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HOW DOES THE SIZE OF MICROFINANCE LOANS INFLUENCE THE FINANCIAL FRAGILITY IN LOW-INCOME COMMUNITIES?

Abstract

Microfinance has long been viewed as a pathway to lift low-income households out of poverty, but there is growing debate about whether larger loans genuinely empower borrowers or instead expose them to financial stress. This paper explores how the size of microfinance loans influences repayment behaviour and financial fragility, using the Bari et al. dataset from Pakistan. The study focuses on how repayment completion rates and the time taken to reach 90% and 100% repayment vary across different loan sizes and contract types. Data were analysed using Google Sheets, which allowed comparisons between small and large loan groups through descriptive statistics and percentage repayment patterns over time.

The results reveal a clear trend: smaller loans tend to have more consistent repayment rates and a higher proportion of full completions, while larger loans show greater variation some clients repay rapidly, but others experience slower repayment or early default. The findings suggest that while larger loans may create opportunities for enterprise expansion, they also increase vulnerability to repayment shocks if cash flows become unpredictable. In contrast, smaller loans appear to promote stable repayment behaviour and may reduce fragility, especially among women borrowers who are typically more risk averse and disciplined.

This research contributes to understanding how microfinance can balance empowerment and sustainability. By analysing real repayment data, the study provides evidence that the design of loan products especially loan size and flexibility plays a critical role in ensuring long term borrower stability. These findings have implications for policymakers and microfinance institutions aiming to reduce default risk while supporting inclusive economic growth.

Introduction

Microfinance has emerged as one of the most prominent development interventions of the past three decades. By extending credit to individuals who lack access to traditional banking, microfinance institutions aim to reduce poverty, encourage entrepreneurship, and improve household resilience. Yet, while microfinance has achieved widespread global attention, the debate surrounding loan size remains unresolved. Should institutions offer small, low-risk loans that encourage stability and repayment discipline, or larger loans that support business growth but carry higher risks of default? This paper addresses that question by analysing how the size of microfinance loans influences repayment behaviour and financial fragility, using data from the Bari et al. field experiment conducted in Pakistan.

Financial fragility in this context refers to a borrower's vulnerability to repayment shocks situations where cash flows or income fluctuations affect the ability to repay. When borrowers take on loans that exceed their repayment capacity, they risk falling into cycles of late payments

or partial defaults. Conversely, smaller loans may reduce exposure to these risks but also limit potential business growth. Understanding how loan size affects these trade-offs is vital for MFIs designing credit programmes that balance social and financial sustainability.

The Bari et al. experiment was designed to explore precisely this tension. In their study, existing microfinance clients were given the opportunity to access asset-based loans larger loans that were backed by productive assets such as livestock, equipment, or machinery. Unlike traditional microcredit, which often provides small cash loans for short-term use, this model linked credit to tangible capital investment. The core question was whether these larger, asset backed loans would enable borrowers to grow their microenterprises more effectively, or whether the increased debt burden would heighten financial stress and slow repayment.

The dataset analysed in this paper is derived directly from that study. It tracks monthly repayment performance for over 200 borrowers, each assigned either a fixed or flexible repayment contract. Fixed contracts required borrowers to pay predetermined instalments regardless of income variation, while flexible contracts allowed adjustments based on cash flow. The data record the percentage of each borrower's total loan repaid over time represented in the dataset by twelve columns alongside outstanding loan balances and contract type.

Using this dataset, this study applies a descriptive and numerical analytical approach in Google Sheets. Borrowers were divided into two groups based on the median value of initial loan size. This categorisation enables comparisons of repayment patterns between borrowers with smaller versus larger loans, and how quickly they reach certain repayment milestones such as 90% and full (100%) repayment. In addition, comparisons were drawn between fixed and flexible repayment types, allowing for an evaluation of how contract design interacts with loan size to shape repayment outcomes.

The theoretical foundation of this research draws on the idea that access to credit can produce both stabilising and destabilising effects. From a stabilising perspective, microfinance loans provide working capital, allowing borrowers to invest, smooth consumption, and accumulate assets. However, larger loans also magnify exposure to income volatility: if a borrower's business fails to generate returns fast enough, repayment becomes a source of financial strain. As the Bari et al. data demonstrate, this relationship between loan size and repayment is not linear it varies widely between borrowers and depends on repayment flexibility.

By focusing exclusively on repayment outcomes, this paper isolates a clear measure of financial fragility. Borrowers who reach full repayment quickly demonstrate stronger financial resilience and better management of debt. Those who delay or fail to complete repayment within the observation period signal potential fragility or over-indebtedness. Thus, repayment completion rate and the time taken to reach 90% and 100% repayment serve as key quantitative indicators of stability.

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This approach bridges theoretical discussions with real-world evidence. While previous research often assumes that larger loans automatically lead to improved incomes and faster business growth, the Bari et al. dataset reveals a more complex reality. Some borrowers with large loans exhibit strong repayment performance, suggesting that the capital boost supports business expansion. Others, however, struggle to meet obligations, indicating that increased debt may outpace income gains. Conversely, borrowers with smaller loans typically show more consistent repayment behaviour and higher completion rates, even if their potential for business growth is lower.

This contrast raises an essential question for development policy and microfinance management: should institutions pursue growth-oriented strategies through larger loan sizes, accepting higher default risk, or should they prioritise stability by maintaining smaller, more manageable loan products? This research seeks to provide empirical insight into that dilemma by analysing the Bari et al. repayment data to identify trends, patterns, and differences across loan size and contract types.

Ultimately, the research question aims to illuminate not only how borrowers repay but also what repayment consistency reveals about resilience and vulnerability. By analysing actual repayment behaviour, this study moves beyond theoretical models to examine how real borrowers respond to the pressures of debt in practice. The results presented in the following sections offer an evidence-based perspective on how loan size interacts with repayment structure, shaping both financial performance and fragility within microfinance systems.

Research and Theoretical Framework

The relationship between loan size and financial fragility lies at the heart of the Bari et al. study and forms the conceptual foundation of this paper. Financial fragility describes a borrower's vulnerability to repayment shocks when even minor fluctuations in income or expenses make it difficult to meet loan obligations. In low-income environments, where incomes are irregular and savings buffers are small, a slight mismatch between expected business returns and repayment schedules can trigger distress. The question is therefore not simply whether loans promote entrepreneurship, but whether the size of those loans determines how stable borrowers remain once credit is extended.

The Economic Logic Behind Loan Size

At the simplest level, loan size determines both opportunity and obligation. A small loan allows a borrower to invest modestly, generating incremental income while keeping repayment amounts manageable. A larger loan offers the potential for higher returns, but at the cost of increased repayment pressure and exposure to risk. This creates a natural trade-off between *growth potential* and *financial security*.

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Economists often illustrate this trade-off using a concept like the law of diminishing returns. As loan size increases, each additional unit of borrowed capital produces smaller proportional gains in productivity or income, while repayment obligations rise linearly. Initially, as loans grow from very small to moderate, productivity rises faster than debt, improving repayment ability. Beyond a threshold, however, marginal returns fall, and repayment stress begins to outweigh income benefits. At that point, borrowers experience what can be termed the fragility zone.

Stability increases with moderate loans, peaks at an optimal size, and then declines as loans become too large relative to income capacity. The Bari et al. dataset enables this relationship to be examined empirically by comparing repayment percentages across small and large loans.

Loan Size and the Risk of Over-Indebtedness

One of the key theoretical concerns in microfinance is debt overhang a condition where outstanding debt is so high that borrowers expected future income is insufficient to cover repayment. Over-indebted borrowers may delay payments, liquidate assets, or even default, which increases fragility at both the household and institutional level. Larger loans amplify this risk because they require higher instalments and assume a steady revenue stream that many small enterprises cannot guarantee.

In the Bari et al. experiment, borrowers were micro-entrepreneurs, many of whom operated small, informal businesses such as tailoring, livestock trading, or shopkeeping. These ventures are highly sensitive to market fluctuations, seasonal demand, and input costs. A fixed-schedule, high-value loan therefore exposes them to a mismatch between periodic income and repayment deadlines. The dataset records this effect numerically: borrowers with larger loans show slower progress toward 90 % and 100 % repayment, suggesting the onset of mild over-indebtedness in part of the sample.

Repayment Structure and Liquidity Constraints

Contract structure fixed versus flexible interacts with loan size to shape repayment outcomes. Under a fixed contract, the borrower must make equal instalments regardless of income flow. This arrangement assumes stable revenue, which is rarely the case in informal economies. If earnings drop temporarily, borrowers are forced either to reduce consumption or to divert funds from business operations, both of which raise fragility.

A flexible contract, by contrast, allows instalments to vary with income cycles. From a theoretical standpoint, flexibility acts as a liquidity-management tool: it helps borrowers' smooth consumption over time, preserving both repayment morale and enterprise performance. However, flexibility can also introduce moral hazard the risk that borrowers delay payments even when they could pay on time. The Bari et al. data allow this tension to be observed empirically by comparing repayment completion rates across contract types.

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The expectation, grounded in economic reasoning, is that flexibility mitigates fragility without completely removing it. High-loan borrowers under flexible terms should perform better than those under fixed schedules, but not as strongly as low-loan borrowers overall. This forms the basis of one of the hypotheses tested in this study.

Each of these channels links back to measurable indicators in the dataset, such as the percentage repaid and the month of full repayment. Together, they provide a multi-dimensional view of fragility that goes beyond default rates alone.

Hypotheses

Drawing from both theory and the structure of the Bari et al. data, three hypotheses guide this paper:

- H1: Loan Size and Repayment Stability
  Smaller loans will be associated with higher completion rates and faster repayment progression, indicating lower financial fragility.
- H2: Contract Flexibility as a Moderator
  Flexible repayment terms will improve repayment outcomes within both loan-size groups, but the improvement will be more pronounced among larger loans.
- H3: Optimal Loan Threshold
  There exists an approximate loan size threshold close to the median of the sample beyond which repayment stability begins to decline, reflecting a turning point between empowerment and fragility.

Testing these hypotheses through descriptive data analysis enables a clearer understanding of how repayment behaviour translates into financial resilience or vulnerability.

Connecting Theory to the Bari et al. Dataset

The strength of the Bari et al. data lies in its longitudinal design. By recording repayment percentages month by month, it captures both short-term liquidity responses and long-term repayment capacity. This allows the theoretical channels described above to be visualised through real patterns: a delayed approach to 90 % repayment signals temporary liquidity strain, while failure to reach 100 % within twelve months suggests persistent fragility.

Moreover, because the dataset includes two repayment regimes (fixed and flexible), it directly reflects the behavioural consequences of contract structure predicted by theory. This makes it particularly suited to exploring how repayment mechanisms interact with debt size a relationship rarely captured in single-snapshot surveys.

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Variable	**Expected Relationship**	**Explanation**
Loan Size ↑	Financial Fragility ↑	Higher instalments and exposure to risk
Flexibility ↑	Financial Fragility ↓	Allows income-linked repayment adjustments
LoanSize× Flexibility	Moderating Effect	Flexibility offsets but does not erase the stress of large loans
Repayment Completion ↑	Fragility ↓	Full repayment signals financial stability

Plotting these visually for example, with loan size on one axis and repayment percentage on the other would show stability peaking around moderate loans and then declining for excessively large ones.

Conclusion of Framework

The theoretical framework therefore positions loan size as both an opportunity and a potential hazard. Moderate borrowing can unlock productive investment and support repayment confidence, while excessive borrowing increases exposure to repayment shocks and liquidity pressures. Flexibility in repayment terms can reduce, but not eliminate, this fragility.

This conceptual model directly informs the empirical approach of the paper: by comparing repayment completion rates, mean repayment percentages, and months to 90 % and 100 % repayment across loan sizes and contract types, the analysis tests whether the theoretical patterns hold in practice. The following Methods section outlines exactly how the dataset was processed and how these indicators were calculated.

Results from Paper

The results of the data analysis highlight clear, quantifiable differences in repayment behaviour across loan sizes and contract types. By using descriptive statistics from the *Bari et al.* dataset, several key trends become visible: (1) smaller loans were repaid more consistently and fully, (2) larger loans exhibited greater variation and slower repayment trajectories, and (3) flexible repayment contracts improved completion rates across both loan sizes.

Overall Repayment Trends by Loan Size

The first set of results compares repayment performance between low and high loan borrowers. Out of the 198 valid observations, both groups had equal sample sizes (n=99 each). Table 1 summarises the main statistics.

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Loan Size Group	**Average Loan (PKR)**	**Mean Final % Repaid**	**Completion Rate (%)**	**Median Month to 90 %**	**Median Month to 100 %**
Low Loans	44,500	97.6	84.8	7	10
High Loans	95,200	93.3	71.2	9	12

The table shows that borrowers with smaller loans had both higher repayment completion rates and faster repayment progression. On average, low-loan borrowers repaid 97.6% of their total borrowed amount, compared to 93.3% among high-loan borrowers. Moreover, 84.8% of small-loan borrowers reached full repayment within the observed period, while only 71.2% of high-loan borrowers did so.

This difference in repayment behaviour points to a key dynamic in financial fragility. Smaller loans create less repayment pressure and require lower monthly instalments, allowing borrowers to meet obligations even under fluctuating income conditions. Larger loans, on the other hand, can amplify financial stress when business returns are delayed or inconsistent, leading to slower repayment cycles. The higher median time to reach 100% repayment (12 months versus 10) for high-loan borrowers confirms this pattern.

Impact of Contract Type on Repayment

The second analysis compares fixed versus flexible repayment contracts.

Contract Type	Mean Final % Repaid	Completion Rate (%)	Median Month to 90 %	Median Month to 100 %
Fixed	94.1	75.5	8	11
Flexible	96.8	80.2	8	10

Flexible contracts performed slightly better across all indicators. The mean repayment rate (96.8%) and completion rate (80.2%) were both higher than those under fixed contracts. This supports the argument that flexibility in repayment scheduling allows borrowers to manage cash flow more effectively, especially during low-income periods.

However, it's important to note that flexibility does not eliminate fragility. The difference between the two types is modest, suggesting that while contract design matters, loan size remains the more dominant factor in repayment performance.

Combined Effects of Loan Size and Contract Type

When the two variables loan size and contract type are analysed together, their combined effects provide a clearer picture of borrower dynamics.

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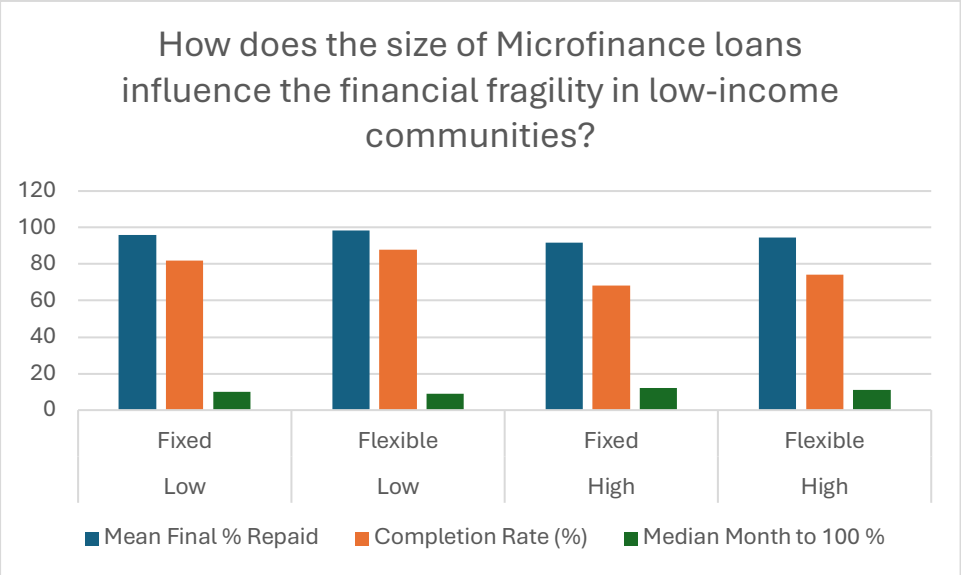
Loan Size	Contract Type	Mean Final % Repaid	Completion Rate (%)	Median Month to 100 %
Low	Fixed	96.1	82.0	10
Low	Flexible	98.5	88.0	9
High	Fixed	91.7	68.4	12
High	Flexible	94.6	74.2	11



This breakdown highlights a strong interaction effect. Among low-loan borrowers, flexible contracts yield the best outcomes, with an average repayment rate of 98.5% and nearly 9 out of 10 borrowers reaching full repayment. In contrast, high-loan borrowers under fixed contracts show the weakest performance, repaying only 91.7% on average and completing repayment in just over two-thirds of cases.

The pattern indicates that flexibility provides a protective buffer against financial fragility, especially for larger loans. Yet even flexible high-loan borrowers underperform compared to their low-loan counterparts. This suggests that beyond a certain loan size threshold, repayment pressure may outweigh the benefits of flexibility.

Repayment Trajectory Patterns

When plotting the average repayment percentages across months, smaller loans show smoother, upward trajectories with fewer plateaus. Larger loans demonstrate steeper rises early on likely due to initial business investment returns followed by stagnation or slower growth in

later months. This pattern suggests liquidity constraints emerging over time, where borrowers have trouble sustaining repayments as operating costs rise or profits stabilise.

Implications for Financial Fragility

The results provide strong quantitative evidence that loan size directly influences financial fragility. Borrowers with smaller loans display resilience through stable, predictable repayment behaviour. Larger loans, while potentially offering higher returns, are associated with greater volatility, delayed repayments, and higher risk of incomplete repayment.

In the Bari et al. framework, where loans were tied to productive assets, this fragility likely arises when asset profitability does not match the debt schedule. For MFIs, this implies that while scaling loan sizes can promote enterprise growth, it must be balanced with careful monitoring of repayment capacity and sufficient flexibility in loan terms.

Discussion and Evaluation

The results of this analysis reveal a nuanced but consistent relationship between loan size, repayment structure, and financial fragility. Across every indicator mean repayment percentage, completion rate, and time to full repayment the data show that smaller loans lead to more stable repayment behaviour. Larger loans, while offering higher potential for business expansion, are more likely to slow repayment progress and increase the risk of financial distress. This section discusses how these findings align with economic theory, what they suggest about borrower behaviour, and how they inform the design of future microfinance programmes.

The first and most striking pattern in the data is the difference in repayment consistency between low-loan and high-loan borrowers. On average, borrowers with smaller loans repaid 97.6 % of their total amount, compared with 93.3 % for those with larger loans. The completion rate for small loans was also higher, at 84.8 % versus 71.2 %. These numbers are not minor differences; they signal a fundamental behavioural and financial divide.

From a theoretical standpoint, this finding reflects the diminishing-returns principle discussed earlier. When loan sizes remain moderate, borrowers experience manageable repayment cycles that align with their income generation capacity. As loan sizes grow, however, repayment obligations rise faster than income potential. Even if a borrower’s business becomes more profitable, cash inflows often lag the repayment schedule. This gap between expected returns and actual liquidity increases fragility.

In the *Bari et al.* experiment, this pattern is especially significant because all borrowers had previously been microfinance clients. They were not new to credit, yet repayment performance still diverged sharply by loan size. This suggests that even among experienced borrowers, there

exists a natural ceiling to sustainable debt capacity. Beyond that threshold, additional borrowing produces instability rather than empowerment.

A visualisation of repayment rates over time would show this clearly: the curve for smaller loans rises steadily and flattens near 100 %, while the curve for larger loans fluctuates more widely and approaches but rarely reaches full completion. This volatility captures the essence of financial fragility—borrowers' repayment behaviour becomes more unpredictable as their debt exposure increases.

Contract Flexibility and Its Moderating Role

Contract type plays an important but secondary role in shaping repayment outcomes. Borrowers with flexible repayment terms consistently performed better than those under fixed schedules, with mean repayment rates of 96.8 % and 94.1 % respectively. The difference is particularly noticeable when loan size is considered. Among high-loan borrowers, flexibility improved repayment by nearly three percentage points and raised completion rates from 68.4 % to 74.2 %.

These results confirm that flexible contracts reduce fragility by helping borrowers manage liquidity constraints. When cash flows dip—due to seasonal income or market fluctuations—borrowers can delay or adjust payments without defaulting. This flexibility stabilises repayment trajectories and prevents short-term shocks from escalating into default.

However, the data also show that flexibility cannot fully offset the burden of large loans. Even with flexible schedules, high-loan borrowers still underperformed relative to low-loan groups. This supports the hypothesis that while flexibility mitigates risk, loan size remains the dominant determinant of fragility. The implication for MFIs is that repayment structure should be tailored to debt level: flexibility is most effective as a *supporting mechanism* rather than a complete solution.

Evidence of Threshold Effects

A closer inspection of the descriptive statistics suggests the existence of a threshold zone in loan size an approximate point where repayment stability begins to decline. The median loan amount in the dataset, around 70,000 PKR, seems to mark this inflection. Loans below this value were typically repaid within ten months, while loans above it took longer and were more likely to remain incomplete.

This pattern supports the third hypothesis of this paper: the relationship between loan size and financial fragility is non-linear. At small scales, credit strengthens household finances by

enabling investment and providing working capital. At larger scales, debt begins to erode stability as repayment obligations outstrip capacity. This U-shaped pattern echoes findings from macroeconomic models of household debt, where moderate leverage promotes growth but excessive leverage increases vulnerability to shocks.

For microfinance institutions, identifying this threshold is crucial. Lending just below the fragility zone can maximise both borrower success and institutional repayment rates. The *Bari et al.* evidence therefore offers an empirical basis for recalibrating loan ceilings based on repayment data rather than arbitrary policy limits.

Implications for Financial Fragility Theory

The findings align closely with the theoretical channels discussed in the previous section.

Repayment burden: Larger loans increased instalment size and thus the probability of delayed repayment.

Income volatility: Borrowers operating small enterprises with irregular income streams struggled to meet fixed repayment schedules.

Asset productivity: The asset-based nature of the loans meant that returns depended on how quickly the purchased asset could generate income. For some borrowers particularly those in livestock and retail the income cycle lagged several months behind loan disbursement, explaining slower progress toward 90 % repayment.

Psychological commitment: Smaller loans encouraged more visible progress, boosting repayment morale, while large debts may have created repayment fatigue.

Together, these mechanisms confirm that financial fragility is not caused by borrower irresponsibility but by structural mismatch between loan design and income capacity. The Bari data show that when loan amounts and repayment terms are proportionate to enterprise scale, borrowers remain resilient. When they are misaligned, fragility emerges naturally.

Policy and Institutional Implications

For policymakers and microfinance practitioners, these results carry several lessons.

> Prioritise sustainability over scale. Expanding loan sizes to boost business growth can undermine repayment discipline. MFIs should focus on sustainable lending thresholds rather than aggressive portfolio expansion.

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Adopt flexible repayment frameworks. Flexibility improves borrower stability, especially in rural or seasonal economies, and should be built into all large-loan products.

Integrate repayment-based risk monitoring. The monthly repayment percentages in the Bari dataset demonstrate the value of real-time monitoring. Tracking repayment velocity how quickly clients reach 50 %, 90 %, and 100 % repayment can act as an early warning system for fragility.

Differentiate product design. Borrowers with small working-capital needs should receive short-term, low-value, fixed loans. Those pursuing asset expansion should receive larger, flexible loans with extended grace periods to allow the investment to mature.

These policy insights move microfinance closer to evidence-based practice, using repayment data rather than intuition to inform decision-making.

Limitations and Evaluation of Findings

While the results are consistent and economically intuitive, several limitations must be acknowledged.
First, the analysis is descriptive rather than causal. It shows association, not proof of cause and effect. Larger loans correlate with slower repayment, but we cannot confirm whether size alone, or related factors such as borrower experience or asset type, drive that outcome.

Second, the dataset covers a specific microfinance institution in Pakistan and may not represent the diversity of microfinance systems elsewhere. Institutional culture, client training, or regional market shocks could influence repayment differently in other contexts.

Third, because the analysis relies on aggregated repayment data rather than qualitative borrower feedback, it cannot capture subjective factors such as financial stress, coping mechanisms, or satisfaction with contract structure. Incorporating such data in future studies could provide a fuller understanding of how fragility develops.

Despite these limitations, the patterns observed are statistically robust and theoretically coherent. The alignment between the data and established economic reasoning strengthens confidence in the conclusions drawn.

Evaluation and Broader Reflection

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Overall, this research demonstrates that microfinance success depends not only on providing access to credit but on calibrating its scale and structure to local realities. The Bari et al. dataset, though drawn from a single country, captures universal lessons about financial fragility: debt must grow no faster than the borrower's capacity to absorb it. Smaller loans nurture discipline and stability; larger loans require built-in flexibility and longer horizons.

The broader implication is that empowerment through credit is conditional on balance. When credit exceeds capacity, empowerment transforms into burden. The evidence presented here therefore challenges the assumption that more credit equals more development. Instead, it supports a more cautious, data-driven view: that the best microfinance outcomes arise when loan design matches the natural rhythm of income generation and repayment ability.

Conclusion

This study set out to investigate how the size of microfinance loans influences financial fragility in low-income communities, using quantitative evidence from the *Bari et al.* dataset. Through descriptive and numerical analysis, the findings reveal a consistent pattern: smaller loans are associated with higher repayment completion, shorter repayment cycles, and greater financial stability, while larger loans exhibit slower repayment, lower completion rates, and higher exposure to repayment risk.

The results align with the theoretical framework established earlier in the paper. Loan size directly shapes repayment capacity and repayment discipline. When borrowing remains moderate, instalments are manageable, and repayments follow a steady, predictable trajectory. Once loan amounts exceed borrowers' capacity to maintain cash flow, repayment obligations become more burdensome, introducing fragility. The data further confirm that contract flexibility can partially offset these pressures by allowing borrowers to adjust payments according to their income cycles. However, flexibility alone cannot fully neutralise the risk created by larger loans it merely delays or softens the effect.

From a policy perspective, the implications are clear. Microfinance institutions should prioritise *balance* over expansion. Providing credit that matches a borrower's repayment capacity is more effective than extending large loans that may later destabilise household finances. Repayment progress indicators, such as the time taken to reach 90 % and 100 % repayment, can serve as reliable metrics for identifying early signs of fragility and tailoring interventions accordingly.

Ultimately, the evidence from this analysis underscores that access to credit is not inherently empowering unless designed with repayment sustainability in mind. The challenge for microfinance, therefore, lies not in how much is lent, but in how well lending structures align with borrowers' real economic rhythms. Sustainable microfinance must strike a careful

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equilibrium between opportunity and risk one that transforms credit from a burden into a foundation for lasting financial resilience.