*** [0.034]	0.030*** [0.008]	0.136*** [0.033]
SIZ	0.007 [0.005]	0.020 [0.013]	0.007 [0.005]	0.020 [0.014]
PIL	−0.013** [0.005]	−0.075*** [0.016]	−0.013*** [0.004]	−0.072*** [0.016]
*Δ*GDP	−0.0003 [0.002]	0.003 [0.012]	−0.001 [0.002]	−0.000 [0.011]
NGI	0.013 [0.014]	0.124** [0.049]	0.016 [0.014]	0.118** [0.046]
Constant	−0.222*** [0.076]	−0.081 [0.268]	−0.242*** [0.080]	−0.0341 [0.295]
R^2	0.131	0.160	0.141	0.158
Model, F	5.10***	6.55***	5.28***	7.41***
Fixed effect, F	3.97***	3.88***	4.03***	3.75***
Wald, χ2	6.0 x 10^{30}***	9.2 x 10^{32}***	2.0 x 10^{32}***	7.8 x 10^{33}***
Hausman, χ2	14.91**	17.71**	16.59**	18.74***
Wooldridge, F	12.11***	0.60	11.40***	1.70

Notes: Wooldridge F represents the first-order serial correlation test. Modified Wald $\chi 2$ statistic indicates it confirms heteroscedasticity in panel data. Therefore, robust standard errors are calculated and presented in square brackets []. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$
Source: Author's own work

4.4.2 Movement of investments from urban toward rural borrowers. In India. Table 5, *Panel P* presents the statistical results for the movement of investments from urban toward rural borrowers in developing nations. The results indicate that the variable RUR-B is positively significant on ROA [0.086***, $p < 0.01$] (see Model [5]) and OSS (0.146*, $p < 0.10$] (see Model [6]). More or less similar results are found in other models of Table 5. In addition, the variable RUR-B positively moderates the relationship between LLR and ROA [LLR x RUR-B, 0.013*** $p < 0.01$] (see Model 5), and WR-OFF and ROA [WR-OFF × RUR-B, 0.011***, $p < 0.01$] (see Model [7]). However, the interaction variable WR-OFF × RUR-B is insignificant on OSS. Therefore, without any loss of generality, it can be concluded that movements of investments from urban to rural borrowers generate extra returns. However, whether these shifts in investments foster self-sufficiency remains questionable.

In the USA. Table 6, *Panel X* presents the results for statistical results for the movement of investments from urban toward rural borrowers for developed nations. Unlike the developing country (India), neither the variable RUR-B impacts financial sustainability (ROA and OSS) positively, nor does it interact with LLR and WR-OFF to drive financial sustainability. In fact, in one case (see model [17]), RUR-B is negatively significant on ROA [−0.011*, $p < 0.10$]. Therefore, the movement of investments from urban to rural areas does not produce any extra returns, nor does this induce OSS in the case of a developed economy.

4.4.3 Movement of investments toward microenterprises. In India. Table 5, *Panel Q* presents the statistical results for the movement of investments toward microenterprises. The results indicate that the variable MICRO positively impacts the ROA [0.498*, $p < 0.10$] (see model [8]) and OSS [1.713*, $p < 0.10$] (see model [9]). Similar results are evident from models [10] and [11] in the same panel. In addition, the interaction variable (LLR x MICRO) is positively significant on ROA [0.078*, $p < 0.10$] and OSS [0.264*, $p < 0.10$]. Results similar to the impact of LLR are also obtained for the variable WR-OFF. Therefore, not only

Table 5. Movements of funds within the country for developing economies

	Panel P			
	[5]	[6]	[7]	[8]
Variables	ROA	OSS	ROA	OSS
RUR-B	0.086*** [0.020]	0.146* [0.086]	0.071*** [0.018]	0.074 [0.081]
LLR	−0.002 [0.006]	−0.038 [0.025]		
LLR x RUR-B	0.013*** [0.003]	0.013 [0.015]		
WR-OFF			−0.005 [0.005	−0.054** [0.021]
WR-off × RUR-B			0.011*** [0.002]	0.001 [0.014]
CAR	0.010 [0.013]	0.054 [0.064]	0.010 [0.013]	0.049 [0.063]
SIZ	0.005 [0.008]	0.021 [0.038]	0.009 [0.007]	0.039 [0.036]
PIL	−0.006 [0.005]	−0.018 [0.023]	−0.007 [0.005]	−0.025 [0.025]
*Δ*GDP	0.006* [0.003]	0.036** [0.017]	0.005 [0.003]	0.029* [0.016]
NGI	−0.006 [0.012]	−0.003 [0.069]	−0.014 [0.013]	−0.039 [0.073]
Constant	−0.155 [0.166]	0.341 [0.738]	−0.247 [0.150]	−0.098 [0.691]
R^2	0.654	0.465	0.648	0.474
Model, F	62.50***	46.52***	43.90***	28.54***
Fixed effect, F	3.99***	3.86***	3.85***	3.65***
Wald, χ2	1.5×10^{31}***	2.6×10^{33}***	3335.97***	5.7×10^{31}***
Hausman, χ2	1.91	1.61	11.57	3.47
Wooldridge, F	0.250	0.927	0.262	0.768

Notes: Wooldridge F represents the first-order serial correlation test. Modified Wald $\chi 2$ statistic indicates it confirms heteroscedasticity in panel data. Therefore, robust standard errors are calculated and presented in square brackets []. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$
Source: Author's own work

(*continued*)

Table 5. Continued

	Panel Q			
	[9]	[10]	[11]	[12]
Variables	ROA	OSS	ROA	OSS
MICRO	0.498* [0.266]	1.713* [0.957]	0.486** [0.229]	1.519* [0.844]
LLR	−0.006 [0.005]	−0.039* [0.020]		
LLR x MICRO	0.078* [0.041]	0.264* [0.150]		
WR-OFF			−0.006 [0.004]	−0.042** [0.017]
WR-off × MICRO			0.077** [0.036]	0.237* [0.132]
CAR	0.024 [0.016]	0.075 [0.064]	0.021 [0.015]	0.053 [0.062]
SIZ	0.023** [0.011]	0.055 [0.036]	0.023** [0.010]	0.058 [0.035]
PIL	−0.015** [0.007]	−0.033 [0.023]	−0.015** [0.007]	−0.033 [0.024]
*Δ*GDP	0.004 [0.003]	0.029** [0.014]	0.004 [0.003]	0.023* [0.012]
NGI	−0.024 [0.020]	−0.019 [0.084]	−0.026 [0.019]	−0.039 [0.084]
Constant	−0.520** [0.209]	−0.291 [0.640]	−0.522** [0.198]	−0.384 [0.618]
R^2	0.510	0.422	0.520	0.432
Model, F	2.46**	4.17***	2.69**	6.03***
Fixed effect, F	3.07***	3.12***	3.25***	3.20***
Wald, χ2	2701.35***	1.8e + 30***	11884.16***	9.7e + 31***
Hausman, χ2	14.01*	6.65	22.16***	11.26
Wooldridge, F	0.657	0.098	0.704	0.099

(*continued*)

Table 5. Continued

	Panel R			
	[13]	[14]	[15]	[16]
Variables	ROA	OSS	ROA	OSS
FEM-L	0.342*** [0.065]	0.603* [0.327]	0.310*** [0.066]	0.409 [0.356]
LLR	−0.007 [0.005]	−0.045** [0.020]		
LLR x FEM-L	0.047** [0.022]	0.069 [0.124]		
WR-OFF			−0.008* [0.004]	−0.048*** [0.017]
WR-off × FEM-L			0.041* [0.022]	0.031 [0.123]
CAR	0.012 [0.014]	0.049 [0.066]	0.009 [0.014]	0.038 [0.064]
SIZ	0.001 [0.008]	0.013 [0.041]	0.004 [0.008]	0.030 [0.042]
PIL	−0.004 [0.005]	−0.013 [0.024]	−0.005 [0.005]	−0.020 [0.026]
*Δ*GDP	0.004 [0.003]	0.026* [0.014]	0.003 [0.003]	0.021 [0.013]
NGI	0.001 [0.014]	0.022 [0.083]	−0.005 [0.014]	−0.017 [0.084]
Constant	−0.0872 [0.168]	0.518 [0.787]	−0.152 [0.166]	0.139 [0.800]
R^2	0.634	0.421	0.622	0.419
Model, F	425.08***	271.96***	419.06***	243.61***
Fixed effect, F	3.53***	3.38***	3.50***	3.28***
Wald, χ2	4.0e + 26***	1.4e + 33***	3.0e + 31***	8.7e + 31***
Hausman, χ2	6.29	5.31	9.57	8.36
Wooldridge, F	0.482	0.165	0.971	0.277

Table 6. Movements of funds within the country for developed economies

	Panel X			
	[17]	[18]	[19]	[20]
Variables	ROA	OSS	ROA	OSS
RUR-B	−0.011* [0.006]	0.032 [0.049]	−0.004 [0.005]	0.042 [0.029]
LLR	−0.007** [0.003]	0.007 [0.017]		
LLR × RUR-B	−0.002 [0.001]	0.010 [0.012]		
WR-OFF			−0.006** [0.003]	−0.000 [0.015]
WR-off × RUR-B			−0.000 [0.001]	0.012 [0.008]
CAR	0.040*** [0.011]	0.145*** [0.039]	0.0403*** [0.009]	0.162*** [0.040]
SIZ	0.000 [0.005]	0.022 [0.017]	0.003 [0.005]	0.017 [0.022]
PIL	−0.012*** [0.004]	−0.116*** [0.021]	−0.012*** [0.003]	−0.103*** [0.021]
*Δ*GDP	−0.003 [0.003]	−0.007 [0.016]	−0.004 [0.003]	−0.011 [0.015]
NGI	0.080** [0.038]	0.301** [0.134]	0.088*** [0.032]	0.292** [0.117]
Constant	−0.608* [0.347]	−1.655 [1.121]	−0.711** [0.293]	−1.451 [1.056]
R-squared	0.151	0.206	0.168	0.203
Model, F	11.82***	12.89***	11.01***	13.26***
Fixed effect, F	4.03***	4.83***	4.11***	4.75***
Wald, χ2	3.5e + 06***	7.1e + 05***	4.3e + 06***	2.0e + 05***
Hausman, χ2	14.31*	29.63***	13.61*	31.98***
Wooldridge, F	13.899***	9.597***	8.615***	18.574***

Notes: Wooldridge F represents the first-order serial correlation test. Modified Wald $\chi 2$ statistic indicates it confirms heteroscedasticity in panel data. Therefore, robust standard errors are calculated and presented in square brackets []. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$
Source: Author's own work

(*continued*)

Table 6. Continued

	Panel Y			
	[21]	[22]	[23]	[24]
Variables	ROA	OSS	ROA	OSS
MICRO	0.050 [0.031]	0.110 [0.114]	0.040 [0.025]	0.104 [0.088]
LLR	−0.001 [0.002]	0.003 [0.010]		
LLR × MICRO	0.006 [0.004]	0.014 [0.016]		
WR-OFF			−0.003 [0.002]	−0.003 [0.011]
WR-off × MICRO			0.005 [0.003]	0.012 [0.013]
CAR	0.027*** [0.008]	0.125*** [0.035]	0.029*** [0.008]	0.145*** [0.036]
SIZ	0.007* [0.004]	0.029* [0.017]	0.007* [0.004]	0.024 [0.023]
PIL	−0.008 [0.005]	−0.073*** [0.023]	−0.008 [0.005]	−0.063*** [0.023]
*Δ*GDP	−0.003 [0.003]	−0.013 [0.018]	−0.004* [0.002]	−0.015 [0.016]
NGI	0.088*** [0.030]	0.309*** [0.114]	0.095*** [0.028]	0.305*** [0.104]
Constant	−0.763*** [0.257]	−1.695* [1.001]	−0.818*** [0.243]	−1.529 [0.998]
R-squared	0.152	0.122	0.170	0.130
Model, F	4.44***	6.11***	4.55***	6.61***
Fixed effect, F	7.13***	4.67***	7.03***	4.51***
Wald, χ2	1.9e + 06***	9.0e + 07***	1.7e + 07***	6.6e + 05***
Hausman, χ2	19.50**	14.28*	15.08*	13.49*
Wooldridge, F	8.289***	0.616	9.711***	1.607

(*continued*)

Table 6. Continued

	Panel Z			
	[25]	[26]	[27]	[28]
Variables	ROA	OSS	ROA	OSS
FEM-L	0.004 [0.021]	0.134 [0.088]	0.017 [0.023]	0.147 [0.131]
LLR	−0.005 [0.004]	−0.005 [0.018]		
LLR × FEM-L	−0.001 [0.003]	−0.006 [0.015]		
WR-OFF			−0.005 [0.004]	−0.016 [0.020]
WR-off × FEM-L			0.000 [0.004]	−0.019 [0.026]
CAR	0.036*** [0.011]	0.144*** [0.039]	0.036*** [0.010]	0.157*** [0.038]
SIZ	0.003 [0.004]	0.030* [0.015]	0.005 [0.004]	0.031* [0.016]
PIL	−0.007 [0.004]	−0.084*** [0.021]	−0.008* [0.004]	−0.077*** [0.020]
*Δ*GDP	−0.004 [0.003]	−0.018 [0.019]	−0.005 [0.003]	−0.020 [0.017]
NGI	0.081** [0.033]	0.313*** [0.114]	0.089*** [0.030]	0.311*** [0.105]
Constant	−0.628** [0.294]	−1.691* [0.959]	−0.719*** [0.274]	−1.644* [0.902]
R-squared	0.119	0.166	0.140	0.179
Model, F	5.54***	7.97***	6.08***	9.37***
Fixed effect, F	4.4***	4.43***	4.95***	4.33***
Wald, χ2	6.3e + 07***	1.8e + 06***	3.3e + 08***	1.8e + 06***
Hausman, χ2	17.65**	23.25***	20.08***	30.21***
Wooldridge, F	14.672***	0.617	11.620**	1.732

does lending to microenterprises increase returns and self-sufficiency, but it also curtails the adverse effects of credit risks (LRR and WR-OFF) on financial sustainability.

In the USA. Table 6, *Panel Y* presents the statistical results for movement toward microenterprises. Unlike developing nations, neither the variable MICRO is significant on financial sustainability nor does it curtail the effects of credit risks.

4.4.4 Movement of investments toward female borrowers. In India. Table 5, *Panel R* presents the statistical results for the movement of investments toward female borrowers. The results indicate that the variable FEM-B positively impacts the ROA [0.342***, $p < 0.01$] (see Model 13]) and OSS [0.603*, $p < 0.10$] (see model [14]). In addition, the interaction variable LLR x FEM-B is positively significant on ROA [0.047**, $p < 0.05$] (see model [13]) but not on OSS (see model [14]). Likewise, the interaction variable WR-OFF × FEM-B is significant on ROA [0.041*, $p < 0.10$] (see model [15]) but not on OSS (see model [16]). Therefore, lending to female borrowers can generate positive returns and foster OSS directly. In addition, lending to female borrowers also moderates the adverse effects of credit risks on returns. However, it does not moderate the impact of credit risks on the self-sufficiency of MFIs.

In the USA. Table 6, *Panel Z* presents the results for statistical results for movement toward female borrowers. Unlike developing nations, neither the variable FEM-B is significant on financial sustainability, nor does it curtail the effects of credit risks.

4.5 Endogeneity and robustness

Multiple techniques and tests are conducted to ensure the robustness of statistical results. First, fixed effects estimation, used in the study, identifies and eliminates the effect of MFI-specific factors that are time-invariant (Adelopo *et al.*, 2022; Lassoued, 2022), thereby controlling for the endogeneity due to some omitted variables that remain fixed over time (Wooldridge, 2013). Second, the Durbin–Wu–Hausman (DWH) test is used to check for endogeneity issues. For the variables of interest in the study, LLR [$\chi^2 = 0.010$, $p = 0.911$; F = 0.01, $p = 0.920$)], WR-OFF [$\chi^2 = 1.22$ $p = 0.267$; F = 1.21 $p = 0.271$], RUR-B [$\chi^2 = 1.98$, $p = 0.159$; F = 1.96, $p = 0.162$], MICRO [$\chi^2 = 1.77$, $p = 0.182$; F = 1.76 $p = 0.184$], FEM-B [$\chi^2 = 3.12$, $p = 0.076$; F = 3.13, $p = 0.07$], where χ^2: Durbin χ^2, F: Wu Hausman F, p: *p*-value, the insignificance of DWH boosts confidence in econometric results against endogeneity. It should be noted that complete elimination endogeneity in social sciences studies is too optimistic an assumption, even after being highly cautious (Panayi *et al.*, 2021). Furthermore, the consistency of results with two variables of financial sustainability (ROA and OSS) and two variables of credit risks (LLR, WR-OFF) signifies the robustness of the statistical results. However, complete control of endogeneity remains debatable in literature (Singh, 2023b). While using control variables and these techniques to address aspects of endogeneity to a great extent, the potential for reverse causality between credit risk and financial sustainability remains a limitation, while allowing the reliability of results under the above-mentioned checks and balances used in the statistical analysis.

5. Discussion and implications

5.1 Relation to previous studies

The existing literature extensively covers the institutionalization of microfinance institutions (MFIs) and their social impact (Fadikpe *et al.*, 2022; Singh, 2023b). However, there is a notable gap in studies that provide statistical evidence on how the economics of microfinance can drive the institutionalization of these crucial institutions. This highlights the novel approach of the current study, which offers fresh insights into this area. Although it is

challenging to directly relate the findings to previous studies, connections can be made with existing literature.

For instance, the study's econometric findings for developed economies align with the law of marginal returns as outlined in "The Economics of Microfinance" (Armendáriz and Morduch, 2010). Empirical evidence from this study supports the notion that investments flow from wealthier regions (such as affluent urban areas and capital-rich corporations) to poorer regions (including rural areas and microenterprises) in support of microfinance institutionalization. The study confirms that such investment flows should be motivated by profit rather than philanthropy. Adams *et al.* (2021) noted that cheap credit or subsidies for rural development often yield disappointing results.

In developing nations, MFIs benefit from operating without subsidies, as suggested by D'Espallier *et al.* (2013a). The current study's findings are consistent with Navin and Sinha (2021), who advocate that MFIs should target low-income clients with smaller loan sizes to achieve profitability and self-sufficiency. In addition, the study supports the Grameen Bank's assertion that a higher proportion of female clients reduces credit risks and enhances profitability (Armendáriz and Morduch, 2010, p. 13). Women entrepreneurs are associated with better decision-making, reduced risk and increased profitability (Jianakoplos and Bernasek, 1998; Sahay *et al.*, 2021). This emphasizes the need for MFIs to focus on female borrowers, a strategy that has proven successful in countries like Bangladesh (Yunus, 2007).

Conversely, the empirical results for developed nations do not support the economic theories proposed by Armendáriz and Morduch (2010). In the USA, investment flows from wealthier areas to poorer ones fail to promote the institutionalization of microfinance or the profit motives of investors. Furthermore, investments moving from developed to developing countries do not support MFI institutionalization, possibly due to high operational costs. This may explain why Yunus rejected World Bank support for Grameen Bank multiple times.

5.2 Relation to theory

Mohammad Yunus argues that subsidies or philanthropic efforts can be more detrimental than beneficial, undermining the goal of self-sufficiency (Yunus, 2007). Armendáriz and Morduch (2010) also emphasize that microfinance should be driven by profit rather than philanthropy. The current study supports this view, particularly within developing countries. MFIs are expected to achieve financial self-sufficiency and reduce reliance on government subsidies or philanthropic support (Singh, 2023b). Financial stability in MFIs should enhance their ability to access resources and capabilities (Armendáriz and Morduch, 2010; Waddock and Graves, 1997). For long-term sustainability, MFIs must prioritize self-sufficiency (Singh, 2023b). The viability of MFIs (Navin and Sinha, 2021) depends on minimizing operational costs and generating sufficient revenue to cover these costs (Fadikpe *et al.*, 2022). The study underscores the importance of OSS for the institutionalization of microfinance.

5.3 Implications

5.3.1 Practical implications. For investors, the study's findings suggest that investing in MFIs within developed nations is more advantageous if the primary motive is profit. Investments in developed nation MFIs offer better profitability and credit risk management. Investments flowing from urban to rural borrowers or to microenterprises and female borrowers in developed countries do not yield additional financial returns or reduce risks.

In developing countries, investments flowing from wealthier to poorer regions are beneficial. Such investments generate extra returns for MFIs and their investors, mitigate adverse credit risk effects on profitability and support the institutionalization of the microfinance sector. The study advocates for MFIs to extend credit to rural borrowers, microenterprises and female borrowers to enhance their sustainability.

5.3.2 Policy implications. The findings have significant policy implications, especially for developing nations. Investment flows from developed to developing countries might discourage investors from directing funds toward MFIs in developing nations. The positive moderation of credit risks and MFI financial sustainability by a country's development status suggests that developed nations offer safer investment opportunities. As Singh (2023b) argues, developing countries must implement policies and governance systems that protect MFI profitability and mitigate credit risks. While national governance positively affects MFI profitability and self-sufficiency (see Table 4), developing countries must adopt policies that enhance investor confidence. Policy interventions should focus on strengthening developing economies to improve investment attractiveness and encourage lending to rural borrowers, microenterprises and female borrowers. Finally, the marginal effects (LLR x DEV and LLR x RUR-B; see Table 4) signify that though national development restricts the negative impacts of credit risks, these reductions are limited. Therefore, policies based solely on national development may fail to address the impact of credit risks completely. Thus, enhancing financial regulation and institutional frameworks is crucial to foster the financial sustainability of MFIs in developing countries.

5.3.3 Social implications. The study has notable social implications, particularly for developing nations. By encouraging MFIs and investors to focus on poorer borrowers, rural areas and female clients, the findings promote poverty alleviation and enhance social dignity. Financial inclusion of female borrowers can also reduce domestic violence, as noted by Yunus (2007).

5.3.4 Contributions/novelty. This study offers substantial empirical evidence on the contemporary economics of microfinance, contributing to the understanding of how microfinance economics can support the institutionalization of this socially relevant sector. The study provides valuable guidance to both MFIs and investors and contributes to policy discussions aimed at supporting microfinance institutionalization. The unique integration of economics and institutionalization to achieve social impact distinguishes this study from existing literature. Unlike previous studies that debate the coexistence of social and financial sustainability, this research provides robust empirical evidence supporting the institutionalization of microfinance while aligning with social and financial sustainability goals. The study thus offers novel insights into institutionalizing the microfinance sector, particularly in developing economies, while fostering social impact.

6. Conclusion

The sustainability of MFIs and the self-reliance of their customers are interlinked, requiring a balance between social impact and institutionalization. This study, using MIX data from the World Bank, demonstrates how microfinance economics can promote MFI institutionalization, enhance profitability for investors and amplify social impact. The findings underscore that investments should flow from wealthier regions, including high-income developed countries and affluent urban areas, toward poorer regions, such as low-income developing countries and rural areas, to advance the microfinance sector. Such investment strategies foster social equity, dignity, poverty reduction and financial inclusion. However, this economic model does not apply to developed nations like the USA, where investment flows from developed to developing countries do not support profit motives.

The study reveals practical, policy and social implications. For investors focused on profit, MFIs in developed nations offer safer returns. Conversely, in developing countries, investments from affluent regions yield higher returns and mitigate credit risks, aiding MFI sustainability. Socially, focusing on poorer borrowers and female clients in developing nations can significantly improve lives, foster self-reliance and enhance social dignity. The study provides valuable empirical evidence on microfinance economics and offers guidance for MFIs and investors.

Finally, the study acknowledged its limitations that provide directions for future research. While the binary variable approach to classify developed and developing economies simplifies the analysis and does not adequately capture significant economic, political and social variances within and across nations. Further, using only two countries for analysis in this study leaves scope for other countries to be further examined to make the findings more generalizable.

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