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Relationship between microfinance institutions' self-sustainability and financing sources: Moderating role of external governance

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Abstract

The self-sustainability of microfinance institutions (MFIs) is a growing concern as they work as non-profit organizations to achieve global poverty reduction goals. This study aims to examine the MFIs' self-sustainability using an efficiency measurement technique based on Data Envelopment Analysis (DEA). It also determines the influence of different financing sources on MFIs' self-sustainability as well as the moderating impact of external governance on this relationship. It uses the Generalized Method of Moments (GMM) estimator to analyze the panel data from 661 MFIs in 86 coun-

tries during the 2010–2018 period. The DEA analysis reveals that MFIs are still in the intermediate stage of self-sustainability in terms of technical and cost efficiency. The second-stage regression results reveal that financing sources such as retained earnings and equity have a robust positive and statistically significant effect on the MFIs' self-sustainability, implying that MFIs that rely more on these two sources are more likely to be self-sustainable. The moderation analysis reveals that good governance accelerates the positive effect of financing sources on MFIs' efficiency. Given these empirical findings, MFIs' decision-makers can benefit from considering their own funding and equity. Quality governance can be ensured by government agencies and regulatory bodies to support the MFIs' sustainability.

KEYWORDS
efficiency, external governance, financing sources, microfinance institutions, self-sustainability

JEL CLASSIFICATION
D24, D25, G21, G23, G32, G38

1 | INTRODUCTION

Microfinance has evolved to become a well-known development tool across many developing countries. Providing credit to the poor without collateral, Microfinance Institutions (MFIs) help their borrowers increase their productivity in self-employed economic activities (Ahamad et al., 2022). The different loan lending methods for poor people make MFIs different from traditional banks and other financial institutions. While the microfinance sector is still young, it has experienced an average of 11.5% annual global growth, serving 139.9 million disadvantaged and low-income borrowers. (Microfinance Barometer, 2019). Despite this progress, the current body of literature shows that MFIs' efforts to reach out to new clients are decreasing over time. Empirical studies reveal that numerous MFIs can only cover 25% of their costs (Turini, 2018). Guichandut (2018) claimed that nearly half of MFIs worldwide are still unable to generate enough revenue to survive and grow. The portfolio at risk (PAR) over 30 days in 2018 globally increased from 4.7% to 7% (Microfinance Barometer, 2019). Moreover, Wijesiri and Meoli (2015), Wijesiri et al. (2017), and Babu Muneer and Kulshreshtha (2017) stated that a large proportion of MFIs are financially incompetent and the industry is now much more competitive than before (Hossain et al., 2020; McIntosh & Wydick, 2005). This overall deterioration in financial stability is alarming for MFIs' self-sustainability. Self-sustainability within the microfinance industry represents the capacity of MFIs to maintain their financial viability and operational continuity over the long term while fulfilling their mission of serving marginalized communities without

relying on external subsidies or grants. It encompasses a dynamic equilibrium between generating sufficient revenue from their financial services to cover operational costs, ensuring loan portfolio quality, diversifying financial products, and managing interest rates effectively (Armendáriz & Morduch, 2010; Ledgerwood & White, 2006). Therefore, given the prevalent challenges and financial instability faced by MFIs as described earlier, a critical question arises: How can these institutions achieve the efficiency necessary for financial self-sustainability? Hence, it requires a more in-depth analysis of the performance of MFIs, which will ensure their sustainability.

Given the importance of assessing the sustainability of MFIs, yet there is a notable gap in empirical evidence regarding the factors that influence their sustainability. One particularly critical area of study revolves around how the sources of financing impact the sustainability of these institutions. The study on this relationship is important as these institutions were introduced as revolutionary approaches to provide credit to the poor without requiring collateral. Traditionally, subsidies have been the primary source of funding for MFIs. Traditionally, subsidies have served as the primary source of funding for the microfinance industry. MFIs are receiving substantial financial support from donors to cover startup expenses and running their poverty reduction programs (Mia et al., 2021; Cull et al., 2011). It's worth noting that previous research has placed significant emphasis on subsidies, as highlighted by Hermes and Hudon (2018). However, the findings from past studies (Tahir & Tahrim, 2013; Lebovics et al., 2016; Tchuigoua et al., 2017; Caudill et al., 2009; Bogan, 2012) have revealed a contradictory impact of subsidized funding on the sustainability of MFIs.

Although over the years microfinance has attracted and utilized donor funds, this has recently changed. As the microfinance sector has become more commercial over time, the sector has allowed its financing sources to be diversified. Hence, understanding the effect of diverse funding sources on the MFIs' efficiency is essential for their stable operation and self-sustainability. Recent studies of Parvin et al. (2020) and Mia et al. (2021) similarly stressed this need. Studies conducted by Hartarska and Nadolnyak (2007), Hamada (2010), Mersland and Urgeghe (2013), and Bayai and Ikhide (2018) have explored the effects of debt financing on MFIs performance, yielding mixed outcomes. There has been a strong focus on subsidies, a few studies on debt, but a lack of studies examining the potential impact of other funding sources, for instance, deposits in the form of micro-savings, retained earnings, donations, commercial borrowing, equity for MFIs performance and long-term sustainability.

Existing literature shows that retained earnings are the most popular internal financing source of developing MFIs (Bayai & Ikhide, 2018). For instance, Mia et al. (2021) stated that some MFIs generate a good amount of retained earnings that can influence them to avoid external funding. Further, MFIs could avail the opportunity to be self-dependent and can create self-financing capacity by collecting and utilizing deposits, which can ultimately improve their self-sustainability. However, the literature presents inconsistent evidence regarding the impact of deposits on MFI performance (Annim, 2012; Dupas & Robinson, 2013; Tehulu, 2013; Chikalipah, 2019). Moreover, due to insufficient internal funds, MFIs often resort to borrowing from external sources, including commercial borrowing and equity (Parvin et al., 2020). Nevertheless, research on the effects of commercial borrowing and equity on MFI performance remains limited and yields mixed results (Khachatryan et al., 2017; Bayai & Ikhide, 2018). Overall, the presence of unclear and contradictory evidence, coupled with a scarcity of comprehensive studies, underscores the necessity for further investigation into the effects of different financing sources on the self-sustainability of MFIs.

External governance, particularly national-level governance, rules, regulations, etc., plays a significant role in MFI sustainability (Bibi et al., 2018; Müller & Uhde, 2013). In particular, the regulatory environment within a country plays a pivotal role in determining the sustainability and outreach of MFIs. Studies conducted by Bassem (2008) and Emeni (2008) have asserted that a conducive regulatory environment is positively linked to the performance of MFIs. Conversely, Anku-Tsede (2014), Bakker et al. (2014), Halouani and Boujelbène (2015), and Pati (2015) have contended that excessive regulatory restrictions can impede MFI performance and sustainability rather than supporting them. Beyond regulations, political stability serves as another critical indicator that significantly impacts the financial risk faced by businesses and enhances organizational sustainability (Sainz-Fernandez et al., 2015). Ault and Spicer (2014) have argued that MFIs often experience poor financial performance in politically unstable states. Hermes and Hudon (2018) also argued that the political system is part of the country's institutional context, and political stability may increase the demand for services from MFIs. Better rule of law can also mitigate financial crises and help business growth (Quayes & Joseph, 2017).

Empirical evidence demonstrates that there is a linear relationship between country good governance and MFI performance. Pinz and Helmig (2015) argued that country-specific contextual variables typically have a moderating impact. Hermes and Hudon (2018) corroborated the argument and asserted that the relationship between drivers and MFIs performance depends on the context. Particularly, country governance factors may play a significant moderating role. Thus, there is scope to incorporate external governance factors as moderating variables in the relationship between financial sources and the MFIs' sustainability.

The pecking order theory (POT) is widely used to explain the banking industry's capital structure. Most of the microfinance studies has focused on agency theory to explain the financial structure. As microfinance institutions have recently started to use external financing besides grants, POT can better explain the trend of financial structure.

To deal with all the issues, data from 661 MFIs in 86 countries between 2010 and 2018 were used in this study. MFIs self-sustainability issues were measured utilizing the advanced efficiency analysis technique Data Envelopment Analysis (DEA). The initial findings of the DEA approach reveal that MFIs are still in an intermediate stage in terms of technical and cost efficiency. The low revenue-generating efficiency shows their inefficiency and unsustainability as well. The findings of second-stage hypotheses testing affirm that retained earnings and equity are more important for financial sustainability than the the source of funding. Further, with the existence of quality governance, the effect of financing sources on MFIs sustainability is positively and largely affected.

Hence, this paper makes significant contributions in various dimensions. Firstly, it addresses the pressing challenge faced by MFIs in maintaining self-sustainability while simultaneously serving disadvantaged communities. It underscores the necessity of exploring diverse funding sources and their intricate relationship with MFIs' performance and long-term sustainability. Additionally, the paper sheds light on the pivotal role of external governance factors in shaping the sustainability of MFIs. This paper advances the field by considering external governance factors as moderators in the relationship between financing sources and MFIs' efficiency, even calculating marginal effects to describe their moderating influence, and providing new insights into the microfinance literature. Moreover, the paper introduces the pecking order theory (POT) as a framework to explain the financial structure of MFIs, highlighting its potential applicability in understanding the changing trends in financial structure as MFIs increasingly utilize external financing. The paper provides empirical insights from advanced efficiency analysis techniques, specifically DEA, and in particular three efficiency dimensions, namely Technical Efficiency (TE),

Cost Efficiency (CE) and Revenue Efficiency (RE), to assess MFIs' self-sustainability, which are rarely utilized in microfinance studies. Further, unlike other studies, this research employs the robust GMM method to estimate the relationships, aligning with recent suggestions by Mia et al. (2021) and Parvin et al. (2020). Finally, the findings highlight the significance of retained earnings and equity for MFIs' financial sustainability, with governance quality amplifying this effect, contributing to a deeper understanding of the sustainability relationship between financing sources and MFIs.

The rest of the paper is organized as follows: Section 2 briefly describes previous studies on the relationship between funding structure and MFIs efficiency and sustainability. Section 3 presents the research methods, i.e., data and sample, efficiency, and regression models, followed by the findings and discussions in Section 4. Finally, Section 5 presents the conclusion, implications, and recommendations.

2 | LITERATURE REVIEW

2.1 | MFIs' self-sustainability

Self-sustainability within the microfinance industry represents the capacity of MFIs to maintain their financial viability and operational continuity over the long term while serving marginalized communities without relying on external subsidies or grants (Armendáriz & Morduch, 2010; Ledgerwood & White, 2006). It embodies a dynamic equilibrium encompassing various facets, including the generation of adequate revenue from financial services to cover operational expenses, the assurance of loan portfolio quality, the diversification of financial products, and effective interest rate management. This study employs advanced efficiency analysis techniques, specifically Technical Efficiency (TE), Cost Efficiency (CE), and Revenue Efficiency (RE), to measure MFIs' self-sustainability. These dimensions are not commonly explored in microfinance research but offer a more holistic understanding of the multifaceted nature of self-sustainability (Mia et al., 2021; Parvin et al., 2020). By incorporating these efficiency dimensions, the study seeks to assess how efficiently MFIs operate, allocate resources, generate revenue, and minimize costs. This approach enables a nuanced exploration of the factors influencing MFIs' self-sustainability and their interactions with diverse financing sources, thereby contributing to a more comprehensive conceptualization of self-sustainability within the microfinance landscape.

2.2 | Financing sources for MFIs' self-sustainability

This study delves into the evolving financial structure of MFIs' and its implications for their self-sustainability. Traditionally, subsidies were the primary sources of funding for MFIs (Mia et al., 2021; Cull et al., 2011). However, the microfinance sector has experienced a transformation with an increasing trend towards commercialization. This evolution has allowed MFIs to diversify their financing sources, moving away from a heavy reliance on subsidies. The sources of funding for MFIs now encompass a broader spectrum, including debt financing, retained earnings, deposits, donations, commercial borrowing, and equity (Hartarska & Nadolnyak, 2007; Hamada, 2010; Mersland & Urgeghe, 2013; Bayai & Ikhide, 2018). For instance, some MFIs have managed to generate substantial retained earnings, enabling them to reduce their dependence on external funding sources (Mia et al., 2021). Others have explored the potential of deposits to create self-financing capacity and enhance self-sustainability. However, it is essential to note that the impact of these

various financing sources on MFIs' self-sustainability remains a complex and multifaceted issue. Thus, it delves into the reasons behind this evolution and explores how these various financing sources influence MFIs' self-sustainability, aiming to shed light on this multifaceted issue and contribute to the existing body of knowledge in the field of microfinance.

2.3 | Underpinning theory for MFIs' financial decision-making and self-sustainability

This study is grounded on the POT, initially proposed by Myers and Majluf (1984) to illuminate the financial behavior of MFIs. POT offers valuable insights into organizational financial decisions, particularly their prioritization of various funding sources. Essentially, POT posits that companies adhere to a specific hierarchy when raising capital, beginning with internal funds like retained earnings or savings, followed by debt financing, while equity financing is a last resort (Adair & Adaskou, 2015). The relevance of POT to this study becomes evident in its alignment with the study focus on the evolving financial landscape of MFIs. Given that MFIs operate using a mix of internal resources, i.e., client deposits and external financing, POT's central idea of favoring internal funds due to lower information asymmetry and cost advantages resonates with the shifts observed in MFIs' funding models away from traditional subsidies. By anchoring this study in POT, we aim to investigate how MFIs' changing financing structures correspond to POT principles (Myers & Majluf, 1984), offering a nuanced exploration of their funding source decisions and their impact on self-sustainability. The application of POT in this context enhances comprehension of the distinctive financial choices and capital structure dynamics of MFIs (Myers & Majluf, 1984).

2.3.1 | Retained earnings and MFIs' efficiency

Retained earnings represent a significant internal source of capital for MFIs, allowing them to operate without the immediate need for external financing, which, in turn, can enhance their technical efficiency (Mia & Lee, 2017). When MFIs have ample retained earnings at their disposal, they can strategically allocate these funds to improve their operational effectiveness, leading to a positive impact on their overall technical efficiency.

Furthermore, the influence of retained earnings extends to the realm of cost efficiency within MFIs. The POT underscores the cost-effectiveness of retained earnings compared to external financing options. This theory finds resonance within the microfinance context, where the presence of substantial retained earnings reduces the need for costly external funds, resulting in lower interest payments and overhead expenses (Khachatryan et al., 2017). This strategic reliance on internal funds not only aligns with theoretical principles but also manifests empirically as a positive driver of cost efficiency in MFIs (Bayai & Ikhide, 2018).

Furthermore, the implications of retained earnings extend to revenue efficiency. When MFIs possess a solid foundation of retained earnings, they can prioritize revenue-generating activities without the encumbrance of servicing external debts. This strategic focus on income-generating endeavors naturally translates into increased revenue from their financial services (Mia et al., 2021). Empirical findings support this notion, highlighting the positive influence of retained earnings on revenue efficiency in MFIs (Khachatryan et al., 2017). In light of this comprehensive theoretical underpinning and empirical evidence, this study articulates the following hypothesis:

$H_{1\ a,\ b,\ c}$: Retained earnings significantly enhance the MFIs' technical, cost, and revenue efficiency.

2.3.2 | Deposits and MFIs' efficiency

Deposits play a multifaceted role in enhancing MFIs' financial sustainability. While empirical studies have substantiated the significance of deposits in amplifying the performance of MFIs (Hartarska & Nadolnyak, 2007; Annim, 2012). These deposits serve as a reliable source of internal funding, allowing MFIs to expand their operations, reach more marginalized individuals, and ultimately enhance their technical efficiency. As deposits increase, MFIs can allocate these funds strategically to improve their service delivery, ultimately contributing to their efficiency and self-sustainability. Aligning with theoretical principles, deposits are theoretically positioned as an attractive internal financing source due to their cost-effectiveness, thereby aligning with the POT (Khachatryan et al., 2017; Parvin et al., 2020). POT advocates the preference for internal funds over external financing options, reflecting the inherent benefits of deposit-driven capital for MFIs.

Furthermore, the role of deposits extends to minimizing external financing costs, thereby positively impacting the cost efficiency of MFIs—a crucial determinant of self-sustainability (Bayai & Ikhide, 2018). POT reinforces the preference for internal funds like deposits due to their lower costs compared to external financing options (Myers & Majluf, 1984). By reducing reliance on costlier external sources, MFIs can enhance cost efficiency, ensuring optimal resource allocation for their core mission of serving marginalized communities.

Moreover, while deposits serve as a cost-effective internal financing source, they also facilitate the generation of healthy revenue streams for MFIs (Khachatryan et al., 2017; Parvin et al., 2020). The cost-effective nature of deposits allows MFIs to allocate more resources to revenue-generating activities, such as lending to marginalized borrowers. This enables MFIs to serve their target communities more effectively while simultaneously improving their revenue efficiency. Moreover, deposits offer stability in funding, reducing the reliance on unpredictable external sources and ensuring consistent revenue streams. This aligns with POT's emphasis on the preference for internal funds over external financing sources due to their cost-effectiveness. This theoretical support with empirical evidence highlights the significance of deposits in enhancing MFIs' self-sustainability (Khachatryan et al., 2017; Parvin et al., 2020). Overall, deposits emerge as a critical factor in bolstering MFIs' financial sustainability, impacting technical efficiency, cost efficiency, and revenue efficiency. Therefore, aligned with the arguments, the following hypothesis is proposed:

$H_{2\ a,\ b,\ c}$: Deposits significantly enhance the MFIs' technical, cost, and revenue efficiency.

2.3.3 | Donation and MFIs' efficiency

Donations, as a pivotal funding source for MFIs, wield significant influence over these institutions' self-sustainability. The role of donations in enhancing MFIs' technical efficiency is underscored by their ability to bolster initial operations, cover startup costs, and support early financial needs (Khachatryan et al., 2017; Mia et al., 2021). However, extensive research demonstrates that an overreliance on donor funds can have divergent effects on MFIs' financial performance. Bogan (2012) reveals that MFIs' operating self-sufficiency continuously diminishes with increasing reliance on donor funding. This erosion of self-sufficiency is substantiated by the work of Bayai and Ikhide (2018), who conducted a study on South African MFIs, concluding that donations play an insignificant role in ensuring the long-term financial sustainability of MFIs. These findings align with the POT, which posits that donations should be a secondary

financing option after exhausting internal sources like retained earnings and deposits (Myers & Majluf, 1984).

The relationship between donations and cost efficiency in MFIs is intricate and contingent on the scale of donations received. Research findings suggest that the correlation between MFIs' efficiency and donation funds is intricately tied to the scale of donations (Hudon & Traca, 2011). Studies such as Tahir and Tahrim's (2013) research on Vietnamese MFIs and Lebovics et al. (2016) have found that MFIs remain financially efficient even when relying on donated funds. Conversely, the impact of donations on cost efficiency varies, with some studies suggesting that excessive donations can hinder cost effectiveness (Caudill et al., 2009). The POT, which advocates for internal funds like deposits and retained earnings before external financing, aligns with the notion that donations may affect cost efficiency depending on their scale (Myers & Majluf, 1984).

Moreover, donations have the potential to influence revenue efficiency in MFIs significantly. The cost-effectiveness of donations allows MFIs to allocate more resources to revenue-generating activities, such as lending to marginalized borrowers, enhancing their revenue efficiency (Khachatryan et al., 2017; Parvin et al., 2020). Furthermore, donations offer a stable funding source, reducing reliance on unpredictable external sources and ensuring consistent revenue streams. This stability aligns with the POT, which advocates for internal funding sources due to their cost-effectiveness and reliability (Myers & Majluf, 1984). Empirical evidence further substantiates the role of donations in enhancing MFIs' self-sustainability, emphasizing the multifaceted relationship between donations and MFIs' efficiency (Khachatryan et al., 2017; Parvin et al., 2020). In light of these considerations, this study proposes the following hypothesis to comprehensively investigate the impact of donations on MFIs' self-sustainability across different dimensions of technical, cost, and revenue efficiency:

$H_{3\ a,\ b,\ c}$: Donations significantly enhance the MFIs' technical, cost, and revenue efficiency.

2.3.4 | Commercial borrowing and MFIs' efficiency

Commercial borrowing is a critical component of MFIs' financial strategy, especially when faced with resource constraints (Parvin et al., 2020). It significantly impacts various dimensions of MFIs' efficiency and, consequently, their self-sustainability. Firstly, commercial borrowing has a substantial influence on the technical efficiency of MFIs. Empirical studies conducted by Mersland and Urgeghe (2013) and Khachatryan et al. (2017) provide evidence of a positive association between commercial borrowing and the financial performance of MFIs. This finding aligns with the POT, which asserts that firms prefer debt financing over equity due to its cost-effectiveness (Myers & Majluf, 1984). MFIs, in particular, benefit from this cost-effectiveness, as it enables them to allocate resources more efficiently, ultimately contributing to improved technical efficiency.

Secondly, cost efficiency plays a pivotal role in MFIs' self-sustainability, as it directly affects resource allocation and operational effectiveness. The relationship between commercial borrowing and cost efficiency in the context of MFIs is multifaceted. While Hoque et al. (2011) suggest that debt can decrease social efficiency but enhance financial performance, Bayai and Ikhide (2018) argue that high-debt financing can reduce cost efficiency. The underlying principle here is that commercial borrowing introduces an additional cost in the form of interest payments. However, Ngo's (2013) research suggests that efficient utilization of borrowed funds can lead to cost-effective operations and improved sustainability.

Lastly, commercial borrowing not only influences costs but also has implications for generating revenue. The cost-effective nature of debt allows MFIs to allocate more resources to

revenue-generating activities, such as lending to marginalized borrowers. This, in turn, enables them to serve their target communities more effectively while simultaneously improving their revenue efficiency. Evidence from studies by Mersland and Urgeghe (2013) and Khachatryan et al. (2017) supports this notion. Additionally, the stability of funding from commercial borrowing reduces reliance on unpredictable external sources, ensuring consistent revenue streams. Considering the above discussions, the following hypotheseis is proposed:

$H_{4\ a,\ b,\ c}$: Commercial borrowings significantly enhance the MFIs' technical, cost, and revenue efficiency.

2.3.5 | Equity and MFIs' efficiency

Equity, as a financing source, plays a crucial role in shaping the efficiency and sustainability of MFIs (Mia et al., 2021). It represents an ownership stake typically contributed by owners and supported by domestic and international donor agencies and development partners (Bayai & Ikhide, 2018). However, empirical evidence regarding the impact of equity on MFIs' performance has yielded mixed results. Particularly, the influence of equity on the technical efficiency of MFIs is multifaceted. Wijesiri et al. (2015) observed in their study of Sri Lankan MFIs that equity had a less favorable impact, showing a negative effect on financial efficiency. Conversely, Abrar and Javaid (2016), in an analysis spanning 70 countries, found that equity had a positive influence on increasing revenue and enhancing profitability for MFIs. Meanwhile, Khachatryan et al. (2017) discovered a different outcome in Eastern Europe and Central Asia, where equity, particularly from social investors, had a negative effect on profitability but led to improved social performance. However, studies by Bayai and Ikhide (2018) and Chikalipah (2019) conducted in African countries indicated that equity financing contributed to the financial sustainability and overall performance of MFIs.

Cost efficiency is another vital aspect of MFIs' self-sustainability, where equity's impact has been the subject of investigation. Parvin et al. (2020) stated that equity can increase MFIs' net income by covering costs and enhancing profitability. The POT suggests that equity is often the last resort for firms in their financing structure (Myers & Majluf, 1984). However, this decision may not always be driven solely by cost considerations, as POT acknowledges that firms may choose to issue equity even when costs are relatively small. The relationship between equity and cost efficiency depends on how effectively equity funds are managed within MFIs.

Revenue efficiency is a critical aspect of MFIs' overall sustainability, and equity financing can significantly impact this dimension. While empirical studies have explored various aspects of the relationship between equity and revenue efficiency. For instance, Abrar and Javaid (2016) examined data from 70 countries and concluded that equity positively influences revenue, potentially contributing to better financial performance for MFIs. Khachatryan et al. (2017) also found a positive relationship between equity financing and revenue performance. These findings suggest that equity financing not only influences revenue efficiency but also contributes to the overall sustainability of MFIs. These findings align with the POT, which posits that equity financing is favored by firms due to its cost-effectiveness, ultimately allowing MFIs to allocate resources more effectively for revenue-generating activities. Therefore, in alignment with POT and considering the empirical arguments, the following hypothesis is proposed:

$H_{5\ a,\ b,\ c}$: Equity significantly enhances the MFIs' technical, cost, and revenue efficiency.

2.3.6 | Moderating role of external governance

A robust governance structure is paramount for the microfinance sector's effective functioning, as it plays a vital role in ensuring the sector's sustainability. The absence of strong governance structures can lead to crises, such as the one witnessed in Andhra Pradesh, India, in 2010, where over-indebted clients resorted to extreme measures (Taylor, 2011). In contrast, a robust governance framework can help prevent such crises and improve the performance of MFIs. Scholars, including Churchill et al. (2018), acknowledged that a country's governance structures significantly influence MFIs' performance across nations.

The governance structure of a country is influenced by various factors, including regulatory quality, the rule of law, the fight against corruption, political stability, as well as voice and accountability, which are components of the World Governance Indicator (Athari & Bahreini, 2021; Churchill et al., 2018). Regulatory quality, as part of the governance framework, is a key driver of the microfinance sector's sustainability. A study conducted by Emeni (2008) and Bassem (2008) indicated that a favorable regulatory framework positively correlates with the financial performance of MFIs. However, it is crucial to strike a balance between regulation and enabling MFIs to fulfill their mission effectively. This is important because excessive regulatory restrictions can hinder their ability to provide cost-effective financial services to the poor (Bakker et al., 2014; Anku-Tsede, 2014; Halouani & Boujelbène, 2015).

Political stability is another critical factor impacting the financial risk of MFIs. Politically unstable countries often experience MFIs underperformance due to higher risk levels (Ault & Spicer, 2014). Political stability not only mitigates this risk but can also expand the market for microfinance services (Hermes & Hudon, 2018). An effective rule of law is equally vital, as it helps to mitigate financial crises and enhance business performance (Quayes & Joseph, 2017).

Empirical evidence suggests that good governance at the country level is essential for the development and growth of MFIs. However, the relationship between good governance and MFIs' performance is not straightforward, and external governance factors can moderate this relationship (Pinz & Helmig, 2015). Moreover, Hermes and Hudon (2018) argued that external factors influence the relationship between explanatory variables and MFIs' performance. Therefore, this study aims to examine how governance stability, as an external governance factor, can strengthen or weaken the link between self-sustainability and financial structure in MFIs. By incorporating governance stability as a moderating variable, this study seeks to provide a more comprehensive understanding of this intricate relationship and its implications for MFIs' sustainability. Based on the above discussion, the following hypothesis is proposed:

H6: The relationship between financing sources (i.e., retained earnings, deposits, donations, commercial borrowings, equity) and the technical, cost and revenue efficiency of MFIs is moderated favourably by external governance.

3 | METHODOLOGY

3.1 | Data and sample

This study extensively utilized secondary data obtained from two distinct databases—the Microfinance Information Exchange (MIX) and the World Governance Indicators (WGI) index—supplemented by control variables from the World Development Indicators (WDI) database. The

MIX database contains a wealth of financial data related to MFIs. The dataset encompasses a wide array of variables, including but not limited to indicators of financial performance, capital structure, and operational metrics. These variables provide a comprehensive view of MFIs' financial characteristics. From the extensive MIX dataset, this study carefully selected variables that directly aligned with the research questions, which primarily revolved around the relationships between financial structure and the sustainability of MFIs. Variables related to financial performance, capital composition, and operational efficiency were prioritized due to their relevance to our study's focus.

Additionally, the WGI index includes six governance indicators, each capturing specific aspects of a country's governance framework. The index of those six indicators has been used to measure external governance factors. These governance indicators range from −2.5 to +2.5, with +2.5 denoting very good governance and −2.5 denoting very poor governance (World Bank, 2019). This judicious selection ensured that the selected dataset was tailored to address the specific research questions and hypotheses formulated for this study. The WDI database also offers a wealth of variables. In this study, inflation and GDP per capita growth were included as control variables. These two variables were chosen because any changes in inflation and GDP growth significantly affect MFIs' operations, as MFIs are an integral part of the economy and financial sector (Mia & Lee, 2017).

The combination of data from the MIX, WGI, and WDI databases was executed systematically to construct a coherent and internally consistent dataset. The data from the MIX database, focusing on MFIs, was matched with the relevant governance indicators from the WGI index based on the countries in which these MFIs operate. This matching process allowed us to merge the financial data of MFIs with the corresponding governance indicators of their respective countries. The combination was meticulously executed to ensure that the variables from both databases harmonized with the study's research objectives, thereby facilitating a comprehensive examination of the relationships between financial structure, self-sustainability, and governance stability in MFIs.

3.2 | Measuring microfinance institutions' efficiency

This study employed a robust efficiency measurement approach, DEA, to assess the technical, cost, and revenue efficiency of MFIs. DEA is a non-parametric method known for its flexibility and adaptability, making it particularly well-suited for analyzing MFIs' multifaceted operations (Akçay et al., 2012; Cooper et al., 2011). In selecting input and output variables for analysis, the production approach was followed, aligning with the research objectives of examining the relationships between financial structure, self-sustainability, and governance stability in MFIs.

For the assessment of technical efficiency, this study carefully selected three input variables: total funds, the number of staff, and total fixed assets. These inputs are critical components that influence the operational effectiveness of MFIs, as they directly relate to resource allocation and utilization. To evaluate technical efficiency, two output variables have been chosen: total loans and income generated from the loan portfolio. These outputs capture the core financial activities of MFIs and their ability to provide loans while generating revenue (Adesina, 2019; Vidyarthi & Tiwari, 2019).

Cost efficiency is pivotal for MFIs' self-sustainability, as it directly impacts their ability to allocate resources optimally. Cost efficiency was assessed based on the cost of inputs. Three input variables—cost of funds, cost of labor, and cost of assets—and two output variables—total loan

TABLE 1 Mathematical formulation of technical, cost and revenue efficiency.

Technical Efficiency (Input-oriented model)	$\theta, \lambda j \ ^{min}\theta$ Subject to: $\sum_{j=1}^{n} \lambda_j Y_{rj} \geq Y_{rj}$ (Y is output, r = 1,…..,s) $\theta X_{ij} \geq \sum_{j=1}^{n} \lambda_j X_{ij} \geq Y_{rj}$ (X is input, i = 1,….,m) $\sum_{j=1}^{n} \lambda j = 1$ (MFIs, j = 1…., n) $\lambda_j \geq 0$	(*Equation*……1)
Cost Efficiency (Input-oriented model)	$\theta, \lambda j \ ^{min}\theta$ Subject to: $\sum_{j=1}^{n} \lambda_j Y_{rj} \geq Y_{rj}$ (Y is output, r = 1,…..,s) $\theta X_{ij} \geq \sum_{j=1}^{n} \lambda_j X_{ij} \geq Y_{rj}$ (X is input, i = 1,….,m) $\sum_{j=1}^{n} \lambda j = 1$ (MFIs, j = 1…., n) $\lambda_j \geq 0$	(*Equation*……2)
Revenue Efficiency (Output-oriented model)	$\theta, \lambda j \ ^{max}\theta$ Subject to $\theta Y_j + \lambda_j Y_{rj} \geq 0$, (Output is Y, r = 1,….,s) $X_i - \lambda_j X_{ij} \geq 0$, (Input is X, I = 1,…,m) $\sum_{j=1}^{n} \lambda j = 1$ (MFIs, j = 1…., n) $\lambda_j \geq 0$	(*Equation*……3)

and income generated from the loan portfolio—have been selected to find the cost efficiency. This selection allows the evaluation of how efficiently MFIs manage their resources in cost-effective ways to deliver financial services (Adesina, 2019; Vidyarthi & Tiwari, 2019; Mahendru & Bhatia, 2017).

Revenue efficiency is examined by three input variables—total funds, the number of staff, and total fixed assets—and two output variables—interest income from the loan portfolio and non-interest income. This perspective is essential for understanding how effectively MFIs convert their resources into revenue-generating activities. By considering these variables, the aim was to provide a comprehensive assessment of MFIs' technical, cost, and revenue efficiency. The adoption of the DEA methodology ensured that the analysis captured the nuances of MFIs' operations and their implications for self-sustainability.

Table 1 and Table 2 shows the mathematical formulation of technical, cost and revenue efficiency.

TABLE 2 Operational definition and measurement of the variables.

Specification	Indictors	Operational definition	Notation
Dependent variables			
MFI self-sustainability	Technical efficiency	Technical efficiency scores estimated using input-oriented DEA.	TE
	Cost efficiency	Cost efficiency scores estimated using input-oriented DEA.	CE
	Revenue efficiency	Revenue efficiency scores estimated using output-oriented DEA.	RE
Independent variables			
Financing Sources	Retained earnings	The ratio of retained earnings to total assets	RTEN
	Deposit	The ratio of deposits to total assets	DPST
	Donation	The ratio of donation to total assets	DNTN
	Commercial borrowing	The total amount borrowed from commercial banks to total assets	CB
	Equity	The ratio of total equity to total assets	EQT
Moderating variable			
External governance	Index of the World Governance Indicators (WGI) has six dimensions: voice and transparency, political environment and lack of violence, good governance, administrative competence, the rule of law, and corruption prevention.	Governance indicators are scaled from −2.5 to +2.5, where −2.5 represents very weak governance quality and +2.5 represents very good governance quality.	EGOV

3.3 | Data analysis

This study assessed the technical, cost, and revenue efficiency of MFIs using DEA. These efficiency scores, generated through DEA, fall within the range of 0 to 1, providing a quantitative measure of efficiency. Initially, DEA generates raw scores, which do not account for the specific operational characteristics or factors under the control of microfinance management for each sampled MFI. To address this limitation and gain a more comprehensive perspective on technical, cost, and revenue efficiency, this study adopted the second-stage regression approach advocated by Fried et al. (1999). This approach has been consistently employed in previous research, including studies conducted by Bibi et al. (2018) and Wijesiri et al. (2017).

To proceed with the second stage analysis, this study utilized the GMM to address potential endogeneity concerns and improve the validity of results in the dynamic panel model with lagged variables. Traditional fixed-effects or random-effects models were deemed less suitable due to their vulnerability to endogeneity issues. GMM, introduced by Arellano and Bond (1991), offers a robust alternative, particularly well-suited for handling serial correlation and heteroskedasticity. In this analysis, a version of System GMM was applied to control for heterogeneity in the presence of endogenous explanatory variables, following recommended practices (Roodman, 2009). This choice was supported by GMM's capacity to handle measurement errors, unobserved

panel heterogeneity, omitted variable bias, and the potential correlation between error terms and explanatory variables. To enhance precision, instrumental variables were incorporated, including appropriate lags of both dependent and independent variables, validated through the Hansen test. The Arellano and Bond test confirmed the absence of second-order serial correlation, underlining the reliability and accuracy of the chosen analytical approach.

3.4 | Regression models

To assess the technical efficiency (TE), the following regression models are specified:

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 RTEN_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (1)$$

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 DPST_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (2)$$

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 DNTN_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (3)$$

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 CB_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (4)$$

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 EQT_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (5)$$

Here, TE stands for the MFIs' technical efficiency score, i is the institution, t is the year. $y_{i,t-1}$ is defined as the lag dependent variable. β_1 to β_6 are the coefficients of the variables. Size, INF, GDP, and CYR are the control variables. Size is the natural logarithm of total assets, INF is the country's inflation rate, GDP is the real GDP per capita growth rate, and CYR stands for the fixed country and year effect that is used to control the country's heterogeneity. RTEN represents retained earnings, DPST denotes the percentage of deposit collected from borrowers, DNTN represents the percentage of donation received from domestic and international donors, CB represents the percentage of commercial borrowing, and EQT is the percentage of equity and log in nature. ε_{it} is the error term. Accordingly, the following models are specified for cost and revenue efficiency:

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 RTEN_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (6)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 DPST_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (7)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 DNTN_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (8)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 CB_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (9)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 EQT_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (10)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 RTEN_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (11)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 DPST_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (12)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 DNTN_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (13)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 CB_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (14)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{it-1} + \beta_2 EQT_{it} + \beta_3 \mathrm{MFIs\ Size} + \beta_4 \mathrm{INF} + \beta_5 \mathrm{GDP} + \beta_6 \mathrm{CYR} + \varepsilon_{it} \quad (15)$$

where CE stands for the MFIs' cost efficiency and RE for their revenue efficiency. For robustness check, the Tobit regression model is used besides the base models. One advantage of this model is that it can produce an unbiased estimate of the coefficients (McCarty & Yaisawarng, 1993). Additionally, Tobit regression is employed because it is suitable when the dependent variable is censored on either the left, right, or both sides and the range of efficiency scores is from 0 to 1. As the estimated technical, cost and revenue efficiency scores of MFIs are censored left and right and range from 0 to 1, the Tobit model is a better fit for robustness check. To assess the moderating impact of external governance, the following interaction term models are specified:

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 RTEN_{it} + \beta_4 (\mathrm{EGOV}_{it} \times RTEN_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (16)$$

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 DPST_{it} + \beta_4 (\mathrm{EGOV}_{it} \times DPST_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (17)$$

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 DNTN_{it} + \beta_4 (\mathrm{EGOV}_{it} \times DNTN_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (18)$$

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 CB_{it} + \beta_4 (\mathrm{EGOV}_{it} \times CB_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (19)$$

$$\mathrm{TE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 EQT_{it} + \beta_4 (\mathrm{EGOV}_{it} \times EQT_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (20)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 RTEN_{it} + \beta_4 (\mathrm{EGOV}_{it} \times RTEN_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (21)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 DPST_{it} + \beta_4 (\mathrm{EGOV}_{it} \times DPST_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (22)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 DNTN_{it} + \beta_4 (\mathrm{EGOV}_{it} \times DNTN_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (23)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 CB_{it} + \beta_4 (\mathrm{EGOV}_{it} \times CB_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (24)$$

$$\mathrm{CE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 EQT_{it} + \beta_4 (\mathrm{EGOV}_{it} \times EQT_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (25)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 RTEN_{it} + \beta_4 (\mathrm{EGOV}_{it} \times RTEN_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (26)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 DPST_{it} + \beta_4 (\mathrm{EGOV}_{it} \times DPST_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (27)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 DNTN_{it} + \beta_4 (\mathrm{EGOV}_{it} \times DNTN_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (28)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 CB_{it} + \beta_4 (\mathrm{EGOV}_{it} \times CB_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (29)$$

$$\mathrm{RE}_{it} = \beta_0 + \beta_1 \mathrm{y}_{i,t-1} + \beta_2 \mathrm{EGOV}_{it} + \beta_3 EQT_{it} + \beta_4 (\mathrm{EGOV}_{it} \times EQT_{it}) + \sum_{it}^{n} \beta_{5,6,7,8} Control_{it} + \varepsilon_{it} \quad (30)$$

where $EGOV_{it} * RTEN_{it}$ stands for interaction term between external governance and retained earnings. External governance and deposit interaction is denoted by the terms $EGOV_{it} * DPST_{it}$ while external governance and donation interaction is denoted by the terms $EGOV_{it} * DNTN_{it}$ while $EGOV_{it} * CB_{it}$ stands for the interaction between external governance and commercial borrowing and the terms $EGOV_{it} * EQT_{it}$ stand for external governance and equity, respectively. Furthermore, over the interaction term, the study computed the marginal effect of financing sources on MFI efficiency. It is important to find whether the external governance favorably or adversely moderates the relationship between determinants and efficiency. Hence, the marginal effects are computed through the following equations:

$$\frac{\partial y_{it}}{\partial RTEN_{it}} = \beta_3 + \beta_4 EGOV_{it} \tag{16.1}$$

$$\frac{\partial y_{it}}{\partial DPST_{it}} = \beta_3 + \beta_4 EGOV_{it} \tag{17.1}$$

$$\frac{\partial y_{it}}{\partial DNTN_{it}} = \beta_3 + \beta_4 EGOV_{it} \tag{18.1}$$

$$\frac{\partial y_{it}}{\partial CB_{it}} = \beta_3 + \beta_4 EGOV_{it} \tag{19.1}$$

$$\frac{\partial y_{it}}{\partial EQT_{it}} = \beta_3 + \beta_4 EGOV_{it} \tag{20.1}$$

The above models were formulated for MFIs technical efficiency. The models were then repeated for MFI cost and revenue efficiency. However, the sign of the coefficients (β_3 and β_4) gives insightful meaning to describe the result (Ehigiamusoe et al., 2020). For example, if $\beta_3 > 0$ and $\beta_4 < 0$, then higher retained earnings have a positive effect on MFIs efficiency, but higher *EGOV* reduces that positive effect. If $\beta_3 < 0$ and $\beta_4 > 0$, then higher retained earnings have a weakening effect on MFIs efficiency and higher *EGOV* moderates the impact. If $\beta_3 < 0$ and $\beta_4 < 0$, higher retained earnings reduce MFIs efficiency, and higher *EGOV* strengthens that effect. If $\beta_3 > 0$ and $\beta_4 > 0$, higher retained earnings positively affect MFIs efficiency and higher *EGOV* increases that positive effect. Moreover, the marginal impact with a positive sign ($\beta_3 + \beta_4 EGOV_{it}$) indicates that higher retained earnings and governance accelerate MFI efficiency and the marginal effect with negative sign describes the opposite.

4 | FINDINGS AND DISCUSSIONS

This study's findings are discussed in four separate sections. The initial section provides insight into sample characteristics through descriptive statistics and a correlation matrix. Subsequently, the second section delves into the technical, cost, and revenue efficiency scores of MFIs. The third section scrutinizes the impacts of various financing sources on MFIs' efficiency, while the final section investigates the moderating influence of external governance. This structured approach allows for a comprehensive examination of the study's outcomes.

TABLE 3 Descriptive statistics.

Variables	Observations	Mean	Standard dev.	Minimum	Maximum
TE	1873	.584	.252	.163	1
CE	1873	.496	.276	.095	1
RE	1873	.126	.259	0	1
DPST	1873	.45	.249	.01	.884
RTEN	1873	.035	.133	.587	.436
DNTN	1873	.008	.017	0	.124
CB	1873	.263	.227	0	.848
EQT	1873	0.01	0.09	0	.029
SIZE	1873	17.043	1.984	12.327	21.282
EGOV	1873	.582	.332	1.569	.185
INF	1873	4.773	3.551	.848	17.455
GDP	1873	3.265	2.664	4.168	9.826

Note: TE = Technical efficiency, CE = cost efficiency, RE = revenue efficiency, RTEN = retained earnings, DPST = deposit, DNTN = donation, CB = commercial borrowing, and EQT = equity. SIZE = size of microfinance institutions, (natural logarithm of total assets), EGOV = external governance (world governance indicators estimate that signify the governance performance ranging from 2.5, weak to 2.5, strong), GDP = GDP per capita growth.

4.1 | Sample characteristics

The descriptive statistics for the variables used in this study are provided in Table 3. The mean value of technical efficiency is 0.584, followed by cost efficiency and revenue efficiency scores of 0.496 and 0.126 respectively. Regarding financing sources, the percentage of deposits is the highest based on the mean value, followed by commercial borrowing and retained earnings. The mean value of donation reports that MFIs reduce dependency on the donation, and the poor mean value of equity revealed that many MFIs still do not use equity.

The Pearson Correlation Matrix is widely used to test multicollinearity to validate the explanatory variables. The computation of the correlation coefficients was carried out to see the relationship between the estimated efficiency score and explanatory variables. The value of the correlation coefficients (r) shows the relationship between the variables under investigation. The correlation between explanatory variables should be within 0.80, as suggested by Kennedy (2008). Table 4 presents the correlations among the study variables. As for the relationship between explanatory variables and dependent variables, Table 4 shows that all the correlation coefficients are within an acceptable range; hence, no multicollinearity issues were observed.

4.2 | Estimating MFIs' efficiency

The outcomes of technical, cost, and revenue efficiency displayed in Table 5 provide valuable insights into MFIs sustainability. In terms of technical efficiency, this study finds that, on average, MFIs exhibit a 58% level of technical efficiency globally, with a score of 0.584. Regionally, the range varies from 41% to 71% technical efficiency. These findings are consistent with previous research, such as Mersland and Strøm (2010), which highlights the challenge of balancing social goals and financial sustainability. The results also reveal that cost efficiency aligns closely with technical

TABLE 4 Pairwise correlations.

Variables	TE	CE	RE	DPST	RE	DNTN	CB	EQT	SIZE	EGOV	INF	GDP
TE	1.000											
CE	0.003	1.000										
RE	0.342*	0.304*	1.000									
DPST	0.050*	0.080*	0.088*	1.000								
RTEN	0.102*	0.151*	0.067*	0.162*	1.000							
DNTN	0.086*	0.020*	0.048*	0.145*	0.014	1.000						
CB	0.146*	0.088*	0.024*	0.736*	0.022*	0.043*	1.000					
EQT	0.131*	0.012	0.328*	0.068*	0.045*	0.198*	0.046*	1.000				
SIZE	0.162*	0.142*	0.123*	0.293*	0.049*	0.245*	0.093*	0.342*	1.000			
EGOV	0.163*	0.079*	0.031*	0.017*	0.030*	0.023*	0.022*	0.038*	0.053*	1.000		
INF	0.169*	0.054*	0.063*	0.198*	0.099*	0.092*	0.160*	0.040*	0.135*	0.180*	1.000	
GDP	0.014	0.142*	0.115*	0.137*	0.082*	0.004	0.162*	0.012	0.047*	0.078*	0.088*	1.000

Note: * shows significance at the 0.5% level. TE = Technical efficiency, CE = cost efficiency, RE = revenue efficiency, RTEN = retained earnings, DPST = deposit, DNTN = donation, CB = commercial borrowing, and EQT = equity. SIZE = size of microfinance institutions, EGOV = external governance, GDP = GDP per capita growth.

TABLE 5 Efficiency scores of global and regional MFIs.

Efficiency score	Observation	Technical efficiency	Cost efficiency	Revenue efficiency
Global (All sample)	1873	0.584	0.495	0.126
Regional				
South Asia	325	0.518	0.603	0.076
East Asia and Pacific	399	0.573	0.555	0.275
Est. Europe and Central Asia	166	0.601	0.518	0.096
Latin America and the Caribbean	564	0.712	0.387	0.071
The Middle East and North Africa	15	0.410	0.453	0.073
Africa	404	0.468	0.492	0.110

Note: Technical and Cost efficiency used an input-oriented model, and Revenue efficiency used an output-oriented model.

efficiency, with MFIs globally achieving 50% cost efficiency. Latin America and the Caribbean region displays relatively lower cost efficiency compared to South Asian MFIs, which achieve the highest cost efficiency at 60%. These findings corroborate the importance of resource allocation and utilization(see Armendáriz & Morduch, 2010).

However, when examining revenue efficiency, it becomes evident that MFIs globally are only 13% efficient in generating revenue. This suggests that there is substantial room for improvement in terms of revenue generation. These results are in line with the study by Cull et al. (2011), which emphasizes the trade-offs faced by MFIs in terms of regulation, competition, and financing. The findings imply that to enhance their self-sustainability, MFIs should optimize their resource utilization. For instance, operational costs should be reduced to meet their financial objectives, a concept explored by D'Espallier et al. (2011). Additionally, the adoption of digital solutions such as mobile banking and e-wallet systems can potentially reduce costs and enhance efficiency, as indicated in Schicks' review of evidence on microfinance and poverty reduction (Schicks, 2013). These findings emphasize the paramount importance of efficiency in achieving self-sustainability for MFIs. Therefore, optimizing resource allocation, cost management, and revenue generation should be central to the strategic agenda of MFIs striving for long-term sustainability.

4.3 | Regression result on the relationship between self-sustainability and financial structure

The findings of the second-stage GMM are shown in Table 6. The result shows that retained earnings have a positive and significant coefficient on all three technical, cost, and revenue efficiencies. Hence, the projected hypotheses have been accepted and support the national and international donor agencies' urge to emphasize MFIs self-sustainability. It implies that dependency on their own surplus can make MFIs self-sustainable. The finding is similar to Khachatryan et al. (2017) and aligned with the pecking order theory that own funding source is the better option under the capital structure for institutional efficiency.

Further, the impact of equity on MFIs' technical, cost, and revenue efficiency is also evident by a positive and significant outcome, as shown in Table 6. The finding is corroborated by Chikalipah (2019), who found a positive impact of equity on MFIs performance. Hence, the hypothesis

TABLE 6 Regression result for technical, cost and revenue efficiency using GMM estimation.

	Technical efficiency					Cost efficiency					Revenue efficiency				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15
Lag DV	0.491***	0.435***	0.335**	0.284**	0.461***	0.125	0.088	0.018	0.275*	0.109	0.263*	0.257**	0.377*	0.213**	0.038
	[0.088]	[0.097]	[0.138]	[0.123]	[0.083]	[0.117]	[0.143]	[0.147]	[0.145]	[0.110]	[0.135]	[0.108]	[0.197]	[0.098]	[0.192]
RTEN	0.408**					0.360***					0.289**				
	[0.164]					[0.130]					[0.143]				
DPST		0.061					0.379					0.031			
		[0.130]					[0.380]					[0.047]			
DNTN			0.690					0.796					1.249		
			[0.889]					[1.409]					[2.432]		
CB				0.153*					0.255*					0.029	
				[0.089]					[0.153]					[0.045]	
EQT					0.021***					0.034***					0.013*
					[0.007]					[0.010]					[0.008]
SIZE	0.010	0.006	0.029	0.084*	0.075**	0.000	0.084	0.045	0.033	0.076***	0.034**	0.005	0.014	0.015	0.007
	[0.025]	[0.036]	[0.038]	[0.047]	[0.034]	[0.027]	[0.114]	[0.087]	[0.024]	[0.020]	[0.016]	[0.014]	[0.026]	[0.016]	[0.022]
INF	0.059***	0.051**	0.031	0.008	0.023	0.061***	0.106*	0.088**	0.042***	0.000	0.043**	0.032***	0.017	0.023**	0.042***
	[0.019]	[0.024]	[0.026]	[0.026]	[0.028]	[0.018]	[0.063]	[0.034]	[0.015]	[0.014]	[0.016]	[0.012]	[0.019]	[0.010]	[0.015]
GDP	0.009	0.008	0.005	0.007	0.006	0.000	0.008	0.006	0.044*	0.033**	0.001	0.003	0.002	0.002	0.007
	[0.007]	[0.010]	[0.009]	[0.008]	[0.007]	[0.009]	[0.024]	[0.014]	[0.023]	[0.016]	[0.032]	[0.006]	[0.009]	[0.006]	[0.007]
CYR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000***	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	0.502	0.229	0.066	0.743	1.065*	0.408	3.085	1.069	0.598	1.536***	1.039**	0.155	0.277	0.158	0.186
	[0.531]	[0.809]	[0.679]	[0.844]	[0.625]	[0.651]	[3.001]	[1.415]	[0.819]	[0.530]	[0.516]	[0.316]	[0.447]	[0.336]	[0.357]
Observations	976	976	976	976	976	976	976	976	976	976	976	976	976	976	976
AR(1)	0.000	0.000	0.002	0.001	0.001	0.001	0.023	0.007	0.001	0.000	0.001	0.001	0.002	0.001	0.006
AR(2)	0.176	0.385	0.275	0.252	0.632	0.851	0.931	0.968	0.916	0.762	0.120	0.082	0.060	0.071	0.219
Hansen (p val)	0.051	0.062	0.081	0.050	0.062	0.076	0.088	0.055	0.079	0.068	0.076	0.062	0.055	0.051	0.081

RTEN = retained earnings, DPST = deposit, DNTN = donation, CB = commercial borrowing, and EQT = equity. SIZE = size of microfinance institutions, INF = inflation rate, GDP = GDP per capita growth, CYR = country year effect. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

of the effect of equity on MFIs efficiency is also accepted. This finding suggests that MFIs with higher retained earnings and equity are more efficient. The results also suggest that this efficiency ultimately helps them achieve self-sustainability goals.

MFIs usually start their operations using donor funds in many countries. This study is devoted to assessing the impact of donations on MFIs' efficiency. The findings revealed that donations are not a significant source of funding for MFIs' efficiency. Mia et al. (2021) argued that the trend and reliance on donor funds have decreased and dramatically changed to other sources in recent years. Moreover, donors emphasize MFIs to operate without donations and influence to be financially self-sustainable (Nourani et al., 2020). Because of these changes, donations are not the main factor influencing MFIs financial efficiency, as evidenced by this study. The negative relationship with a negative coefficient of donation on MFI's technical and cost efficiency in this study validates the donor's perception.

The limit on donor funding opportunities further forced MFIs to accumulate capital from other sources for their operations. Mia and Lee (2017) advocated that deposits in the form of borrowers savings counter balanced donor funding in MFIs. The deposit is now the main source of funds for many MFIs in many countries, such as Bangladesh. Therefore, the analysis of this factor evident by insignificant with all three efficiency aspects, though it is positively related to technical and cost efficiency. This insignificant finding is consistent with the performance study conducted by Chikalipah (2019). The MFIs may constrain the regularity restriction on collecting deposits in many countries.

With the current gradual transformation of funding sources, MFIs are also raising capital from commercial lenders (Nourani et al., 2020). The analysis of this important factor shows a positive and significant contribution to MFIs cost efficiency. It is also positively related to revenue efficiency; however, commercial borrowing is not vital for MFIs to be technically efficient, as evident in Table 6. The finding is consistent with Mersland and Urgeghe (2013), who found that commercial debt is related to strong financial performance, while inconsistent with Chikalipah (2019). Therefore, the findings of this study establish that commercial borrowing helps MFIs be sustainable in terms of cost and revenue-generating aspects. Overall, the results again validate the theory of POT in the microfinance industry with arguments that "firms prefer a sequential choice in their capital structure composition." The robustness checks results reported in Table 7 are similar to the empirical outcomes displayed in Table 6.

4.4 | Regression result on the moderating role of external governance

The findings on the moderating role of external governance in the relationship between financing sources and MFIs' efficiency provide important insights into the factors influencing MFIs' efficiency and self-sustainability. The study conducted a comprehensive analysis involving several financing sources and their interaction with external governance, as shown in Table 8.

Firstly, the results indicate that retained earnings have a positive and significant impact on MFIs' efficiency, particularly when external governance is strong. This finding aligns with the idea that good external governance promotes the positive influence of retained earnings on MFIs' technical, cost, and revenue efficiency. It suggests that MFIs should aim to build up their retained earnings, especially in regions or countries with robust governance structures. This is consistent with prior research by Mersland and Strøm (2010), emphasizing the importance of balancing financial sustainability while pursuing social goals.

TABLE 7 Robustness checks using Tobit regression.

	Technical efficiency					Cost efficiency					Revenue efficiency				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15
RTEN	0.225***					0.280***					0.181***				
	[0.049]					[0.048]					[0.059]				
DPST		0.080***					0.105***					0.065**			
		[0.028]					[0.030]					[0.029]			
DNTN			0.106					0.155					0.349		
			[0.459]					[0.460]					[0.537]		
CB				0.125***					0.083***					0.013	
				[0.029]					[0.032]					[0.032]	
EQT					0.002**					0.013***					0.009***
					[0.001]					[0.001]					[0.001]
SIZE	0.007*	0.010**	0.008*	0.007*	0.009**	0.032***	0.036***	0.033***	0.034***	0.037***	0.019***	0.016***	0.018***	0.018***	0.015***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]
INF	0.009***	0.009***	0.008***	0.007***	0.009***	0.002	0.002	0.003	0.002	0.001	0.009***	0.009***	0.008***	0.008***	0.011***
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
GDP	0.086***	0.089***	0.085***	0.082***	0.093***	0.085***	0.082***	0.087***	0.084***	0.049***	0.024***	0.021**	0.024***	0.024***	0.002
	[0.007]	[0.008]	[0.007]	[0.008]	[0.008]	[0.009]	[0.009]	[0.009]	[0.009]	[0.010]	[0.009]	[0.009]	[0.009]	[0.009]	[0.009]
CYR	0.000***	0.000***	0.000***	0.000***	0.000***	0.000*	0.000**	0.000**	0.000*	0.000	0.000***	0.000***	0.000***	0.000***	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	0.262***	0.263***	0.264***	0.262***	0.264***	0.289***	0.290***	0.291***	0.291***	0.284***	0.283***	0.284***	0.284***	0.284***	0.281***
	[0.005]	[0.005]	[0.005]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]	[0.005]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
Observation	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873	1873
F(5, 1868)	55.95	48.68	47.65	57.53	48.64	37.28	30.72	28.11	29.27	49.73	10.7	9.00	8.53	8.46	18.22
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.2320	0.2185	0.2102	0.2290	0.2140	0.1510	0.1376	0.1279	0.1334	0.2008	0.0629	0.0562	0.0525	0.0520	0.0920

RTEN = retained earnings, DPST = deposit, DNTN = donation, CB = commercial borrowing, and EQT = equity. SIZE = size of microfinance institutions, INF = inflation rate, GDP = GDP per capita growth, CYR = country year effect. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE 8 Result of the moderating effect of external governance (EGOV) on MFI efficiencies.

	Technical efficiency					Cost efficiency					Revenue efficiency				
	Model 16	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24	Model 25	Model 26	Model 27	Model 28	Model 29	Model 30
Lag DV	0.328***	0.288**	0.428***	0.323***	0.449***	0.142	0.014	0.127	0.070	0.230**	0.256**	0.102	0.196	0.234**	0.078
	[0.077]	[0.119]	[0.148]	[0.110]	[0.071]	[0.112]	[0.170]	[0.112]	[0.109]	[0.092]	[0.122]	[0.125]	[0.151]	[0.117]	[0.156]
EGOV	0.038	2.513**	0.464	0.028	0.205	1.344***	1.980	0.920**	1.296*	0.317	0.062	0.071	0.100*	0.279**	0.177
	[0.037]	[1.227]	[0.558]	[0.325]	[0.239]	[0.517]	[1.482]	[0.395]	[0.669]	[0.200]	[0.076]	[0.569]	[0.057]	[0.124]	[0.128]
RTEN	0.813**					0.997**					0.415**				
	[0.336]					[0.495]					[0.168]				
RE* EGOV	0.873*					1.232*					0.488*				
	[0.462]					[0.745]					[0.266]				
DPST		3.010**					0.392					0.011			
		[1.435]					[1.677]					[0.803]			
DPST* EGOV		4.194**					1.079					0.121			
		[1.974]					[2.678]					[1.262]			
DNTN			0.724					5.112*					3.587***		
			[9.144]					[2.721]					[1.306]		
DNTN* EGOV			2.634					10.941*					5.370**		
			[17.285]					[5.701]					[2.316]		
CB				2.730***					2.932*					0.592*	
				[0.962]					[1.549]					[0.332]	
CB* EGOV				2.981***					4.400*					0.822**	
				[1.057]					[2.330]					[0.406]	
EQT					0.040***					0.067***					0.037***
					[0.015]					[0.020]					[0.014]
EQT* EGOV					0.037*					0.063**					0.032*
					[0.022]					[0.031]					[0.017]

(Continues)

TABLE 8 (Continued)

	Technical efficiency					Cost efficiency					Revenue efficiency				
	Model 16	**Model 17**	**Model 18**	**Model 19**	**Model 20**	**Model 21**	**Model 22**	**Model 23**	**Model 24**	**Model 25**	**Model 26**	**Model 27**	**Model 28**	**Model 29**	**Model 30**
SIZE	0.065***	0.033	0.113**	0.046***	0.082***	0.024	0.011	0.044*	0.042	0.078***	0.006	0.023	0.021	0.001	0.010
	[0.020]	[0.023]	[0.053]	[0.016]	[0.021]	[0.025]	[0.054]	[0.023]	[0.029]	[0.016]	[0.005]	[0.036]	[0.019]	[0.010]	[0.017]
INF	0.014**	0.008	0.015	0.018	0.014	0.056***	0.074***	0.052***	0.045**	0.022**	0.009*	0.063***	0.017**	0.025**	0.026**
	[0.007]	[0.020]	[0.027]	[0.016]	[0.013]	[0.020]	[0.022]	[0.016]	[0.019]	[0.011]	[0.005]	[0.022]	[0.008]	[0.011]	[0.011]
GDP	0.007	0.002	0.001	0.005	0.025	0.006	0.044	0.004	0.007	0.009	0.017***	0.089**	0.014	0.025*	0.007
	[0.006]	[0.011]	[0.006]	[0.006]	[0.016]	[0.016]	[0.047]	[0.010]	[0.009]	[0.007]	[0.006]	[0.035]	[0.009]	[0.013]	[0.007]
CYR	0.000**	0.000	0.000	0.000	0.000*	0.000**	0.000	0.000***	0.000***	0.000*	0.000**	0.000**	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Constant	0.489	1.779*	1.345	0.038	0.984**	0.110	0.308	0.032	0.131	0.499*	0.234**	0.957	0.381	0.034	0.209
	[0.352]	[0.988]	[1.017]	[0.449]	[0.429]	[0.503]	[0.684]	[0.615]	[0.631]	[0.277]	[0.106]	[0.862]	[0.355]	[0.242]	[0.302]
Observations	976	976	976	976	976	976	976	976	976	976	976	976	976	976	976
AR(1)	0.000	0.000	0.001	0.000	0.000	0.000	0.014	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.002
AR(2)	0.127	0.994	0.330	0.796	0.625	0.740	0.878	0.895	0.712	0.935	0.046	0.143	0.079	0.150	0.105
Hansen (p val)	0.056	0.089	0.071	0.071	0.060	0.066	0.077	0.051	0.059	0.062	0.059	0.087	0.057	0.088	0.089
Marginal effect															
Minimum	0.927	5.351	5.975	3.213	0.033	1.459	1.759	16.701	5.840	0.058	0.557	0.230	7.119	1.046	0.026
Mean	0.306	0.578	2.251	1.001	0.018	0.282	0.233	1.230	0.381	0.030	0.132	0.059	0.473	0.115	0.018
Maximum	1.877	8.126	2.489	6.366	0.085	2.499	1.708	18.458	8.299	0.143	1.010	0.158	10.137	1.594	0.076

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.0$.

Secondly, the study reveals that deposits positively affect MFIs' efficiency, especially in regions with higher levels of external governance. The marginal effects show that deposits can have a negative impact on efficiency in regions with lower governance but become highly beneficial in areas with strong governance. This underscores the significance of robust governance frameworks in enhancing the positive impact of deposit mobilization on MFIs' self-sustainability. These findings resonate with the work of Cull et al. (2011), highlighting the challenges and trade-offs faced by MFIs concerning regulatory environments and financing sources.

Thirdly, donations are found to have a varying impact on MFIs' efficiency. While they negatively affect technical efficiency, the interaction with external governance yields positive results for cost and revenue efficiency. The marginal effects demonstrate that in regions with high external governance, donations significantly boost cost and revenue efficiency, offsetting their negative impact on technical efficiency. This highlights the role of quality governance in moderating the influence of donations on MFIs' self-sustainability. These findings are in line with the notion that external governance can help channel donations effectively, as discussed in previous studies (D'Espallier et al., 2011; Schicks, 2013).

Fourthly, commercial borrowing is observed to adversely affect technical efficiency, especially in regions with stronger external governance. This suggests that higher levels of borrowing can reduce technical efficiency, and external governance amplifies this effect. However, when considering cost and revenue efficiency, commercial borrowing has a positive impact, particularly in areas with robust governance. The marginal effects illustrate this pattern, indicating that at the minimum level of external governance, commercial borrowing increases technical efficiency, while at higher governance levels, it enhances cost and revenue efficiency. These results underscore the nuanced relationship between commercial borrowing and MFIs' efficiency, emphasizing the importance of external governance as a moderating factor.

Finally, equity shows a consistently positive influence on all aspects of MFIs' efficiency, with external governance strengthening this positive effect. The findings suggest that higher equity positively impacts technical, cost, and revenue efficiency, and this effect is more pronounced in regions with better governance structures. The marginal effects support this trend, showing that equity contributes to increased efficiency, especially in regions with strong external governance. These results highlight the moderating role of external governance in enhancing the relationship between equity and MFIs' self-sustainability.

Overall, these findings indicate that external governance plays a crucial moderating role in shaping the relationship between financing sources and MFIs' efficiency. Regions or countries with robust governance environments facilitate the positive impact of various financing sources on MFIs' technical, cost, and revenue efficiency. This underscores the significance of an enabling governance framework in enhancing MFIs' self-sustainability, aligning with the idea that efficient resource allocation and utilization are pivotal for long-term success (Mersland & Strøm, 2010; Cull et al., 2011). Therefore, optimizing financing sources while considering the governance context should be central to the strategic agenda of MFIs striving for greater efficiency and self-sustainability.

Furthermore, the control variables exhibit significant effects on MFIs' efficiency. The findings of the size of MFIs on efficiency varied positively and negatively related to different models. This diverse result is corroborated by Tchuigoua (2015). It implies that financing sources may vary based on MFIs' size, and large firms can use their resources diversely to enhance their financial efficiency and vice versa. Macroeconomic factors such as inflation and growth were included in the study, as MFIs are an integral part of the economy. For example, overall expenses are supposed to increase due to inflation. This study reveals a corroborative outcome as it shows negative results

with all three efficiencies. The findings are consistent with Bibi et al. (2018) and Mia et al. (2021), who found a similar result in the microfinance industry. GDP growth shows the overall economy's progress, and it is expected to have a positive effect. Though GDP is adversely correlated with technical efficiency, it is positively related to MFIs cost and revenue efficiency. Its positive correlation suggests that a growing economy will benefit the citizens of the country appropriately; deserving borrowers can continue repaying their loans, which ultimately helps to improve MFIs' efficiency (Mia & Soltane, 2016).

5 | CONCLUSION, IMPLICATIONS AND FUTURE RESEARCH DIRECTION

One of the main goals of microfinance institutions is self-sustainability. The findings of this study indicate that MFIs are not entirely successful in achieving this sustainability goal. Therefore, this study identified the improper use of inputs and outputs in business operations that causes inefficiency. Based on these findings, this study recommends that MFIs should use their inputs effectively to increase efficiency and sustainability.

An in-depth analysis was conducted on which financing sources affect the efficiency of MFIs. The positive and significant effect identified on MFIs internal sources of funds, such as retained earnings. Similarly, equity is also determined by a positive and significant financing source for MFIs' efficiency. On the other hand, deposits and donations have been identified as less necessary for the self-sustainability of MFIs. Commercial borrowing is also recognized as a vicious capital source for long-term efficiency that ultimately harms sustainability. MFIs top management can take advantage of this study's results to revise and emphasize their existing financial structure. These findings are consistent with the POT, which states that a financial organization prioritizes self-financing first, then safe debt, risky bank loans, and, as a last resort, issuing equity (Adair & Adaskou, 2015). This condition is somewhat aligned with the study findings. Particularly after retained earnings and deposits, equity is more important than commercial borrowing, which argues that equity is better than borrowing from commercial sources for MFIs.

The moderating impact of external governance on relationships was also investigated in this study. The results show the positive and significant higher impact of these sources on MFIs' efficiency in the presence of good governance in the country. These findings give the government and policymakers intuitive implications to help the microfinance industry. Particularly, reasonable rules and regulations, corruption-free administration, and overall good governance can help the microfinance industry. With this quality governance environment, MFIs can flourish in their sustainable operations, which will ultimately help to reduce the country's poverty.

Despite the study's useful findings, the present study is not without limitations. This study could not conduct a comparative study of profitable and non-profitable MFIs. Further research can consider this comparison. Although this study enhanced the existing literature by incorporating WGI as an internal governance factor with moderating positioning, assessing other internal governance elements, e.g., board size, females on board, etc., is desirable. Future studies will benefit from extending the observations to more countries and periods.

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