

Macro-Institutional Quality and Capital Structure in Microfinance Institutions: A Global Dynamic Panel System-GMM Analysis

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Abstract

Microfinance institutions (MFIs) operate in diverse institutional environments, but evidence on the relationship between national governance, financing choices and board composition remains inconclusive. This study examines whether institutional quality is associated with MFI capital structure and whether women's board representation moderates that association. It combines MIX Market financial and governance records with Worldwide Governance Indicators and World Development Indicators for 2010–2018. Dynamic relationships are estimated using collapsed two-step system GMM with Windmeijer-corrected standard errors, supported by alternative leverage measures and fixed-effects sensitivity checks. Aggregate institutional quality and its six governance dimensions show no statistically significant association with debt-to-equity in the main system-GMM estimates. The interaction between institutional quality and women's board representation is also insignificant. The debt-to-equity model produces an economically questionable adjustment estimate, while the borrowing model displays plausible persistence but fails important instrument-validity tests. A country-clustered fixed-effects estimate yields a negative institutional-quality association, demonstrating estimator sensitivity. The findings therefore do not establish a general institutional-quality effect on MFI financing. They underscore the importance of leverage measurement, sample composition and instrument diagnostics when assessing dynamic capital structure in microfinance.

JEL Classification: G21; G32; D02; J16

Keywords: Institutional Quality; Microfinance Institutions; Capital Structure; Women on Boards; System GMM

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INTRODUCTION

Microfinance institutions have been at the forefront of financial inclusion efforts, enabling countless low- and middle-income households and micro entrepreneurs to gain access to credit, savings, and other financial services. The microfinance industry has undergone tremendous growth over the past three decades, transforming from a heavily subsidized and donor-dependent industry into a diverse field of non-governmental organizations, non-banking financial institutions, and profit-oriented entities (Ledgerwood et al., 2013). At the same time, the financial sustainability of microfinance institutions (MFIs) has been a persistent concern, as has the question of how best to balance their social and economic objectives. The resolution of the double bottom line problem is closely linked to the capital structure of MFIs, which has long been the subject of debate among practitioners and researchers. According to the classical finance theory, the irrelevance, trade-off, and pecking order propositions have been advanced to explain the capital structure behavior of mainstream firms. In the microfinance environment, the capital structure is hypothesized to be determined by a combination of equity, grants, deposits, and borrowings, with varying implications for outreach and financial sustainability (Biringanine, 2020). Empirical evidence confirms that MFIs with high leverage ratios are better positioned to achieve greater outreach, particularly in sub-Saharan Africa, but at the same time, such an approach poses significant risks of default (Githaiga & Bitok, 2023; Kyereboah-Coleman, 2007). Similarly, Bogan reveals that increased reliance on grants tends to undermine the operational sustainability of large MFIs (Bogan, 2012). By contrast, in the institutional environment of Asian countries, debt and donations seem to have less impact on MFI capital structure than equity (Habib & Kabir, 2024).

Although the influence of the level of leverage on MFI outreach and sustainability is well-documented, less is known about how the leverage adjustment process takes place once a deviation from the target level occurs. In reality, firms rarely operate at their optimal debt ratio, as the adjustment process is often associated with significant costs and requires considerable manager flexibility (Elsas & Florysiak, 2015). The simplest partial-adjustment model captures this phenomenon by specifying a speed-of-adjustment (SOA) coefficient, which proxies for the proportion of the deviation from the optimal leverage that is closed by the firm in a given period (Öztekin, 2015). According to Öztekin, SOA varies across countries due to differences in legal origin and institutional development, which in turn shape the creditor-debtor relationships in each jurisdiction. Similar evidence has been found in emerging markets, where firms exhibit both sand-the-wheels and greasing-the-wheels dynamics in their response to deviations from the target leverage (Cahyono & Chawla, 2019; Iyoha et al., 2022).

The microfinance industry presents a unique institutional environment within which interesting and important insights into the link between organizations' leverage adjustment process and macro-level institutional quality may be gained. First, unlike public companies, MFIs do not rely on a single capital raising method, but rather operate with a combination of different funding sources, including donors, social investors, commercial banks, deposits, and others. Second, macro-level institutional factors cut across a wide spectrum in the microfinance context, ranging from relatively well-established economies to developing countries with nascent financial and institutional ecosystems. Recent studies have sought to understand how the institutional environment influences the capital structure decisions of MFIs. For example, Adusei and Sarpong-Danquah analyze the impact of institutional quality on MFI fundraising and uncover a negative association between macro-level control of corruption, rule of law, regulatory quality, and voice and accountability, on organizations' tendencies to seek debt capital (Adusei & Sarpong-Danquah, 2021). In other words, improved institutional quality

“sand the wheels” of microfinance debt issuance. Similarly, Tehulu finds that the rule of law “greases the wheels” of MFI credit growth, whereas political stability “sand the wheels” of credit expansion (Tehulu, 2022). Finally, Tehulu et al. find that overall institutional quality has a positive impact on the financial sustainability of sub-Saharan African MFIs in the long run. Specifically, government effectiveness and rule of law exhibit a contemporaneous effect, whereas control of corruption influences MFI sustainability with a one-year lag (Tehulu et al., 2024). Fisseha similarly discovers that among various institutional factors, only control of corruption has a significant and positive impact on the performance of non-bank MFIs in Africa (Fisseha, 2024). Together, these studies demonstrate that institutional quality is an important determinant of the capital structure and financial sustainability of MFIs, but the dynamic process of adjustment toward the target leverage has received limited attention.

This study addresses three connected gaps. First, much MFI research relates institutions to borrowing, outreach or financial sustainability, while providing less evidence on whether the dynamics of relative leverage are stable across financing definitions. Second, governance indicators are commonly interpreted as explanatory determinants even though country-level variation, leverage outliers and internal-instrument assumptions can change the result. Third, whether women’s board representation systematically conditions the institutional environment–financing relationship remains unsettled. We assess aggregate and component institutional-quality measures, their interactions with board composition, and the sensitivity of dynamic estimates to alternative samples and leverage measures. The contribution is primarily an assessment of the robustness and limits of institutional explanations of MFI capital structure, not an assertion that the data identify a causal effect. The study uses public MIX Market observations matched to country-year governance and macroeconomic measures for 2010–2018. The rest of the article is organised as follows. Section 2 develops the theoretical arguments and synthesises relevant evidence. Section 3 describes the data, variable definitions, empirical models and diagnostic tests. Section 4 presents the estimates, robustness checks and their implications. Section 5 concludes with contributions, limitations and directions for future research.

Figure 1 presents the conceptual framework linking macro-institutional quality to MFI capital structure through the financing environment, while women on boards are modelled as a moderator of the institutional-quality–capital-structure relationship.

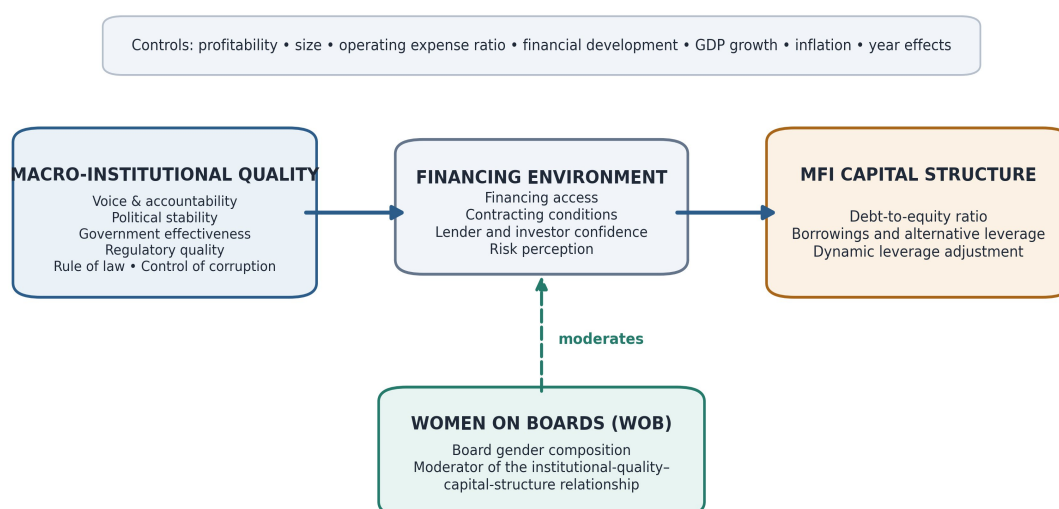


Figure 1: Conceptual framework for institutional quality, board composition and MFI financing (authors’ own illustration, 2026). Source: Authors’ conceptual framework (2026).

LITERATURE REVIEW

Theoretical Review

The capital structure theories in microfinance literature can be grouped into four theoretical traditions. The first tradition encompasses the neoclassical approach of capital structure irrelevance, the trade-off theory, and the pecking-order theory (Brusov et al., 2013; Ippolito et al., 2022; Obeidat, 2021). The trade-off theory posits that, under conditions of positive distress costs and bankruptcy costs, firms select a target debt ratio to maximize the value of the tax shield on interest costs (Leary & Roberts, 2005; Thai, 2019). According to the pecking-order theory, however, information asymmetry and adverse selection drive firms to prioritize internal funds over external financing and safe debt over risky debt, with external equity issuance being a last resort (Bharath et al., 2009; Pacheco & Tavares, 2015).

Secondly, theoretical tradition is the dynamic partial-adjustment theory, which assumes that positive adjustment costs are incorporated into the firm's optimization problem, which in turn accounts for the possibility of slow adjustments towards the target leverage ratio (Hennessy & Whited, 2005; Leary & Roberts, 2005). The partial-adjustment model, pioneered by Flannery and Rangan, estimates the speed-of-adjustment coefficient as the key parameter (Cahyono & Chawla, 2019; Elsas & Florysiak, 2015; Iyoha et al., 2022; Öztekin, 2015). Empirical studies report substantial heterogeneity in the speed-of-adjustment estimates, with firms with higher default risk and higher opportunity costs of deviation from the target leverage adjusting faster to shocks (Elsas & Florysiak, 2011).

The third theoretical tradition is the new institutional economics approach, which argues that institutions thus the formal and informal rules and their enforcement mechanism affect the capital structure choices of firms (Faúndez, 2016; Kassner, 2017; Telles, 2024). The contracting and property-rights theories highlight the role of institutions in determining the relative costs of external debt and equity (Acemoğlu & Johnson, 2005). In particular, the quality of institutions affects the fixed costs of renegotiating debt contracts and re-pricing debt securities, which in turn affects the speed of adjustments towards the target leverage.

The fourth theoretical perspective is related to the institutional setting peculiar to this MFI because these entities pursue a double bottom line, which includes financial and social performance. Ledgerwood, Earne and Nelson (2013) explore the institutional actors which take part in financing decisions, while Hoque et al. (2011) and Schreiner (2002) discuss the tensions between commercial financing and the social-mission financing goals. This line of reasoning is similar to both the dynamic capital-structure argument and the new-institutional approach because MFI can attract different types of financing, such as deposits, debt, equity, donor funds, and grants. In turn, the capital structure of an MFI is changed not only through the capacity to raise debt but also through accessing alternative sources of financing, changing disclosure policies, and responding to diverse stakeholders' interests. Therefore, the empirical findings are presented as competing hypotheses, not supporting the idea of one dominant theory of capital structure.

Empirical Studies

This subsection provides an overview of the empirical studies investigating relationships between microfinance capital structure, dynamic leverage adjustment and macro-institutional quality. Four sets of literature have been examined for this study: (i) the performance and outreach consequences of leverage; (ii) the impact of macro-country institutional factors on

MFI's credit growth, financial sustainability, and leverage choices; (iii) the dynamic partial adjustment literature on capital structure and related stylized facts used as reference in this chapter; and (iv) a small number of papers discussing interaction mechanisms between institutional moderators and capital structure. The first set of papers report findings on MFI performance and outreach consequences of leverage. Kyereboah-Coleman in an African MFI panel reports a positive relationship between leverage and return on assets; his findings suggest double-edged beneficial effects of debt by MFI's commercialization despite the heightened risk of default (Kyereboah-Coleman, 2007). Following the same line of research, Hoque, Chishty and Halloway report evidence on the heterogeneity of capital structure effects in relation to the commercialization process. They find that increase in debt or equity cushions the productivity gains of client-maximizing MFIs, whereas debt-financed outreach has only a limited impact on the relative service to the poorest borrowers (Hoque et al., 2011). In another study, Bogan finds that higher grant support decreases the operational self-sufficiency of large MFIs, which highlights the non-neutrality of concessional equity (Bogan, 2012). Githaiga and Bitok highlight the moderation role of mission-specific characteristics on the leverage-sustainability link. They find that the positive association between leverage and sustainability is attenuated in portfolios with a large share of female borrowers due to the elevated default risks and lower yield of women borrowers (Githaiga & Bitok, 2023). In a sample of 2102 MFIs across 114 countries, Sherpa et al. find that financial performance is not significantly predicted by commercialization once the mission-specific constraints and country macro-characteristics are controlled for; conversely, commercialization predicts higher average loan sizes, which reflects the mission drift hypothesis (Sherpa et al., 2026). Hoque, Chishty and Halloway report similar evidence on the diminution of productivity gains on client-maximization frontiers with commercial debt. (Hoque, Chishty, & Halloway, 2011)

The second set of literature examines the impact of institutional environment on MFI's credit growth, financial sustainability, and leverage. Tehulu reports evidence on the “grease” and “sand” type of effects of macro-country institutional characteristics on the growth of MFI's credit in Africa (Tehulu, 2022). In the subsequent study, Tehulu, Muhammed and Melesse document a positive association between institutional quality and MFI financial sustainability with evidence of heterogeneity in growth channels (Tehulu et al., 2024). Fisseha analyzing the performance of non-bank microfinance institutions in Africa discovers that only control of corruption WGI dimension has a positive impact on MFI performance after controlling for other WGI indicators and country-specific effects (Fisseha, 2024). For the sample of MFIs in Asia, the findings of Habib and Kabir reveal conditional impact of institutional quality on the leverage-performance link: high leverage is associated with higher performance in high- (and lower performance in low-) institutional quality countries (Habib & Kabir, 2024). Adusei and Sarpong-Danquah link macro-country institutional quality characteristics to MFI leverage; report that improvement in the rule of law, regulatory quality, control of corruption, and voice and accountability is associated with lower levels of MFI borrowing; and provide evidence supporting the “sand the wheels” hypothesis (Adusei & Sarpong-Danquah, 2021). Wry and Zhao analyzing the data on 116 MFIs worldwide report that the social-financial trade-off is especially pronounced in environmentally vulnerable institutional environments where it is mitigated by professional managerial practices (Wry & Zhao, 2018). Ault and Spicer in the study of commercial microfinance across countries find that the impact of state fragility on the level of microfinance lending is moderated by the presence of politically inclusive institutions (Ault & Spicer, 2013). Overall, the macro-country institutional literature highlights the heterogeneous impact of institutional quality indicators on various aspects of MFIs' performance.

The third set of literature focuses on dynamic aspects of microfinance capital structure and is centered around the analysis of partial adjustment of firms' leverage to positive or negative change in the value of equity. Leary and Roberts document that US firms follow a systematic pattern of leverage adjustment in response to positive or negative value shocks with half-lives ranging between 2 and 4 years, suggesting positive adjustment costs (Leary & Roberts, 2005). Öztekin reports similar findings in the analysis of 7397 firms worldwide with the adjustment speeds ranging between 25% per year on average globally, with creditor rights and legal origin explaining a significant portion of the cross-country heterogeneity (Öztekin, 2015). Byoun provides evidence in support of the dynamic trade-off theory in his analysis of cash flow financing of re-balance (Byoun, 2008). Cahyono and Chawla report similar findings in the study of capital restructuring of the Indonesian listed firms with speeds of adjustment comparable to those found by Öztekin (Cahyono & Chawla, 2019). Iyoha, Ohiokha, Umoru et al. provide evidence from the similar emerging market settings comparable to those of Öztekin (Iyoha et al., 2022).

A common theme in the literature on dynamic aspects of capital structure is the discussion of heterogeneity in leverage adjustment speeds. Elsas and Florysiak document that the use of standard fixed effects or Blundell-Bond GMM estimator can lead to substantially biased estimation of the speed of adjustment when leverage is fractional (Elsas & Florysiak, 2015). The dynamic fractional response estimator applied to the European sample produced substantially higher speeds of adjustment than those reported in GMM literature, providing further evidence on the importance of the choice of estimator (Elsas & Florysiak, 2011). Similar concerns are raised by Moyo suggesting the use of the fractional response estimator (Moyo, 2016). Ippolito, Steri, Tebaldi et al. find that the extent to which a firm's balance sheet reflects the risk and collateralization of its assets informs its financing and investment choices, emphasizing the importance of controlling for relevant time-invariant covariates in the target leverage specification (Ippolito et al., 2022).

The final set of literature reviews focuses on the interaction between the determinants of capital structure, considered as institutions, and other forces which determine capital structure choices. Firstly, Öztekin (2015) and Adusei and Sarpong-Danquah (2021) provide the basis for the inclusion of interactions between country institutions and firm governance in the analysis, while Githaiga (2021) emphasizes the differences in institutional characteristics of MFIs which lead to different results. This literature review serves as the justification for the inclusion of the dynamic partial adjustment model with institutional characteristics of the countries and the proportion of women in the board of directors. The difference between this analysis and the one suggested by Öztekin (2015) lies in the fact that the specification estimated below is a linear dynamic panel model estimated with two-step system GMM, as opposed to the fractional response model.

MATERIALS AND METHODS

Empirical Model and Data Description

The publicly available data was merged with the corresponding MFI's company characteristics, the six dimensions of the WGI, and macroeconomic country characteristics from the WDI for the period 2010-2018 to obtain the final re-estimated set. The debt-to-equity ratio was adopted from the MIX financial performance indicator data set, and it was cross-validated with the liabilities over equity ratios when available. The natural logarithm of Borrowings is used as a dependent variable. The natural logarithm of Assets is used to assess the size of the MFI, while

its profitability is measured as the net operating income over assets ratio times 100, and the operating expense over assets ratio is measured similarly. The aggregate institutional quality is taken as the average of the six dimensions of the Worldwide Governance Indicators. The inflation rate, real GDP growth rate, and domestic credit to the private sector, expressed as a percentage of GDP, are used as country-year controls.

In the dynamic model specified below, Y_{it} is either the Debt-to-Equity Ratio or the natural logarithm of Borrowings. $Y_{i,t-1}$ is the one-period lag of the regressor, IQ_{ct} denotes the aggregate institutional quality indicator (or one of the six alternative specifications), WOB_{it} is the firm's board-gender variable. The Z_{it} vector includes additional MFI-level and country-time controls, d_t are year dummies, μ_i is the MFI fixed effects, and ε_{it} is the disturbance term. In baseline specifications, the WOB_{it} is interacted with the natural logarithm of 100 times the ratio of female directors to the total number of directors for non-missing observations. Alternatively, in the interaction models, the unlogged percentage of women on the board is used to estimate both the interaction effects and marginal associations.

$$y_{i,t} = c + \lambda y_{i,t-1} + \sum_k \gamma_k l_{c,t,k} + \beta' Z_{i,t} + d_t + \mu_i + \varepsilon_{i,t}.$$

Table 1: Definition of Mathematical Symbols

Symbol	Definition
$Y_{i,t}$	Capital-structure measure of MFI i in year t (debt-to-equity ratio; ln of MFI borrowings)
$Y_{i,t-1}$	Lagged capital-structure measure
λ	Coefficient on the lagged dependent variable ($= 1 - \text{speed of adjustment toward target leverage}$)
c	Intercept of the dynamic panel model
$X_{i,t}$	Vector of explanatory variables (institutional-quality index and components, women on boards)
$Z_{i,t}$	Vector of control variables (profitability, size, efficiency)
γ	Coefficient vector on explanatory variables
β	Coefficient vector on control variables
d_t	Year (time) dummy
μ_i	Unobserved MFI fixed effect
$\varepsilon_{i,t}$	Idiosyncratic error term

Note: Symbols are defined for the dynamic panel specification; i denotes an MFI and t a year.

Estimation Technique

All dynamic models were estimated in Python using a two-step Arellano–Bover/Blundell–Bond system-GMM matrix implementation. The dependent institutional-quality measure, the board variable, profitability, size, and operating expense intensity are all declared as GMM-style variables and instrumented with collapsed level lag 2–3 in the differenced equations and lagged differences in the level equations. GDP growth, inflation, financial development, and year dummies are declared as IV-style exogenous

instruments. The instrument matrix is collapsed for all specifications. Two-step standard errors are reported with Windmeijer's finite-sample correction. The baseline lag range was 2–3, with specification tests also reported for 2 only and 2–4 lag ranges.

Specification diagnostics are reported jointly for Arellano–Bond AR(1) and AR(2) by the Hansen J-test of over-identifying restrictions, the number of instruments, the number of available MFI-year equations, the Difference-in-Hansen test for the additional level moment conditions (when identified), and the number of MFIs. For a standard first-difference residual process, AR(1) is expected while AR(2) should not be significant. The diagnostics are therefore interpreted jointly rather than relying on the Hansen p-value only.

Short-Run and Long-Run Coefficients

For each explanatory variable X_k , the long-run coefficient is calculated from the short-run system-GMM estimate and the lagged-dependent-variable coefficient as:

$$\beta_k^{LR} = \beta_k^{SR} / (1 - \lambda)$$

$$SOA = 1 - \lambda$$

where λ is the estimated persistence coefficient and SOA is the implied speed of adjustment. Long-run standard errors are computed with the delta method using the full Windmeijer-corrected covariance matrix. This is important because uncertainty in both β_k and λ contributes to uncertainty in the derived long-run effect.

Sources of Data

The estimation uses the public World Bank MIX Market Financial Performance Dataset in US dollars and the associated MFI Company Metadata. Country-year institutional variables are taken from the 2025 release of the Worldwide Governance Indicators, and GDP growth, CPI inflation, and domestic credit to the private sector (% of GDP) are taken from World Development Indicators. The use of the USD file is necessary for meaningful cross-country comparisons of logged assets and borrowings.

Data quality and pilot testing. The study analyses administrative financial records and published country-level indicators. It does not use a questionnaire, interview schedule or survey instrument, so a respondent pilot sample, Cronbach's alpha and instrument pre-test are not applicable. Measurement checks instead comprise record deduplication, country-year matching, board-share range checks, currency comparability, missing-data screening and sensitivity analyses for extreme leverage. These checks address coding and measurement concerns, but cannot establish that every underlying administrative record is error-free.

Sample Filtering and Composition

The public MIX USD file contains 10,095 annual observations for 2,294 MFIs in 2010–2018 before duplicate resolution. After resolving duplicate MFI-year records, 10,083 observations remain. WGI matching retains 10,078 observations, and complete WDI matching retains 9,436. Valid board-composition data are available for 5,540 observations. The baseline debt-to-equity variable set is complete for 4,099 observations from 1,179 MFIs before the dynamic lag requirements are applied. The full system-GMM DTE model ultimately uses 548 MFIs and 1,688 usable MFI-year equations; the full borrowing model uses 502 MFIs and 1,528 equations. The moderation model uses 642 MFIs and 1,998 equations because zero female

representation can be retained when WOB is entered as an unlogged percentage. The historical MIX diamond-rating variable is not included in the current public release, so the former 4/5-diamond filter and exact 600-MFI sample cannot be independently reconstructed from the public files. Figure 2 summarises this filtering process visually.

Sample-construction flow for the public-data re-estimation (2010–2018)

Starting from the public MIX Market USD file, sequential matching and completeness filters lead to the final estimation samples.

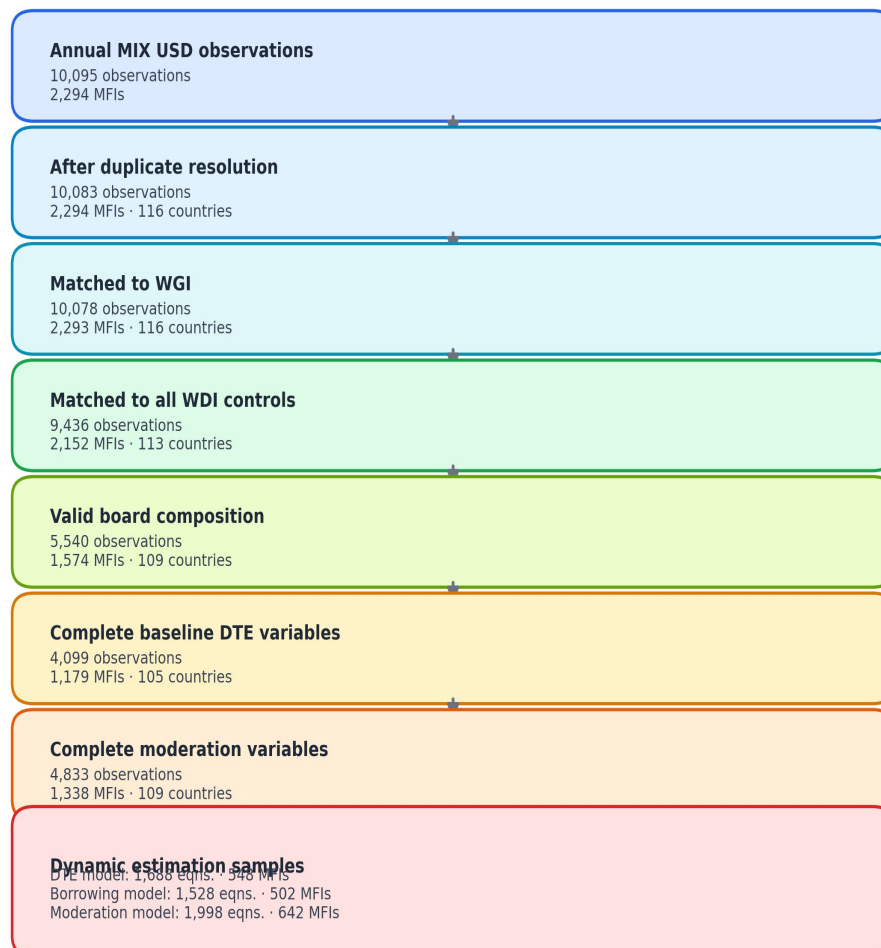


Figure 2: Sample-construction flow for the public-data re-estimation, 2010–2018.

Table 2: Public-data Sample Construction for the estimation

Stage	MFI-year obs.	MFIs	Countries
Annual MIX USD observations, 2010–2018	10,095	2,294	—
After MFI-year duplicate resolution	10,083	2,294	116
Matched to WGI	10,078	2,293	116
Matched to all WDI controls	9,436	2,152	113
Valid board composition	5,540	1,574	109
Complete baseline DTE variables (positive WOB for log)	4,099	1,179	105
Complete moderation variables	4,833	1,338	109

Stage	MFI-year obs.	MFIs	Countries
System-GMM DTE full (lag structure)	1,688	548	80
System-GMM ln borrowings full (lag structure)	1,528	502	76
System-GMM moderation DTE (lag structure)	1,998	642	86

Note: Source: Authors' compilation from MIX Market, WGI and WDI (2010–2018). Counts reflect sequential sample screens.

Identification and Inference

The estimation proceeds by treating both dynamics as potentially endogenous/preset by using internal lagged instruments. The main country-level governance variables are thus varied at country-year and observations on an MFI-year basis. The resulting common shock concerns the alternative MFI fixed-effects model with year effects and country clustering of standard errors also reported for comparison with the system-GMM robustness. This complementary estimator is not a substitute for addressing dynamic endogeneity with system GMM but provides a direct sensitivity check for country-level inference.

Measurement of Variables and Predicted Relationships

Preliminary Remarks

The study employs four main classes of variables: (i) capital-structure outcomes, (ii) explanatory treatment of macro-institutional quality and board gender composition, (iii) operating controls at the MFI level, and (iv) country-year macroeconomic controls. The predicted relationships emanate from the capital-structure, dynamic partial-adjustment, new-institutional-economics, and microfinance double-bottom-line theories expounded in Sections 2.1 and 2.2. As discussed, these views have various competing implications, and thus the analysis reports associations that are consistent with specific mechanisms rather than findings that directly favor one theoretical perspective over the others.

The mathematical definitions of each variable are given below, together with the predicted sign of the relationship with MFI leverage. All variable definitions are summarized in Table 3.

Dependent Variables: Capital Structure

Debt-to-equity (DTE) is used because it represents debt financing relative to the MFI's equity cushion and permits comparison of financing structure across institutions of different sizes. The ratio comes from MIX Market financial-performance fields; its comparability is checked against liabilities-to-equity information where available. However, liabilities and interest-bearing borrowings are not identical, and negative or small equity can generate extreme or negative ratios. Therefore, DTE is not a bounded fraction, and unusually large values can dominate dynamic estimates. Results are tested with winsorised leverage, restrictions involving positive equity and a separate log-borrowings outcome. Log borrowings measures financing scale rather than relative leverage; differences between their coefficients should not be treated as contradictions.

Explanatory Variables: Institutional Quality and Board Gender Composition

Institutional quality is defined as the arithmetic mean of six World Governance Indicators (WGI) estimates: voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption. The six indicators are combined on their original estimate scales, not logged. A principal-component index based on standardised dimensions is also considered as a sensitivity measure; its first component explains 77.7% of the variation in those standardised indicators. The debt-to-equity ratio and the logarithm of borrowing amounts capture different aspects of financing and must not be interpreted as interchangeable leverage measures.

$$\overline{IQ}_{c,t} = \frac{1}{6} \sum_{k=1}^6 I_{c,t,k}$$

Board gender composition is constructed directly from the MIX variables as WOB Share = Female Board Members / Total Board Members and WOB% = 100×WOB Share. In the reconstructed public panel, WOB ranges from 0 to 100%, with a mean of approximately 30.9% across observations with valid board data. The previous descriptive value of 2.382 represented a count-like measure and is not used as the percentage/proportion measure in the re-estimation. Baseline models use $\ln(\text{WOB}\%)$ for strictly positive WOB observations; moderation models use WOB% without logging, and this distinction is applied consistently in all tables and interpretations.

$$WOB_{i,t} = \frac{\text{Female board members}_{i,t}}{\text{Total board members}_{i,t}}$$

Control Variables: MFI-Level Operating Characteristics

Three MFI-level control variables capture the within-MFI operating conditions that the institutional and board variables abstract away from.

Profitability is measured by return on assets:

$$ROA_{i,t} = \frac{\text{Net Operating Income}_{i,t}}{\text{Total Assets}_{i,t}}$$

A negative sign on leverage is predicted by the pecking-order theory (Bharath et al., 2009; Pacheco & Tavares, 2015): MFIs that are profitable produce higher internal cash flows, which lessens the need for external debt. Through bankruptcy-cost considerations, the trade-off theory offers a counter prediction: profitable MFIs have lower expected distress and higher tax shields, increasing the ideal debt level. According to Bogan (2011), Githaiga (2021), and Kyereboah-Coleman (2007), the empirical sign in MFI samples is usually negative, which is consistent with pecking-order dominance. Size is measured by the natural logarithm of total assets:

$$\ln TA_{i,t} = \ln(\text{Total Assets}_{i,t})$$

According to trade-off theory, larger MFIs have easier access to wholesale debt markets, more diversified loan portfolios, and lower bankruptcy costs per unit (Iyoha et al., 2022; Öztekin, 2015; Kyereboah-Coleman, 2007; Pacheco & Tavares, 2015). A positive correlation is consistently supported by empirical data in microfinance and listed-firm samples (Cahyono & Chawla, 2019; Iyoha et al., 2022; Öztekin, 2015; Kyereboah-Coleman, 2007). As a result, a positive sign is anticipated.

Operating efficiency is measured by the operating-expense ratio:

Macroeconomic Controls

Three country-year controls are included in the full re-estimation: real GDP growth (annual %), CPI inflation (annual %), and domestic credit to the private sector (% of GDP) as the financial-development measure. All three are entered contemporaneously and treated as IV-style exogenous variables in the system-GMM instrument matrix.

Summary of Variables and Predicted Signs of Association

Table 3 provides an overview of the variables used and their predicted sign of association. The table includes the formula used to measure each variable, the unit of measurement, and the source of the data.

Table 3: Variable Definitions, Sources, and Predicted Signs

Variable	Measurement	Source	Role/expected Sign
Debt-to-equity ratio	Total debt / total equity	MIX Market USD	Dependent variable
ln borrowings	ln(Borrowings, US\$)	MIX Market USD	Dependent variable
Institutional quality	Mean of six WGI dimensions	World Bank WGI 2025	Ambiguous
WGI components	VA, PV, GE, RQ, RL, CC estimates	World Bank WGI 2025	Component-specific
Women on boards	$100 \times \text{female board members} / \text{total board members}$; baseline uses $\ln(\text{WOB}\%)$ for $\text{WOB} > 0$	MIX Market	Moderator; ambiguous
Profitability	$\text{ROA} = \text{net operating income} / \text{total assets} \times 100$	MIX Market USD	Control; negative prior
Size	$\ln(\text{total assets, US\$})$	MIX Market USD	Control; positive prior
Operating-expense ratio	$\text{Operating expenses} / \text{total assets} \times 100$	MIX Market USD	Control; ambiguous
GDP growth	Real GDP growth, annual %	World Bank WDI	Control; positive prior

Variable	Measurement	Source	Role/expected Sign
Inflation	CPI inflation, annual %	World Bank WDI	Control; ambiguous
Financial development	Domestic credit to private sector, % GDP	World Bank WDI	Control; ambiguous

Source: MIX Market, WGI and WDI (2010–2018). Predicted signs are theoretical priors, not findings.

Descriptive Statistics

Table 4 reports descriptive statistics for the 4,099 MFI-year observations with complete variables required for the full debt-to-equity specification before dynamic-lag restrictions. The use of the public USD dataset corrects the currency comparability problem that would arise from logging local-currency assets and borrowings across countries. The raw debt-to-equity ratio remains highly dispersed, with extreme positive and negative values. This motivates the explicit winsorisation, positive-equity, and alternative-leverage robustness tests reported in Section 4.6. Board gender composition is now expressed on the correct percentage scale rather than as a female-director count. Institutional quality also shows substantial cross-country variation, supporting identification from country-year changes.

The descriptive statistics in Table 4 thus highlight the variation in the sample that is used to estimate the static and dynamic effects of institutional quality on MFI leverage discussed in Sections 4.2 – 4.4.

Table 4: Descriptive Statistics for the Public-Data Re-estimation

Variable	Obs	Mean	SD	Min	Max
Debt-to-equity ratio	4,099	4.725	30.333	-335.920	1314.180
Borrowings (US\$)	3,997	29,112,287	104,699,766	0.000	2,648,153,718
Institutional quality	4,099	-0.490	0.400	-1.741	1.254
Women on boards (%)	4,099	36.764	22.550	0.224	100.000
GDP growth (%)	4,099	4.936	2.717	-12.715	19.675
Inflation (%)	4,099	5.152	3.749	-3.749	36.907
Financial development (% GDP)	4,099	38.881	21.397	3.128	153.193
Profitability (ROA, %)	4,099	1.695	9.736	-186.192	137.671
Assets (US\$)	4,099	109,011,778	495,599,121	2279.000	19,194,688,923
Operating expense/assets (%)	4,099	16.149	12.667	0.000	247.290

Source: Authors' calculations using the complete-case analysis sample (2010–2018). SD denotes standard deviation.

Table 5 reports pairwise correlations in the complete public-data DTE variable set.

The strongest pairwise association is between $\ln(\text{Borrowings})$ and $\ln(\text{Assets})$ ($r=0.826$), which is expected because larger MFIs carry larger absolute borrowing volumes. Institutional quality is moderately correlated with financial development ($r=0.397$). These correlations are descriptive and do not establish independence, causality, or the validity of the dynamic instruments.

Correlation Matrix

Table 5: Matrix of Correlations

	DTE	lnBORROW	IQUAL	lnWOB	GROWTH	INFL	FINDEV	ROA	SIZE	OER
DTE	1.000	0.025	-0.024	-0.018	-0.001	0.030	-0.003	-0.004	0.023	-0.032
lnBORROW	0.025	1.000	0.019	-0.235	0.047	-0.038	0.158	0.072	0.826	-0.241
IQUAL	-0.024	0.019	1.000	0.010	0.020	-0.179	0.397	-0.014	-0.010	0.005
lnWOB	-0.018	-0.235	0.010	1.000	-0.015	-0.066	0.046	0.013	-0.236	0.009
GROWTH	-0.001	0.047	0.020	-0.015	1.000	0.038	0.040	0.035	0.006	-0.063
INFL	0.030	-0.038	-0.179	-0.066	0.038	1.000	-0.116	-0.007	-0.106	0.089
FINDEV	-0.003	0.158	0.397	0.046	0.040	-0.116	1.000	0.037	0.072	-0.158
ROA	-0.004	0.072	-0.014	0.013	0.035	-0.007	0.037	1.000	0.110	-0.330
SIZE	0.023	0.826	-0.010	-0.236	0.006	-0.106	0.072	0.110	1.000	-0.291
OER	-0.032	-0.241	0.005	0.009	-0.063	0.089	-0.158	-0.330	-0.291	1.000

Source: Authors' calculations using MIX Market, WGI and WDI (2010–2018). Entries are descriptive pairwise correlations.

Figure 3 complements Table 5 by visualising the correlation matrix as a heatmap, which makes the strongest positive and negative pairwise associations immediately visible.

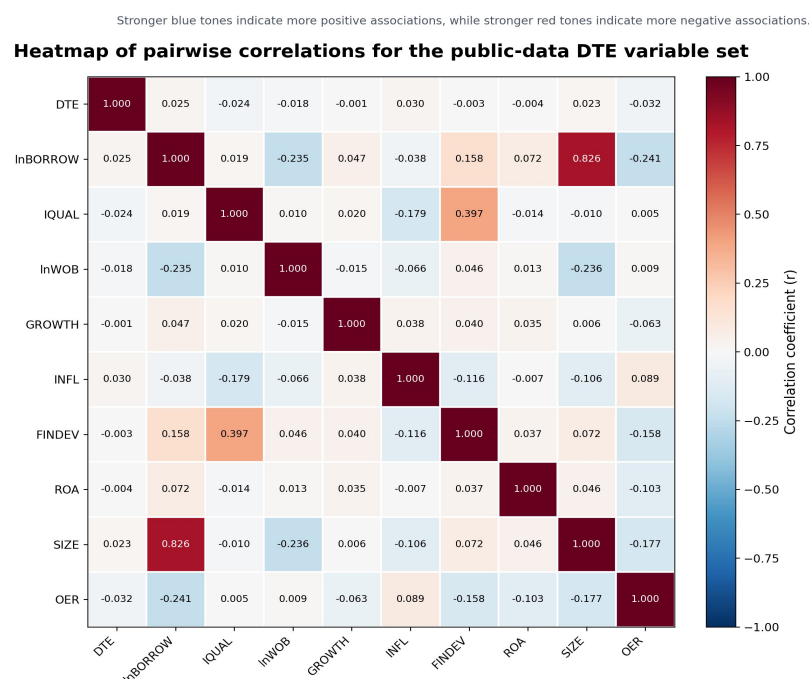


Figure 3: Heatmap of pairwise correlations in the public-data DTE variable set.

Note: The figure visualizes the pairwise correlations reported in Table 5. Warmer blue tones indicate stronger positive associations, while warmer red tones indicate stronger negative associations.

Baseline System-GMM estimation

Table 6 reports the estimated two-step system-GMM models with Windmeijer-corrected standard errors. The full debt-to-equity model uses 548 MFIs and 1,688 usable MFI-year equations; the full log-borrowings model uses 502 MFIs and 1,528 equations.

Table 6: Two-Step System-GMM estimation of MFI Capital Structure

Variable	DTE Basic	ln Borrowings Basic	DTE full	ln Borrowings full
Lagged dependent variable	-0.023 (0.019)	1.007*** (0.099)	-0.033* (0.020)	0.824*** (0.117)
Institutional quality	0.103 (3.322)	0.078 (0.268)	-1.488 (7.136)	0.647 (0.394)
ln(Women on boards %)	0.439 (1.694)	0.326 (0.218)	0.634 (2.329)	0.133 (0.176)
Profitability (ROA, %)	—	—	-0.159 (0.187)	0.002 (0.012)
ln(Assets, US\$)	—	—	1.374 (1.228)	0.460*** (0.129)
Operating expense/assets (%)	—	—	-0.107 (0.153)	0.002 (0.008)
Financial development	—	—	-0.007 (0.053)	-0.005 (0.003)
GDP growth	—	—	0.089 (0.092)	0.023*** (0.008)
Inflation	—	—	0.051 (0.098)	0.008 (0.008)
AR(1) p-value	0.357	0.000	0.335	0.000
AR(2) p-value	0.274	0.552	0.279	0.448
Hansen p-value	0.357	0.030	0.717	0.026
Difference-in-Hansen p-value	0.210	0.066	0.754	0.006
Instruments	16	16	28	28
MFIs	609	552	548	502
Usable MFI-year equations	1895	1683	1688	1528

Source: Authors' system-GMM estimations, 2010–2018. Standard errors and diagnostic p-values are reported; interpretation is conditional on diagnostic validity.

DTE, debt-to-equity ratio; BORROW, borrowings; IQUAL, institutional quality; WOB, women on boards; PROFIT, profitability; SIZE, size of an MFI; EFFICI, efficiency of an MFI.

*Note: Two-step System-GMM with collapsed instruments. Endogenous/predetermined variables use level lags 2–3 in differenced equations and lagged first differences in level equations. Windmeijer finite-sample corrected robust standard errors are reported. AR(1), AR(2), Hansen and Difference-in-Hansen p-values are shown. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

*Note: Two-step system GMM with collapsed instruments and year effects. GMM-style variables use level lags 2–3 in the differenced equations and lagged first differences in the level equations. Standard errors in parentheses are Windmeijer finite-sample corrected. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. AR(1) and AR(2) are Arellano–Bond tests. Difference-in-Hansen tests the additional level moment restrictions where identified.*

Table 7: Component-Level Two-Step System-GMM Results

WGI component	Control of corruption	Rule of law	Regulatory quality	Voice & accountability	Political stability	Government effectiveness
Coef.	-0.915	1.196	-2.376	-0.355	-2.644	-1.827
SE	4.232	8.081	13.943	7.019	3.296	6.389
p	0.829	0.882	0.865	0.960	0.423	0.775
Lagged DTE	-0.033	-0.027	-0.024	-0.027	-0.025	-0.042
Lag p	0.106	0.136	0.211	0.164	0.247	0.017
AR(1) p	0.348	0.275	0.315	0.277	0.290	0.361
AR(2) p	0.280	0.277	0.290	0.276	0.270	0.272
Hansen p	0.678	0.799	0.939	0.726	0.667	0.704
Diff-Hansen p	0.718	0.763	0.961	0.618	0.797	0.738
Instr.	28	28	28	28	28	28
MFIs	548	548	548	548	548	548
Obs.	1688	1688	1688	1688	1688	1688

Source: Authors' system-GMM estimations, 2010–2018. Each institutional dimension is fitted separately.

The results presented above offer mixed evidence on the relationship between institutional quality and the capital structure of microfinance institutions. In the debt-to-equity (DTE) specification, aggregate institutional quality has a negative coefficient ($\beta = -1.488$) but is statistically insignificant ($SE = 7.136$, $p = 0.835$). In the log-borrowings specification, by contrast, institutional quality has a positive coefficient ($\beta = 0.647$, $SE = 0.394$), which is also statistically insignificant at conventional levels ($p = 0.101$). Overall, aggregate institutional quality does not appear to have a statistically significant relationship with either the relative leverage position of MFIs or their absolute level of borrowings. At the same time, the two dependent variables display materially different dynamic properties and control-variable patterns, indicating that the institutional-quality–capital-structure association is sensitive to how financing is measured.

Turning to the dynamic properties of the DTE ratio, the coefficient on the lagged dependent variable is negative and statistically significant at the marginal level ($\lambda = -0.033$, $p = 0.096$). The implied speed of adjustment using the conventional partial-adjustment formula, ($SOA = 1 - \lambda$), would be 103.3%. Since this figure is substantially greater than 100%, it is not a plausible

estimate of the speed of adjustment in the DTE position of MFIs. One possible explanation for this result is that the Arellano–Bond AR (1) test does not find evidence of first-order serial correlation in the differenced residuals ($p = 0.335$). As a result, the usual partial-adjustment interpretation of the lagged dependent variable in a dynamic model is inappropriate, and the estimated speed of adjustment should not be taken as a serious economic proposition. Specifically, it is not the case that MFIs adjust their DTE position by about 100% per year toward some long-run target.

By contrast, the dynamic properties of log-borrowings are more consistent with a partial-adjustment model than those of raw DTE. The coefficient on the lagged log-borrowings is positive and highly statistically significant ($\lambda = 0.824$, $p < 0.001$). The implied speed of adjustment is 17.6%, which is economically plausible because it lies within the (0, 1) interval. The serial-correlation diagnostics also support a dynamic specification: the model shows the expected first-order serial correlation and no evidence of second-order serial correlation (AR(1) $p < 0.001$; AR(2) $p = 0.448$). However, the instrument-validity diagnostics are weak, with a Hansen p -value of 0.026 and a Difference-in-Hansen p -value of 0.006. Accordingly, the borrowing specification yields a plausible adjustment speed, but its instrument set should be interpreted cautiously.

The contrast between the two financing measures remains informative. In the full log-borrowings model, MFI size measured by the natural logarithm of total assets has a positive and statistically significant association with borrowings ($\beta = 0.460$, $p < 0.01$), and GDP growth is also positive and statistically significant ($\beta = 0.023$, $p < 0.01$). By contrast, both variables are statistically insignificant in the DTE specification. This indicates that absolute borrowing levels behave differently from relative leverage ratios. Taken together, the System-GMM estimates do not support a statistically significant aggregate institutional-quality effect in either specification. At the same time, the MFI fixed-effects specification with country-clustered standard errors reported below yields a negative and statistically significant DTE coefficient for institutional quality ($\beta = -7.189$, $SE = 3.510$, $p = 0.041$), underscoring substantial estimator sensitivity in the institutional-quality–capital-structure relationship.

By and large, the findings do not provide robust support for the sand-the-wheels hypothesis in its most general form. The most conservative interpretation is that any association between institutional quality and MFI capital structure is weak, specification-dependent, and sensitive to the leverage proxy employed. While some alternative estimators indicate a negative relationship between institutional quality and DTE, that result does not generalize across the full set of System-GMM specifications.

Contribution to knowledge: The evidence separates financing scale from financing structure and shows why an apparently well-behaved borrowing persistence coefficient is insufficient when the associated over-identification restrictions are rejected. It further demonstrates that a statistically significant institutional-quality coefficient under fixed effects does not establish robustness across dynamic specifications. For researchers, the central implication is to assess equity denominator problems, the instrument set and clustered country shocks before drawing policy conclusions. For practitioners, the results do not justify changing funding policy on the assumption that higher national governance scores necessarily reduce or increase MFI leverage.

Component-Level Institutional Quality estimation

The six WGI dimensions were re-estimated separately using the same full two-step system-GMM specification. Table 7 reports each focal coefficient and the complete diagnostic set.

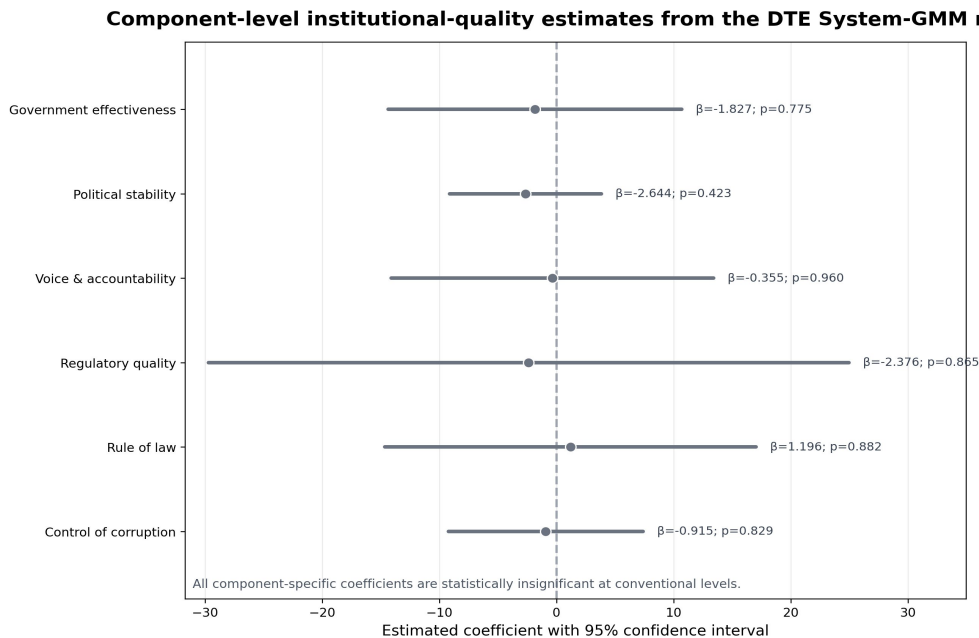


Figure 4: Component-level System-GMM institutional-quality estimates with 95% confidence intervals.

None of the six governance dimensions is statistically significant in the estimated DTE models. The coefficients are -0.915 for Control of Corruption ($p=0.829$), 1.196 for Rule of Law ($p=0.882$), -2.376 for Regulatory Quality ($p=0.865$), -0.355 for Voice and Accountability ($p=0.960$), -2.644 for Political Stability ($p=0.423$), and -1.827 for Government Effectiveness ($p=0.775$). The component models generally do not reject the Hansen restrictions and do not show AR (2) serial correlation, but their AR (1) tests are also not significant. This weak first-order serial-correlation pattern, together with the wide Windmeijer-corrected confidence intervals, argues against strong component-level causal claims.

Moderating Role of Women on Boards

The moderation analysis tests whether the association between institutional quality and MFI capital structure is conditional upon board gender composition. In the interaction models, women on boards (WOB) is entered as a continuous variable ranging from 0 to 100 percent. Consequently, the conditional marginal effect of institutional quality on the debt to equity ratio is given by:

$$\partial DTE / \partial IQ = \beta_{IQ} + \beta_{IQ \times WOB}(WOB)$$

where β_{IQ} represents the coefficient on institutional quality and $\beta_{IQ \times WOB}$ represents the interaction coefficient. The latter therefore measures the change in the institutional-quality slope associated with a one-percentage-point increase in female board representation. The interaction between aggregate institutional quality and women on boards is positive but statistically insignificant ($\beta = 0.054$, $SE = 0.238$, $p = 0.822$). This finding indicates that changes in female board representation do not significantly alter the relationship between aggregate

institutional quality and the debt-to-equity ratio. Similar results are observed for the individual institutional-quality dimensions. The interaction coefficients for Control of Corruption $\times$ WOB ($\beta = -0.032$, $p = 0.841$), Rule of Law $\times$ WOB ($\beta = -0.037$, $p = 0.926$), Regulatory Quality $\times$ WOB ($\beta = -0.054$, $p = 0.803$), and Voice and Accountability $\times$ WOB ($\beta = -0.081$, $p = 0.729$) are all statistically insignificant. Thus, the findings provide no statistically significant evidence that board gender composition moderates the relationship between these institutional-quality dimensions and MFI leverage.

The marginal-effects analysis provides further support for this conclusion. The conditional effects of aggregate institutional quality were evaluated at representative levels of female board participation corresponding approximately to the 10th, 25th, 50th, 75th, and 90th percentiles of the WOB distribution: 0.0%, 14.3%, 27.3%, 42.9%, and 66.7%, respectively. Across these values, the estimated marginal effect of aggregate institutional quality ranges from -1.657 to 1.919 . However, the 95% confidence interval associated with each estimate includes zero. Consequently, the effect of institutional quality on the debt-to-equity ratio cannot be statistically distinguished from zero at any of the examined levels of female board representation. Figure 5 illustrates these conditional marginal effects and their associated confidence intervals.

Overall, the moderation results indicate that greater female representation on MFI boards does not systematically strengthen or weaken the relationship between institutional quality and capital structure. Although the estimated interaction coefficients vary in magnitude and direction across the institutional-quality dimensions, none attains conventional levels of statistical significance. The findings therefore suggest that the effects of institutional quality and board gender composition on MFI financing decisions are better understood as distinct governance relationships rather than as a statistically established interactive mechanism within the overall sample.

Table 8: Women-On-Boards Moderation estimation

Model	Aggregate IQ	Control of corruption	Rule of law	Regulatory quality	Voice & accountability
Inst. coef.	-1.657	0.664	5.345	1.830	-0.182
Inst. SE	10.747	6.869	21.349	12.962	7.240
Inst. p	0.877	0.923	0.802	0.888	0.980
WOB coef.	-0.035	-0.072	-0.093	-0.098	-0.056
WOB SE	0.202	0.121	0.329	0.180	0.123
WOB p	0.861	0.553	0.778	0.585	0.649
Interaction	0.054	-0.032	-0.037	-0.054	-0.081
Int. SE	0.238	0.159	0.405	0.215	0.235
Int. p	0.822	0.841	0.926	0.803	0.729
Lag DTE	0.013	0.013	0.019	0.019	0.014
Lag SE	0.052	0.058	0.057	0.053	0.051
Lag p	0.799	0.824	0.742	0.719	0.787
AR(1) p	0.257	0.268	0.260	0.258	0.274
AR(2) p	0.382	0.348	0.350	0.347	0.325

Model	Aggregate IQ	Control of corruption	Rule of law	Regulatory quality	Voice & accountability
Hansen p	0.813	0.798	0.844	0.899	0.806
Diff-H p	0.743	0.722	0.834	0.890	0.878
Instr.	31	31	31	31	31
MFIs	642	642	642	642	642
Obs.	1998	1998	1998	1998	1998

Source: Authors' moderation estimations, 2010–2018. WOB denotes percentage of female board members.

Note: WOB is measured on a 0–100 percentage scale in the interaction models. The two-step System-GMM estimates employ collapsed instruments and Windmeijer-corrected standard errors. Statistical significance is denoted by *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$.

Conditional marginal effect of aggregate institutional quality across women-on-boards values

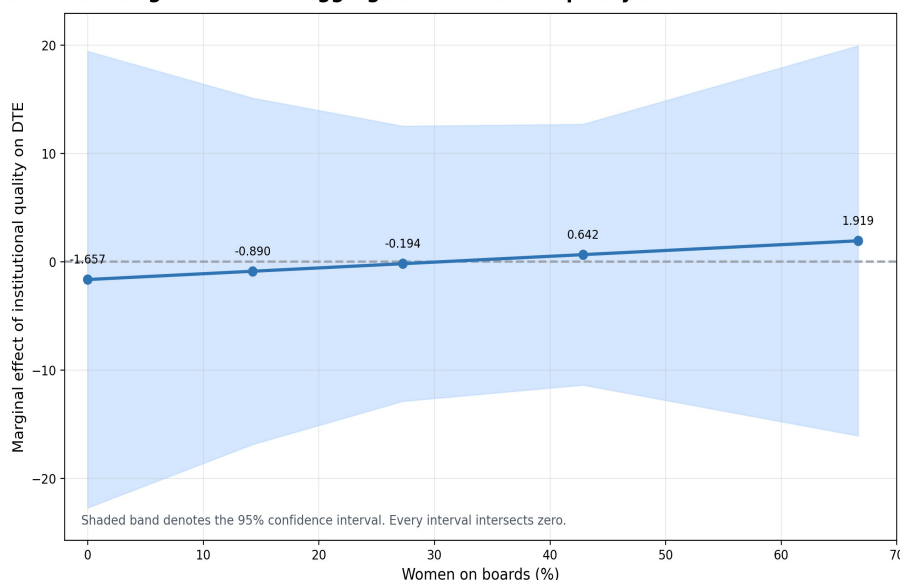


Figure 5: Marginal effect of aggregate institutional quality on DTE across women-on-boards values, with 95% confidence intervals.

Note: Marginal effects are evaluated at the 10th, 25th, 50th, 75th and 90th percentiles of observed WOB. Every confidence interval includes zero.

Table 9: Conditional Marginal Effects of Institutional Quality across Women-On-Boards Values

Model	Quantile	WOB (%)	Marginal effect	SE	95% CI low	95% CI high	p
Aggregate IQ	0.100	0.000	-1.657	10.747	-22.720	19.407	0.877
Aggregate IQ	0.250	14.286	-0.890	8.152	-16.868	15.087	0.913
Aggregate IQ	0.500	27.273	-0.194	6.474	-12.883	12.496	0.976
Aggregate IQ	0.750	42.857	0.642	6.138	-11.388	12.672	0.917

Model	Quantile	WOB (%)	Marginal effect	SE	95% CI low	95% CI high	p
Aggregate IQ	0.900	66.667	1.919	9.180	-16.074	19.913	0.834
Regulatory quality	0.100	0.000	1.830	12.962	-23.575	27.235	0.888
Regulatory quality	0.250	14.286	1.063	11.669	-21.808	23.935	0.927
Regulatory quality	0.500	27.273	0.366	11.115	-21.419	22.152	0.974
Regulatory quality	0.750	42.857	-0.470	11.354	-22.724	21.784	0.967
Regulatory quality	0.900	66.667	-1.748	13.429	-28.068	24.573	0.896
Voice & accountability	0.100	0.000	-0.182	7.240	-14.373	14.008	0.980
Voice & accountability	0.250	14.286	-1.345	5.623	-12.367	9.676	0.811
Voice & accountability	0.500	27.273	-2.403	5.687	-13.550	8.744	0.673
Voice & accountability	0.750	42.857	-3.671	7.609	-18.584	11.241	0.629
Voice & accountability	0.900	66.667	-5.610	12.202	-29.526	18.307	0.646

Source: Authors' estimated conditional marginal effects, 2010–2018. Confidence intervals reflect estimated uncertainty.

Note: Marginal effect = $\beta_{institution} + \beta_{interaction} \times WOB$. Standard errors and confidence intervals use the estimated variance–covariance matrix. None of the reported marginal effects is statistically significant at conventional levels.

Robustness and Sensitivity Analysis

Table 10 evaluates whether the aggregate institutional-quality conclusion and the implied speed of adjustment are sensitive to leverage outliers, negative equity, alternative leverage measures, PCA institutional quality, stricter longitudinal coverage, and alternative collapsed instrument lag ranges

Table 10: Robustness and Speed-of-Adjustment Sensitivity

Panel A. Estimated coefficients and adjustment speed

Specification	Lag dep.	Lag p	SOA	IQ coef.	IQ SE	IQ p
Raw DTE	-0.033	0.096	1.033	-1.488	7.136	0.835
Winsorised (1st–99th pct.)	0.399	0.014	0.601	0.146	2.426	0.952
Positive equity	0.097	0.497	0.903	2.049	2.077	0.324
Winsorised + positive equity	0.750	0.004	0.250	1.102	1.254	0.380
Minimum 4 consecutive years	-0.024	0.673	1.024	-0.351	3.030	0.908
Instrument lag 2 only	0.016	0.516	0.984	-3.041	15.251	0.842
Instrument lags 2–4	-0.047	0.032	1.047	-1.485	6.207	0.811
Liabilities / assets	0.459	0.051	0.541	0.075	0.176	0.668

Specification	Lag dep.	Lag p	SOA	IQ coef.	IQ SE	IQ p
Borrowings / assets	0.844	0.000	0.156	-0.039	0.088	0.661
PCA institutional quality	-0.034	0.080	1.034	-0.272	1.861	0.884

Panel B. Specification tests and estimation sample

Specification	AR(1) p	AR(2) p	Hansen p	Diff-H p	Instr.	MFIs	Obs.
Raw DTE	0.335	0.279	0.717	0.754	28	548	1,688
Winsorised (1st–99th pct.)	0.062	0.635	0.376	0.186	28	548	1,688
Positive equity	0.214	0.333	0.604	0.552	28	539	1,662
Winsorised + positive equity	0.027	0.926	0.036	0.101	28	539	1,662
Minimum 4 consecutive years	0.384	0.276	0.569	0.200	28	379	1,513
Instrument lag 2 only	0.242	0.314	0.960	—	22	548	1,688
Instrument lags 2–4	0.383	0.272	0.674	—	34	548	1,688
Liabilities / assets	0.072	0.217	0.265	0.598	28	549	1,690
Borrowings / assets	0.004	0.957	0.468	0.110	28	530	1,617
PCA institutional quality	0.340	0.278	0.725	0.659	28	548	1,688

Notes: DTE = debt-to-equity ratio; IQ = institutional quality; SOA = 1 – coefficient on lagged dependent variable; SE = standard error; Diff-H = Difference-in-Hansen test; Instr. = number of instruments; Obs. = reported usable MFI-year equations. The p-values reported as 0.000 should be interpreted as $p < 0.001$. A dash indicates a value not reported. SOA values outside 0–1 do not support a conventional partial-adjustment interpretation. All values are reproduced from the supplied table.

Note: SOA = 1 – λ . Alternative specifications test outlier treatment, positive equity, minimum longitudinal coverage, lag depth, alternative leverage measures and PCA institutional quality.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

The robustness analysis reveals that the estimated speed of capital-structure adjustment is highly sensitive to leverage measurement, extreme observations, and sample restrictions. Whereas the raw debt-to-equity (DTE) specification implies a value as high as 103.3%, winsorising DTE at the 1st and 99th percentiles reduces the estimate to 60.1%. Restricting the sample to positive equity yields 90.3%, while winsorising DTE and restricting the sample to positive equity jointly lowers the estimate to 25.0%, although the Hansen test becomes problematic ($p = 0.036$). Using alternative leverage measures produces 54.1% for liabilities-to-assets and 15.6% for borrowings-to-assets. Overall, the results show that raw DTE generates unstable adjustment dynamics, whereas bounded alternative leverage measures—especially borrowings-to-assets—yield more economically plausible estimates.

Meanwhile, the conclusion about the aggregate institutional-quality coefficient is robust across the System-GMM sensitivity checks. Institutional quality remains statistically insignificant in the models using the principal-component index of institutional quality ($p = 0.884$), winsorised DTE ($p = 0.952$), positive equity ($p = 0.324$), a minimum of four consecutive observations ($p = 0.908$), lag-2-only instruments ($p = 0.842$), lags 2–4 as instruments ($p = 0.811$), liabilities-

to-assets ($p = 0.668$), and borrowings-to-assets ($p = 0.661$). Hence, the absence of a robust aggregate institutional-quality effect is a stable finding. The fixed-effects estimates with year effects and country-clustered standard errors nevertheless reveal estimator heterogeneity: institutional quality is negatively related to DTE ($\beta = -7.189$, $SE = 3.510$, $p = 0.041$) but not to the log of borrowings ($\beta = -0.168$, $SE = 0.233$, $p = 0.471$). Moreover, the negative DTE association is statistically significant for MFIs in East Asia and the Pacific ($\beta = -6.549$, $p = 0.034$) and NGO MFIs ($\beta = -8.908$, $p = 0.005$), but not for the other regional or legal-form subsamples.

Figure 6 summarizes how the implied speed of adjustment changes across the robustness specifications reported in Table 10.

The results illustrate the sensitivity of adjustment dynamics to specification choices while also highlighting the lack of a robust aggregate institutional-quality effect. Although the System-GMM estimates are generally consistent with the absence of such an effect, the fixed-effects analyses reveal heterogeneity in institutional-quality associations with different financing indicators. Thus, institutional-quality effects, if they exist, are likely to be obscured by the choice of financing proxy, estimation method, organisation-specific factors, and regional differences. This finding is important because it suggests that a uniform approach to analysing the institutional-quality–financing nexus may yield misleading conclusions about the overall impact of institutional quality on MFI capital structure.

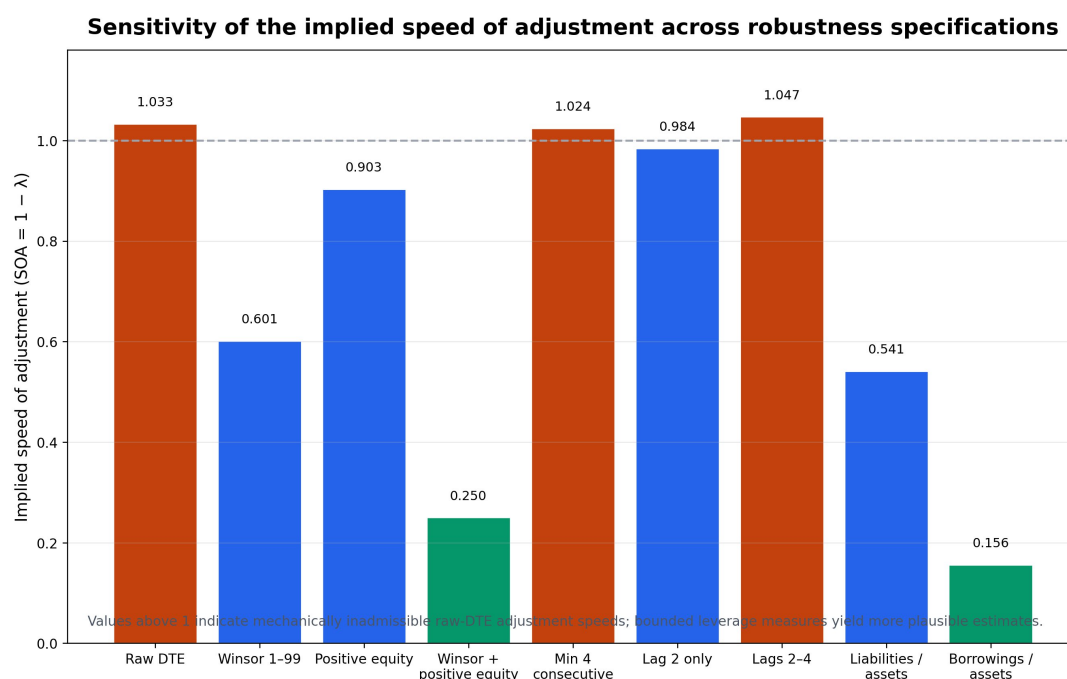


Figure 6: Sensitivity of the implied speed of adjustment to leverage definition, outlier treatment, sample restriction and instrument design.

Note: $SOA = 1 - \lambda$. The raw-DTE estimate above 100% is mechanically inadmissible as a conventional partial-adjustment speed and demonstrates the sensitivity of the adjustment interpretation to specification and leverage measurement

Table 11. MFI Fixed-Effects Estimates with Country-Clustered Standard Errors

Variable	DTE coef.	DTE SE	DTE p	lnBORROW coef.	lnBORROW SE	lnBORROW p
Lagged dependent variable	-0.288	0.066	0.000	0.215	0.049	0.000
Institutional quality	-7.189	3.510	0.041	-0.168	0.233	0.471
Women on boards (log)	-1.294	1.004	0.198	0.016	0.038	0.675
Profitability	0.142	0.083	0.086	0.002	0.002	0.469
Size (log)	0.963	0.630	0.126	0.986	0.097	0.000
Efficiency/OER	-0.122	0.105	0.245	0.000	0.002	0.853
Financial development	0.009	0.070	0.895	-0.002	0.003	0.472
GDP growth	0.122	0.147	0.406	0.008	0.006	0.147
Inflation	0.370	0.281	0.189	0.008	0.006	0.237

Source: Authors' fixed-effects estimations, 2010–2018. Standard errors are clustered by country.

As an inference check for country-level dependence, MFI fixed-effects models with year effects and country-clustered standard errors were estimated. Institutional quality is negative and statistically significant for DTE (coefficient -7.189 , SE 3.510 , $p = 0.041$), but insignificant for log borrowings (coefficient -0.168 , SE 0.233 , $p = 0.471$). The contrast with the System-GMM estimates indicates estimator sensitivity and supports cautious interpretation rather than a universal negative institutional-quality effect.

Table 12: Regional and Legal-Form Heterogeneity in the DTE–Institutional-Quality Association

Dimension	Group	IQ coef.	SE	p	Obs.	MFI	Countries
Region	Africa	-1.868	3.031	0.538	485	214	32
Region	Latin America and The Caribbean	-2.362	10.072	0.815	1117	288	22
Region	Eastern Europe and Central Asia	0.829	2.143	0.699	426	142	21
Region	East Asia and the Pacific	-6.549	3.087	0.034	397	128	10
Legal_Status	NBFI	-13.023	13.278	0.327	1048	325	67
Legal Status	NGO	-8.908	3.143	0.005	1290	362	61
Legal Status	Credit Union / Cooperative	1.446	4.085	0.723	516	189	43
Legal Status	Bank	-0.199	1.049	0.850	425	110	46

Source: Authors' subgroup analyses, 2010–2018. Subgroup comparisons are descriptive, not causal.

The heterogeneity analysis uses MFI fixed effects, year effects and country-clustered standard errors in subgroups with adequate coverage. The institutional-quality coefficient is negative and significant in East Asia and the Pacific (-6.549 , $p = 0.034$) and among NGOs (-8.908 , $p = 0.005$), but is statistically insignificant in Africa, Latin America and the Caribbean, Eastern Europe and Central Asia, NBFIs, credit unions/cooperatives and banks. These subgroup results reinforce the conclusion that the institutional-quality association is heterogeneous rather than uniform across the global MFI sector.

Long-Run Effects

Table 13: Delta-Method Long-Run Effects from the Full System-GMM Models

Variable	DTE LR	DTE SE	DTE p	DTE CI low	DTE CI high	lnBorrow LR	lnBorrow SE	lnBorrow p	lnBorrow CI low	lnBorrow CI high
Institutional quality	-1.442	6.914	0.835	-14.994	12.111	3.673	3.045	0.228	-2.294	9.641
Women on boards (log)	0.614	2.257	0.786	-3.810	5.038	0.755	1.310	0.564	-1.813	3.323
Profitability (ROA)	-0.154	0.182	0.398	-0.510	0.203	0.011	0.066	0.871	-0.118	0.140
Size (log assets)	1.330	1.187	0.262	-0.996	3.657	2.612	1.568	0.096	-0.462	5.685
Operating expense/assets	-0.103	0.149	0.487	-0.395	0.188	0.014	0.048	0.771	-0.079	0.107
Financial development	-0.007	0.051	0.896	-0.107	0.093	-0.026	0.029	0.361	-0.083	0.030
GDP growth	0.086	0.090	0.338	-0.090	0.262	0.128	0.092	0.164	-0.052	0.309
Inflation	0.049	0.095	0.605	-0.137	0.235	0.048	0.047	0.311	-0.044	0.139

Source: Authors' calculations from the dynamic models, 2010–2018. Long-run estimates depend on the estimated persistence coefficient.

Note: Long-run effects are computed as $\beta SR/(1-\lambda)$ from the System-GMM specification. Delta-method standard errors use the estimated Windmeijer-corrected variance-covariance matrix. For the full DTE model $\lambda = -0.033$ (SOA = 1.033); for log borrowings $\lambda = 0.824$ (SOA = 0.176).

Long-run coefficients are derived only from the short-run coefficient and λ from the same specification. Delta-method standard errors use the full Windmeijer-corrected covariance matrix.

The long-run institutional-quality coefficient is -1.442 ($SE=6.914$; $p=0.835$) in the DTE model and 3.673 ($SE=3.045$; $p=0.228$) in the full borrowing model. Neither is statistically significant. Moreover, the borrowing long-run estimate inherits the diagnostic weakness of the baseline borrowing instrument set. The estimation therefore provides no robust evidence of a negative long-run institutional-quality effect.

The implied DTE long-run calculations should be interpreted especially cautiously because λ is slightly negative and the associated SOA exceeds one. In contrast, the borrowing λ implies slower adjustment, but the Hansen and Difference-in-Hansen results require reliance on the

parsimonious instrument sensitivity rather than the unrestricted 2–3 lag specification. Overall, the long-run analysis does not restore the earlier negative institutional-quality finding.

CONCLUSION

This study investigates the links between capital structure and institutional quality for Microfinance Institutions (MFIs). The analysis uses a public panel constructed from the World Bank MIX Market USD database, MFI metadata, the 2025 Worldwide Governance Indicators (WGI), and World Development Indicators (WDI) for 2010–2018. The paper employs a collapsed two-step System-GMM with Windmeijer-corrected standard errors, separate Arellano–Bond AR(1) and AR(2) tests, Hansen and Difference-in-Hansen tests, consistently defined women-on-boards (WOB), delta-method inference for long-run effects, and a broad set of sensitivity checks.

The main results find limited support for the hypothesis that aggregate institutional quality drives the capital structure of MFIs. The coefficient on aggregate institutional quality is negative but not statistically significant in the debt-to-equity (DTE) specification and positive but again not significant in the borrowing specification. At the same time, none of the six dimensions of the WGI proves to be statistically significantly associated with DTE. Similarly, while the association between the WOB and DTE is also negative in line with the anecdotal evidence, it is not statistically significant either. Overall, no evidence was found that links general institutional quality trends with leveraged adjustments to financing, controlling for financing dynamics, firm-specific factors, macroeconomic trends, and time-invariant factors. Board gender heterogeneity also does not appear to moderate the connection between institutional quality and capital structure. WOB is consistently formed based on the underlying statistics of the MIX indicators. Specifically, the logarithm of the percentage of women on the boards is used for the baseline specification with positive female representation for the WOB, while the untransformed percentage is used for the interaction terms. None of the interactions of the aggregate Institutional Quality with the WOB prove statistically significant, nor do any of the interactions of the six institutional dimensions with WOB. In line with this, the confidence intervals for the conditional marginal effects of women on boards also include zero throughout the range of female representation. Overall, there is no evidence that female board representation affects the institutional quality-informed financing trends of the sample MFIs.

The analysis also shows that the estimated speed of capital-structure adjustment can be substantially inflated by specification errors. Specifically, when analyzing the level of absolute borrowing, the winsorisation of DTE or its restriction to narrow the sample reduces the speed of adjustment by an order of magnitude. By contrast, the raw DTE figure exceeds 100% in this specification, which means that the number of years for the capital structure of the MFIs to adjust would be less than one. Hence, a single adjustment speed is not sufficient to describe the trends for the sample of MFIs under study. By contrast, absolute borrowing seems to have a fairly high persistence, with the long-run adjustment speed estimated at 18–20% per year. Notably, the tests of the instruments' validity also indicate that more limited sets of instruments are appropriate for the borrowing equation. A closer look at the pooled-fixed effects specification reveals that its results are qualitatively different and should be interpreted with caution. In particular, the association between institutional quality and DTE was negative and statistically significant for this specification with MFI and year effects and country-specific standard errors. Nevertheless, this conclusion only applies to the System-GMM specifications, where the institutional quality coefficient proved to be statistically insignificant. Furthermore,

the regional and legal-form breakdown also failed to reveal a consistent link between institutional quality and the capital structure of MFIs. Thus, the analysis indicates that this relationship is not universal and differs significantly depending on the estimation method.

The described findings have several implications for further research and practice. First, institutional quality improvements are not a guarantee for reducing the capital structure of MFIs. At the same time, financing trends should be analyzed with a careful choice of the type of leverage, organisational form, regional location, and variables for controlling. In particular, MFIs should take into account the differences in the institutional conditions for their operations when planning their financing. For its part, the institutional environment affects many aspects of the functioning of MFIs beyond the dependent variable under study, so official statistics on institutional quality should be used with caution when analyzing changes in the capital structure of individual MFIs.

There are several limitations for this paper, the most significant of which is the lack of a publicly available diamond-rating history. This study's baseline used a transparent public data sampling methodology, which can be replicated from the input data. The analysis used the 2025 WGI, so the 2010–2018 historical indicators were selected using the same methodology. Future work on this topic should explore alternatives to the 4/5-diamond sampling cut-off, including new public and proprietary databases, other publicly available external instruments, and different determinants of institutional quality, including those beyond the WGI methodology. It is also worth considering post-2018 observations, including a larger set of MFI observations and greater diversity in legal forms and geographical representation.

Overall, this study contributes a cautious note about the impact of institutional factors on the capital structure of MFIs. Both WOB and aggregate institutional quality have weak empirical support within the collapsed two-step System-GMM framework. At the same time, the analysis also finds substantial heterogeneity in the association between MFI financing and institutional quality for different estimators. The paper's main value lies in the evidence that the trends in borrowing by MFIs are highly sensitive to the nuances of the methodology used, sample composition, choice of instruments, organisational and regional peculiarities, and estimation techniques. This finding is critical when analysing the financing structure of MFIs and the factors that affect it.

Declarations

Ethics approval and informed consent. This study relies on secondary institutional and country-level data and did not recruit individual research participants. An individual-participant consent procedure or questionnaire-based ethical approval is therefore not applicable to the analysis described here.

Data availability. The study draws on public MIX Market financial and company metadata, World Bank Worldwide Governance Indicators and World Development Indicators. Access conditions and the precise data versions should be checked against the corresponding providers when reproducing the analysis.

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Competing interests. The authors must confirm whether any financial or non-financial interests could have influenced this study. This information has not been independently verified.

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APPENDIX

List of Abbreviations

Abbreviation	Meaning
AR(1)	Arellano-Bond test for first-order serial correlation
AR(2)	Arellano-Bond test for second-order serial correlation
BORROW	Borrowings
CC	Control of Corruption
CI	Confidence Interval
CPI	Consumer Price Index
DTE	Debt-to-Equity Ratio
FE	Fixed Effects
FINDEV	Financial Development
GDP	Gross Domestic Product
GE	Government Effectiveness
GMM	Generalized Method of Moments
GROWTH	Real GDP Growth
INFL	Inflation
IQ	Institutional Quality
IQUAL	Institutional Quality
IV	Instrumental Variable
ln	Natural Logarithm

Abbreviation	Meaning
lnBORROW	Natural Logarithm of Borrowings
lnWOB	Natural Logarithm of Women on Boards Percentage
LR	Long Run
MFI	Microfinance Institution
MFIs	Microfinance Institutions
MIX	Microfinance Information Exchange (MIX Market)
NGO	Non-Governmental Organisation
Obs.	Observations
OER	Operating Expense Ratio
PCA	Principal Component Analysis
PROFIT	Profitability
PV	Political Stability and Absence of Violence/Terrorism
RL	Rule of Law
ROA	Return on Assets
RQ	Regulatory Quality
SD	Standard Deviation
SE	Standard Error
SIZE	Size of the Microfinance Institution
SOA	Speed of Adjustment
SR	Short Run
System-GMM	System Generalized Method of Moments
US\$	United States Dollars
USD	United States Dollar
VA	Voice and Accountability
WDI	World Development Indicators
WGI	Worldwide Governance Indicators

Source: Authors' compilation. Abbreviations follow the manuscript variable definitions.