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Dynamic Incentives, Group Commitment, Endogenous Rule-Making, Microfinance Experimental Evidence

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Highlights

- **Dynamic incentives in microfinance cut default but suppress risk-taking more.**
- **Voluntary equal-sharing rules raise risk-taking and earnings without proportional default.**
- **Young indebted women are most sensitive to dynamic incentives.**

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Abstract

This study examines the dynamic incentive paradox in microfinance, the tension whereby incentives that improve loan repayment discourage risky, high-return investments needed to escape poverty, and investigates whether an endogenously chosen contract rule can resolve it. We conducted a lab-in-the-field experiment with 60 active microfinance borrowers in Isfahan Province, Iran, across ten treatments varying liability structure, dynamic incentives, and peer mechanisms, yielding a panel dataset of 5,235 observations analyzed with borrower fixed-effects models. Consistent with the dynamic incentive paradox in this sample, dynamic incentives were associated with reductions in both risky-project selection and default rates, but the reduction in risk-taking consistently and substantially exceeded the reduction in default, pointing to a net cost to borrowers' earning capacity. This effect was strongest under peer monitoring and individual liability, and weaker when borrowers could communicate freely or endogenously choose group members. Prior to two of the ten treatments, borrower groups had the option of adopting an equal-sharing profit rule; groups that did so saw significantly higher risk-taking and cumulative earnings without a proportional rise in default, indicating that this self-selected rule functioned as an effective intra-group insurance mechanism even under dynamic-incentive pressure. Young women with a prior debt history were the most sensitive to the suppressive effects of dynamic incentives, while the magnitude of the paradox varied with socio-institutional context and borrower characteristics. These findings suggest that sustainable microfinance contract design may benefit from project failure insurance, multidimensional performance metrics, and demographically informed group structures, alongside greater borrower autonomy in setting profit-sharing rules.

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1. Introduction

Poverty alleviation remains central to development economics. Microfinance was designed to enable a sustainable exit from poverty through group lending, peer monitoring, and dynamic incentives (Yunus, 1999; Armendáriz & Morduch, 2010; Stiglitz & Weiss, 1981). Yet evidence from randomized controlled trials (RCTs) indicates that while microfinance expands credit access and smooths consumption, it rarely generates structural income gains (Banerjee et al., 2015; Meager, 2019).

This shortfall reflects an inherent tension: microfinance institutions (MFIs) demand steady repayments, whereas escaping poverty requires high-risk investment. By raising the opportunity cost of failure, dynamic incentives promote risk-averse conservatism even as repayment rates improve, a pattern the literature terms the "dynamic incentive paradox" (Cecchi et al., 2021; Carlson & Nguyen, 2026).

Recent international research has uncovered further nuances in this dynamic: experienced borrowers interpret loan ceilings as signals of future credit access (Carlson & Nguyen, 2026), group default rates are strongly linked to inequality aversion (Jordan et al., 2022), and flexible contracts can enhance business outcomes without increasing default risk (Barboni & Agarwal, 2023).

Existing evidence from Iran remains predominantly descriptive, yielding mixed conclusions regarding microfinance outcomes. While some studies highlight improvements in income diversity (Alaeddini & Jalali Mousavi, 2010), others point to stagnating assets (Tayyebi & Najafi, 2011) and negative environmental impacts (Sani Heydari et al., 2020). Furthermore, recent literature underscores persistent institutional flaws, such as financial literacy gaps (Taftian et al., 2024) and the failure of state-sponsored credit to foster rural entrepreneurship (Khoob et al., 2025). However, a critical methodological gap persists: the behavioral dynamics of the dynamic incentive paradox and the efficacy of endogenous mechanism design remain empirically untested within Iran's microfinance context.

Our study's contributions are threefold. First, inspired by Giné et al. (2010), we systematically compare conventional lending mechanisms — individual liability, joint liability, peer monitoring, peer communication, and peer selection — both with and without dynamic incentives, using a sample of 60 active borrowers from Isfahan Province.

Second, prior to Treatment D9, borrowers were permitted to select their profit-sharing rule from three options: individual retention, equal sharing, or a risk-taker bonus. The endogenous equal-sharing rule, voluntarily adopted by the groups, functions as an intra-group insurance mechanism (Ostrom, 1990) and mitigates inequality aversion (Jordan et al., 2022). Consequently, it encourages productive risk-taking without proportionally increasing default rates.

Third, using panel fixed-effects estimation, we examined demographic interactions with behavioral outcomes. Our analysis indicates that young women with a prior debt history appear to be the most sensitive demographic cohort to the suppressive effects of dynamic incentives — a novel finding within the Iranian context.

To systematically address these gaps, we pose four research questions: (1) Do dynamic incentives generate the paradox in Iran? (2) How do group-level mechanisms moderate its effects? (3) Can endogenous rule-setting serve as an effective mechanism design solution? (4) How do demographic characteristics moderate the paradox's intensity?

Addressing these questions enriches the mechanism design literature and offers practical contract optimization strategies for microfinance institutions. The remainder of this paper is structured as follows: Section 2 reviews the theoretical framework; Section 3 details the methodology; Section 4 presents the empirical findings; and Section 5 concludes with policy implications and directions for future research.

2. Literature Review

This section outlines the theoretical frameworks underpinning our analysis. We first delineate the core theories of microfinance, followed by a review of the relevant empirical literature.

2.1. Theoretical Foundations

The theoretical foundation of this study rests upon three core pillars: (1) repeated game theory and collective action; (2) information economics and mechanism design; and (3) the behavioral economics of poverty. Integrating these frameworks provides a comprehensive analytical lens to examine the inherent structural tension between the institutional sustainability of microfinance and the imperative of poverty alleviation.

2.1.1. Repeated Games and Collective Action

Conventional microfinance mechanisms are grounded in repeated game theory (Axelrod, 1984), wherein repeated interactions foster cooperative strategies such as peer monitoring and social pressure (Karlan, 2007). Ostrom's collective action theory (1990) posits that local groups can sustainably manage credit resources through self-governed institutional rules. Contemporary empirical work demonstrates that network structure amplifies the effectiveness of peer monitoring (Bassi et al., 2023), although excessive social density may induce herding behavior toward low-risk projects (Gugerty, 2007). Classical frameworks predominantly emphasize repayment compliance but often neglect long-term welfare outcomes. Emerging evidence indicates that peer pressure, when combined with dynamic incentives, can paradoxically entrench risk-averse conservatism (Fischer, 2013).

2.1.2. Information Economics and Mechanism Design

In credit markets, information asymmetry inherently generates adverse selection and moral hazard (Stiglitz & Weiss, 1981). To mitigate these market failures, dynamic incentives were conceptualized within the framework of mechanism design (Myerson, 1982). Contemporary studies demonstrate that information asymmetry between microfinance institutions (MFIs) and their capital

providers can precipitate mission drift (Biancini et al., 2024), while borrowers' beliefs regarding lender liquidity significantly shape their repayment decisions (Jain, 2022). However, a critical conceptual gap persists in the literature: repayment performance is frequently treated as a direct proxy for economic success, even though the two constructs are not strictly equivalent. To address this limitation, recent scholarship emphasizes the necessity of multidimensional screening—assessing both repayment capacity and the potential for broader economic advancement (Karlan et al., 2021).

2.1.3. Behavioral Economics of Poverty

Behavioral economics demonstrates that poverty imposes a cognitive burden that systematically impairs decision-making (Mullainathan & Shafir, 2013; Shah et al., 2012). Under conditions of scarcity, individuals prioritize short-term survival and avoid strategic risks—a pattern consistent with prospect theory (Kahneman & Tversky, 1979). While alleviating financial stress can catalyze productive investment (Haushofer & Shapiro, 2016), responses to incentives remain moderated by risk tolerance, social capital, and financial history (Bryan et al., 2023; Caria et al., 2021). Critically, dynamic incentives that threaten exclusion exacerbate cognitive scarcity (Field et al., 2013), driving borrowers toward low-risk projects and potentially trapping them in poverty (Banerjee & Duflo, 2025; Katreniak et al., 2023).

Within the framework of mechanism design (Myerson, 1982), the primary objective is to align borrower incentives with the institutional goals of microfinance institutions (MFIs). Traditional approaches typically achieve this alignment through exogenous incentive structures. Conversely, insights from behavioral economics demonstrate that endogenous rules—autonomously chosen by participants—foster more sustainable commitment (Ostrom, 1990; Jordan et al., 2022), because self-selected rules are underpinned by identifiable social preferences rather than by compliance alone. Inequality-aversion models (Fehr & Schmidt, 1999; Jordan et al., 2022) predict that borrowers who dislike unequal payoffs will voluntarily share gains once given the option, which lowers the perceived cost of a risky project's downside.

2.2. Empirical Evidence

The literature review comprises two sections: international evidence and Iranian studies.

2.2.1. International Evidence

International evidence extensively documents the dynamic incentive paradox and its behavioral underpinnings. Cecchi et al. (2021) demonstrated in Bolivia that borrowers anchor on progressively increasing credit ceilings, leading to elevated default rates once these limits become non-binding. This behavioral response is highly heterogeneous; in digital credit markets, first-time borrowers default more on larger loans, whereas repeat borrowers interpret expanded ceilings as positive

signals of future access (Carlson & Nguyen, 2026). Furthermore, inequality aversion—measured via ultimatum game rejection rates—strongly predicts group default patterns (Jordan et al., 2022).

To mitigate these adverse dynamics, recent scholarship emphasizes flexible contract designs. Evidence from South Asia indicates that flexible terms and expanded asset financing can catalyze sustained business gains without compromising repayment discipline (Barboni & Agarwal, 2023; Bari et al., 2024). However, institutional mechanisms require careful calibration. While peer selection and monitoring mitigate information asymmetries, excessively severe sanctions can paradoxically exacerbate fund misappropriation (Malhotra, 2026). Similarly, risk-sharing environments often foster heterogeneous group formations in equilibrium, explaining the strategic shift of institutions like the Grameen Bank away from explicit joint liability toward more flexible group structures (Altınok, 2023).

2.2.2. Evidence from Iran

Existing evidence from Iran remains predominantly descriptive, yielding mixed conclusions regarding microfinance outcomes. While some studies highlight improvements in income diversity and human capital formation (Alaeddini & Jalali Mousavi, 2010; Sarani et al., 2024), others point to stagnating assets (Tayyebi & Najafi, 2011) and negative environmental impacts (Sani Heydari et al., 2020). Furthermore, recent literature underscores persistent institutional flaws, such as financial literacy gaps (Taftian et al., 2024), the limited impact of credit structures on self-employment and the failure of state-sponsored credit to foster rural entrepreneurship (Taheri Haftasiabi et al., 2024; Khoob et al., 2025), and the incomplete replication of microfinance models (Ebrahimi & Ranjbari, 2025).

Additionally, domestic evidence indicates that gender composition and institutional structures significantly influence risk aversion and monitoring outcomes in Iranian credit markets (Jafarimehr et al., 2021). Although some studies propose strategies for fostering entrepreneurship (Golshani et al., 2025), empirical evidence suggests that microcredit improves financial performance yet fails to generate non-financial outcomes or meaningful women's empowerment (Yasuri & Mozaffari Vishkaei, 2025; Javidan et al., 2025).

2.3. Research Gaps

Three critical research gaps emerge from the existing literature. First, no Iranian study has used experimental economics to investigate the behavioral relationships among dynamic incentives, institutional viability, group mechanisms, and risk-taking behavior. Second, prior studies have typically examined these mechanisms in isolation, overlooking their simultaneous interactions and compounding effects. Third, to our knowledge, no study in Iran — and rarely globally — has permitted borrowers to autonomously determine their own game rules through participatory mechanism design.

This study addresses these gaps by simultaneously examining institutional and demographic interactions through a controlled lab-in-the-field experiment

involving 60 borrowers across 10 experimental treatments. Methodologically, we allowed participants to voluntarily select their profit-sharing rule, enabling us to measure the endogenous equal-sharing rule's effect as an insurance-like collective action mechanism on both risk-taking and default behavior. Our findings offer actionable insights for microfinance contract redesign in Iran, effectively balancing institutional sustainability with genuine borrower empowerment.

3. Methodology

3.1. Research Design, Sampling, and Ethics

This study employs a triangulated lab-in-the-field experimental framework comprising three sequential phases: (1) trust-building and community engagement; (2) demographic data collection via structured questionnaires; and (3) a controlled online experiment. The target population consisted of active borrowers from local microfinance funds in the Sohr-o-Firoozan rural district (Isfahan Province, Iran). Using purposive sampling (Section 5.5), borrowers were recruited (N=60) and completed ten weekly sessions. The study strictly adhered to international ethical protocols, ensuring informed consent and complete anonymity, in compliance with the Iranian Ministry of Science guidelines. Compensation was performance-based: each participant's earnings in one randomly selected period from each session were converted to actual payment at a fixed rate (1 experimental unit = 1,000 IRR), added to a fixed 20,000 IRR show-up fee, so that final payoffs directly reflected the risky, safe, and default outcomes realized under each treatment.

3.2. Experimental Game Framework

Adapted from Giné et al. (2010), the experiment simulates microfinance investment decisions. In each period, participants received a 100-unit loan ($W = 100$) and chose between:

Safe Project (s): Yields a deterministic gross return of 200 units (net profit $\pi_s = 100$).

Risky Project (r): Yields 600 units (net profit 500) with 50% probability, and 0 units (net loss of 100, resulting in default) with 50% probability.

Under baseline conditions, default merely forfeits the current period's payoff. Under dynamic incentives, default triggers permanent exclusion from the credit cycle, simulating the opportunity cost of losing future market access. Outcomes were determined via a random number generator, and only current-round earnings could be used for repayment.

The experiment comprised 10 sequential treatments (D1–D10) varying along three dimensions: (1) liability structure (individual vs. joint), (2) dynamic incentives (absence vs. presence of suspension), and (3) peer mechanisms (joint liability, supervision, communication, or endogenous partner selection). D1 (individual liability, no dynamic incentives) served as the baseline. D2 introduced dynamic incentives. D3–D8 systematically layered joint liability, peer monitoring, and communication. D9 and D10 incorporated endogenous partner selection and free communication, with D10 adding dynamic incentives.

Endogenous Mechanism Design: Prior to D9 and D10, groups were granted the autonomy to select a profit-sharing rule: (1) individual retention, (2) a risk-taker bonus, or (3) an *equal-sharing rule*. Groups voluntarily adopting the equal-sharing rule effectively created an intra-group insurance mechanism. To isolate this effect, we constructed a binary dummy ($EqualShareRule$) and interacted it with D9 and D10.

While sharing the safe-risky investment structure with Giné et al. (2010), our design extends their framework in four key respects: (i) we incorporate dynamic incentives to capture the opportunity cost of losing future credit access; (ii) we compare five institutional arrangements—individual liability, joint liability, peer monitoring, peer communication, and peer selection—rather than a single mechanism; (iii) we depart from researcher-imposed rules by allowing groups to autonomously select their profit-sharing rule prior to D9-D10, shifting mechanism design from exogenous to participant-selected; and (iv) we examine demographic interactions (debt history, household size, gender, education) that were not analyzed in the original study.

3.3. Game Theoretic Model and Equilibrium Analysis

The game is modeled as a repeated Prisoner's Dilemma to capture the tension between individual rationality and collective welfare. Let $s$denote the Safe Project and $r$the Risky Project. The payoff matrix is structured as follows:

Table 1. payoff matrix

Player i/Player j	Safe(s)	Risky(r)
Safe(s)	3, 3	1, 4
Risky(r)	4, 1	2, 2

Scenario 1: Absence of Dynamic Incentives. Without exclusion threats, the dominant strategy is the Risky Project, as unilateral deviation from Safe yields a higher payoff ($4 > 3$ and $2 > 1$). The Nash Equilibrium (NE) converges to (r, r), yielding $(2, 2)$. This outcome is Pareto-inferior, as mutual coordination on (s, s)would yield $(3, 3)$. This inefficiency reflects a "tragedy of the commons," where borrowers fail to internalize the systemic costs of default externalities.

Scenario 2: Presence of Dynamic Incentives. Dynamic incentives introduce an opportunity cost of elimination (C_E), equal to the continuation value of future credit. The adjusted expected profit for the risky project becomes:

$$E[\pi_r^{adj}] = 0.5(R_r^h - W) + 0.5(-W - C_E) \quad (1)$$

When $C_E$is sufficiently large, the equilibrium shifts toward the Safe Project. Rational players may adopt a mixed-strategy equilibrium. Let $p$be the probability of selecting the risky project. The indifference condition yields:

$$500p - 100(1 - p) = 100 \implies p = 1/3 \quad (2)$$

Thus, under dynamic incentives, players select the risky project with approximately 33% probability and the safe project with 67%.

Mathematical Specification and Risk Aversion. Under risk neutrality,

$$E[\pi_r] = 0.5(500) + 0.5(-100) = 200 \quad (3)$$

which strictly dominates $\pi_s = 100$. To reconcile this with empirical baseline observations, we incorporate a Constant Relative Risk Aversion (CRRA) utility function $U(\pi) = \frac{\pi^{1-\rho}}{1-\rho}$. Numerical calibration reveals indifference at $\rho \approx 0.37$; players with $\rho > 0.37$choose the safe project. For repeated interactions, optimal behavior is characterized by the Bellman equation:

$$V_t(W) = \max_{s\in\{S,R\}} E[\pi_s + \beta V_{t+1}(W')] \quad (4)$$

where $\beta$is the discount factor and W'represents carried capital. This dynamic programming framework demonstrates that as the continuation value increases, the incentive to select the safe project is progressively reinforced.

3.4. Econometric Strategy and Variables

We analyzed the data using panel fixed-effects models in EViews. Across 5,235 observations, the average risky investment rate was 5.34/10 periods, and average defaults were 2.60/8 periods. A Hausman test confirmed the superiority of the fixed-effects model over a random-effects specification at the 5% significance level, indicating that unobserved, time-invariant borrower traits (e.g., baseline risk tolerance) are correlated with the treatment sequence and would bias a random-effects estimator; fixed effects absorb this correlation by design. As a robustness check, we re-estimated all three models with treatment order reversed within matched sub-samples and with session-clustered standard errors; the sign and significance of key EqualShareRule interactions remained unchanged (Section 5.5). The baseline econometric model is specified as:

$$Y_{it} = \alpha + \sum_{k=2}^{10} \beta_k \, Treatment_{Dk,it} + \gamma' X_{it} + \delta' Z_{it} + \mu_i + \varepsilon_{it} \quad (5)$$

where Y_{it}represents the dependent variables for borrower $i$in period t: (1) Risky (binary: 1 if risky project chosen), (2) Default (binary: 1 if borrower defaults), and (3) Return (continuous cumulative payoff).

$Treatment_{Dk,it}$are nine treatment dummies (D2–D10), with D1 omitted as the baseline. $X_{it}$is a vector of demographic controls: Age, Deb (prior loan history), Dep (dependents), Edu (education), Mar (married), Gen (male), and SizeHus (household size), alongside interaction terms ($Edu \times Age$, $SizeHus \times Deb$, $SizeHus \times Mar$). Z_{it}captures mechanism design interactions ($EqualShareRule \times D9$ and $EqualShareRule \times D10$). $\mu_i$represents individual fixed effects, and $\varepsilon_{it}$is the idiosyncratic error term.

4. Findings

4.1. Descriptive Statistics

The sample is demographically balanced, comprises 55% males and 45% females; 57% hold university degrees; and the age distribution spans 52% aged 21–35, 26% aged 20 or younger, and 22% aged 36 or older. Table 2 reports full descriptive statistics (mean, standard deviation, minimum, maximum) for the key outcome and control variables.

Table 2. Descriptive statistics for dependent and control variables

Variable	N	Mean	SD	Min	Max
Risky project choice (0/1)	5235	0.536	0.498	0	1
Default (0/1)	5235	0.26	0.438	0	1
return	5235	232.8	242.1	0	600
Age (years)	60	28.2	11.89	16	75
debt (Deb, 0/1)	60	0.599	0.489	0	1
DEP (0/1)	60	0.23	0.42	0	1
EDU	60	14.23	3.84	5	24
MAR (0/1)	60	0.46	0.49	0	1
GEN (0/1)	60	0.54	0.49	0	1
Household size	60	3.83	0.859	2	5

Source: *Research findings*

4.2. Main Findings

Table 3 reports mean differences in risky-project selection and default rates between each mechanism with and without dynamic incentives. Negative values indicate that dynamic incentives reduce the outcome. Across all mechanisms, both risk-taking and default decline significantly ($p < 0.01$), but the reduction in risk-taking is consistently larger than that in default. This descriptive asymmetry provides initial evidence of the dynamic incentive paradox and motivates the fixed-effects estimates below.

Table 3: Mean Differences in Risky Project Selection and Default Across Experimental Treatments

Institutional Mechanism	Difference in Risky Project Selection (With vs. Without Dynamic Incentives)	Difference in Default Rates (With vs. Without Dynamic Incentives)
Individual liability	**-4.15 (0)	**-1.95 (0)
Group liability	**-2.617 (0)	**-1.067 (0)
Peer Monitoring	**-2.3 (0)	**-0.8 (0.0006)
Peer Communication	**-2.267 (0)	**-1.067 (0.0001)
Peer Selection	**-2.883 (0)	**-1.167 (0)

Source: *Research findings*

Note: *Numbers in parentheses indicate significance levels. Asterisks denote the statistical significance of the estimated coefficients. Double asterisks (**) indicate significance at the 99% level ($p < 0.01$).*

As detailed in Table 3, dynamic incentives are associated with simultaneous reductions in both risky project selection and default rates across all mechanisms. Crucially, a stark asymmetry emerges: risk-taking declines more than defaults, consistent with the dynamic incentive paradox. Improved repayment comes at a disproportionate cost to growth, as borrowers sacrifice earning capacity to preserve future credit access. This asymmetric trade-off is illustrated in Figure 1, where the decline in risk-taking upon activating dynamic incentives is markedly steeper than the corresponding drop in default rates. While this dynamic may secure short-run stability, it ultimately undermines long-term income mobility and sustainable poverty alleviation.

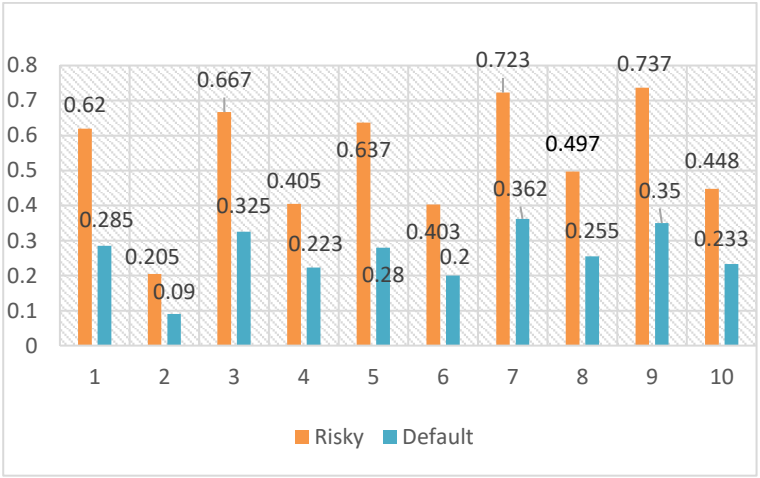


Figure 1: Average Risky Project Selection and Default Rates Across Experimental Treatments

Source: *Research findings*

Dynamic incentives exert their strongest dampening effect on risk-taking under formal monitoring and peer pressure mechanisms (joint liability and peer monitoring), where the threat of exclusion reinforces conservative behavior that prioritizes avoiding failure over pursuing growth. Conversely, under mechanisms rooted in social capital and endogenous choice (peer communication and peer selection), the suppressive effect on risk-taking weakens. In these settings, the decline in default rates is more favorable relative to the drop in risk-taking, partially mitigating the asymmetric trade-off inherent in dynamic incentives.

4.3. Econometric Results

Table 4 presents the summarized estimation results. We estimated three distinct models for: risky project choice, default, and return. Prior to Treatment D9, each group voluntarily selected its own rule, determining the institutional mechanism. We interpret the results based on this endogenous mechanism design. The stability and consistency of the negative coefficients across rounds with

dynamic incentives reveal a systematic pattern, indicating a strong, non-random dampening effect on both risk-taking and default.

Table 4: Performance estimation results of the proposed mechanism

Variable	Risky	Default	Return
β_0	**4.047 (0)	**2.09 (0.0005)	**3084.952 (0)
D_2	-4.14 (0.16)	**-1.94 (0.0000)	**-1454.09 (0)
D_3	**0.47 (0)	*0.403 (0.097)	-20.76 (0.8963)
D_4	-2.14 (0.61)	*-0.61 (0.01)	**-867.43 (0)
D_5	**0.17 (0)	-0.046 (0.8487)	32.56 (0.83)
D_6	**-2.16 (0.0025)	**-0.84 (0.0005)	**-884.06 (0)
D_7	**1.037 (0.0003)	**0.77 (0.0016)	-24.09 (0.8798)
D_8	-1.22 (0.5525)	-0.296 (0.2229)	**-527.43 (0.0010)
D_9	**0.253 (0)	0.28 (0.3525)	-40.15 (0.8401)
D_{10}	**-2.17 (0.0004)	*-0.56 (0.0610)	**-1135.8 (0)
EqualShareRule *D9	1.77 (0.0651)	*0.718 (0.0412)	221.39 (0.3370)
EqualShareRule *D10	**0.91 (0)	0.119 (0.7350)	**610.6 (0.0083)
AGE	-	-	*-16.39 (0.0383)
DEB	**3.77 (0)	**2.001 (0.0014)	-257.4 (0.5454)
DEP	-0.872 (0.8893)	**-0.468 (0.0005)	-41.46 (0.6393)
EDU	**-0.005 (0.0001)	-0.036 (0.1773)	-29.99 (0.3153)
MAR	*-3.29 (0.0520)	*-1.60 (0.0079)	86.35 (0.8291)
GEN	**0.35 (0.0009)	0.202232 (0.1186)	59.4 (0.49)
SIZEHUS	0.612 (0.30)	*0.24 (0.055)	87.3 (0.3172)
EDU*AGE	**0.0008 (0)	*0.001 (0.052)	0.91 (0.21)
SIZEHUS*DEB	**-1.052 (0.0006)	**-0.51 (0.0013)	2.03 (0.9850)
SIZEHUS*MAR	**0.75 (0)	*0.36 (0.0211)	-24.34 (0.8156)
Total observations: 600	F: 29.1019(0) R^2: 0.488	F: 12.71217(0) R^2: 0.294	F: 11.58442(0) R^2: 0.296214

Source: *Research findings*

Note: *Numbers in parentheses indicate p-values. Asterisks denote the statistical significance of the estimated coefficients: ** $p < 0.01$ (99% confidence level), * $p < 0.05$ (95% confidence level), and no asterisk indicates statistical insignificance.*

The first model yields a robust overall fit, evidenced by a highly significant F-statistic ($F = 29.10, p < 0.001$). An adjusted $R^2$of 0.488 indicates substantial explanatory power for these experimental behavioral outcomes. Furthermore, an analysis of the estimated coefficients reveals a systematic pattern wherein dynamic incentives exert a pronounced dampening effect on borrowers' risk-taking behavior.

$$\begin{aligned}\text{Risky} = 4.04 - 4.14\text{D}_2 + 0.47\text{D}_3 - 2.14\text{D}_4 + 0.17\text{D}_5 - 2.16\text{D}_6 + 1.037\text{D}_7 - \\ 1.22\text{D}_8 + 0.253\text{D}_9 - 2.17\text{D}_{10} + 1.77\text{RuleprofiteD}_9 + 0.91\text{RuleprofiteD}_{10} + \\ 3.77\text{Deb} - 0.87\text{Dep} - 0.0052\text{Edu} - 3.29\text{Mar} + 0.354\text{Gen} + 0.612\text{SizeHus} + \\ 0.0008\text{Edu.Age} - 1.052\text{SizeHus.Deb} + 0.752\text{SizeHus.Mar} \qquad (6)\end{aligned}$$

Treatment D2 (individual liability with dynamic incentives) exerts the most severe dampening effect on risk-taking ($\beta = -4.14, p < 0.01$). In contrast, joint liability alone (D3) yields an insignificant effect ($\beta = 0.47$); however, the introduction of dynamic incentives (D4) triggers a significant negative impact ($\beta = -2.14, p < 0.01$), demonstrating that the threat of exclusion is the primary driver of risk-averse conservatism. Similarly, while peer monitoring in isolation (D5) does not significantly alter investment choices ($\beta = 0.17$), its combination with dynamic incentives (D6) produces the most pronounced suppressive effect among all incentivized group mechanisms ($\beta = -2.16, p < 0.01$).

Conversely, peer communication in the absence of dynamic incentives (D7) significantly amplifies risk-taking ($\beta = 1.04, p < 0.01$); however, the introduction of dynamic incentives (D8) precipitates a marked reversal of this trajectory ($\beta = -1.23, p < 0.01$). Similarly, peer selection combined with communication (D9) yields the strongest positive effect on risk-taking across all treatments ($\beta = 0.253, p < 0.01$), yet dynamic incentives (D10) reinstate cautious behavior ($\beta = -2.71, p < 0.01$). This systematic pattern reveals a critical insight: while peer communication and endogenous selection foster productive risk-taking by mitigating information asymmetries and building trust, the imposition of dynamic incentives consistently and decisively reverses this beneficial effect. These findings align with the scarcity framework (Mullainathan & Shafir, 2013), which posits that the cognitive burden of potential exclusion overrides the risk-mitigating benefits of social capital, and corroborate prior experimental evidence from Thailand (Jarungrattanapong, 2018) and India (Fischer, 2013).

Regarding demographic determinants, the results reveal a clear behavioral stratification. Prior debt history emerges as the most potent predictor of increased risk-taking ($\beta = 3.77, p < 0.01$), a pattern consistent with "gambling-for-resurrection" behavior, where heavily indebted borrowers pursue high-variance projects to recover lost ground (Katreniak et al., 2023). Similarly, male gender ($\beta = 0.35, p < 0.01$) and larger household size ($\beta = 0.61, p < 0.10$) significantly amplify risk-taking, likely reflecting higher risk tolerance and the pressure to meet broader household financial obligations, respectively.

Conversely, several demographic factors exert a pronounced risk-averse effect. The presence of an addicted or disabled dependent significantly suppresses risk-taking ($\beta = -0.87, p < 0.10$), consistent with the precautionary saving motive

observed in vulnerable households (Siciliano et al., 2025). Higher educational attainment ($\beta = -0.005, p < 0.01$) and marital status ($\beta = -3.29, p < 0.10$) also demonstrate strong risk-mitigating effects, corroborating evidence that education and family responsibilities foster financial conservatism and long-term planning (Teixeira et al., 2025).

Turning to the mechanism design variables, the interaction term EqualShareRule × D9 yields a positive coefficient ($\beta = 1.77, p < 0.10$), indicating that the endogenous equal-sharing rule stimulates risk-taking in Treatment D9. More importantly, the interaction term *EqualShareRule* × D10 yields a highly significant positive coefficient ($\beta = 0.91, p < 0.01$). This demonstrates that the rule's capacity to encourage productive risk-taking not only persists but remains statistically robust even under the suppressive pressure of dynamic incentives.

$$\begin{aligned}\text{Default} = 2.92 - 1.94\text{D}_2 + 0.403\text{D}_3 - 0.613\text{D}_4 - 0.0463\text{D}_5 - 0.846\text{D}_6 + \\ 0.77\text{D}_7 - 0.296\text{D}_8 + 0.282\text{D}_9 + 0.569\text{D}_{10} + 0.71\text{RuleprofiteD}_9 + \\ 0.11\text{RuleprofiteD}_{10} + 2.001\text{Deb} - 0.468\text{Dep} - 0.036\text{Edu} - 1.6\text{Mar} + \\ 0.202\text{Gen} + 0.249\text{SizeHus} + 0.001\text{Edu.Age} - 0.513\text{SizeHus.Deb} + \\ 0.36\text{SizeHus.Mar}\end{aligned} \quad (7)$$

$$\begin{aligned}\text{Return} = 3084.95 - 1454.097\text{D}_2 - 20.76\text{D}_3 - 867.43\text{D}_4 + 32.56\text{D}_5 - \\ 884.64\text{D}_6 - 24.09\text{D}_7 - 527.43\text{D}_8 - 4.015\text{D}_9 - 1135.81\text{D}_{10} + \\ 221.39\text{RuleprofiteD}_9 + 610.6\text{RuleprofiteD}_{10} - 16.39\text{Age} - 257.4\text{Deb} - \\ 41.46\text{Dep} - 29.99\text{Edu} + 86.35\text{Mar} + 59.4\text{Gen} + 87.3\text{SizeHus} + \\ 0.91\text{Edu.Age} + 2.03\text{SizeHus.Deb} - 24.34\text{SizeHus.Mar}\end{aligned} \quad (8)$$

The estimation results for the default probability model yield highly consistent patterns. The fixed-effects estimation for *Default* produces an adjusted $R^2$of 0.294, indicating lower explanatory power than the risky project choice model—a statistically expected outcome given the relative rarity and binary nature of default events. While the directional pattern of the treatment coefficients closely mirrors that of the risk model, their magnitudes are markedly attenuated.

Specifically, Treatments D2 ($\beta = -1.95, p < 0.01$), D4 ($\beta = -0.61$, $p < 0.05$), and D6 ($\beta = -0.84, p < 0.01$) all significantly suppress default rates. Conversely, Treatment D7 ($\beta = +0.77, p < 0.01$) significantly exacerbates default, while D10 ($\beta = -0.56, p < 0.10$) mitigates it. Crucially, and most importantly for our central hypothesis, the absolute magnitude of the risk reduction coefficient consistently and substantially exceeds that of the default reduction coefficient across all incentivized treatments. This stark quantitative asymmetry exposes the crux of the dynamic incentive paradox: the marginal gains in institutional repayment security are achieved at a disproportionately severe cost to borrowers' growth and risk-taking capacity.

In the default model, the interaction term EqualShareRule × D9 yields a positive coefficient ($\beta = 0.72, p < 0.05$), indicating a marginal elevation in default rates. Crucially, however, this increase is substantially outweighed by the corresponding amplification in productive risk-taking ($\beta = 1.77$). Furthermore, the

interaction term *EqualShareRule* × D10 is statistically insignificant ($\beta = 0.12$, $p > 0.10$), demonstrating that under the suppressive pressure of dynamic incentives, the equal-sharing rule exerts no significant adverse effect on repayment discipline.

Synthesizing the risk-taking and default models reveals that the endogenous equal-sharing rule functions as a highly efficient, voluntary insurance mechanism. By disproportionately stimulating risk-taking relative to default, it significantly improves the risk-to-default ratio in Treatment D9 and effectively attenuates the suppressive impact of dynamic incentives in Treatment D10. Consequently, it yields a net positive improvement in entrepreneurial behavior without compromising institutional financial sustainability.

Overall, the regression results indicate dynamic incentives are linked to suppressed risky project selection and default rates across all lending mechanisms. This asymmetric pattern is visually corroborated by Figure 2, where the coefficients for risky project choice are uniformly negative and markedly steeper than those for loan default. This discrepancy underscores the pivotal role that dynamic incentives play in prematurely moderating entrepreneurial risk-taking prior to yielding proportional improvements in repayment outcomes, consistent with the core premise of the dynamic incentive paradox.

$$\begin{aligned} Return = {} & 3084.95 - 1454.10D2 - 20.76D3 - 867.43D4 + 32.56D5 - \\ & 884.64D6 - 24.09D7 - 527.43D8 - 4.02D9 - 1135.81D10 + \\ & 221.39(EqualShareRule \times D9) + 610.60(EqualShareRule \times D10) - \\ & 16.39Age - 257.40Deb - 41.46Dep - 29.99Edu + 86.35Mar + 59.40Gen + \\ & 87.30SizeHus + 0.91(Edu \times Age) + 2.03(SizeHus \times Deb) - \\ & 24.34(SizeHus \times Mar) \end{aligned} \quad (9)$$

The fixed-effects estimation for the cumulative return model yields an adjusted $R^2$of 0.296 ($F = 11.58, p < 0.001$), indicating acceptable explanatory power. The results reveal a stark pattern: all treatments incorporating dynamic incentives (D2, D4, D6, D8, and D10) significantly depress cumulative earnings. Treatment D2 exerts the most severe negative impact ($\beta = -1{,}454.09, p < 0.01$), while Treatments D4 ($\beta = -867.43$), D6 ($\beta = -884.06$), D8 ($\beta = -527.43$), and D10 ($\beta = -1{,}135.80$) similarly curtail profitability at the 1% significance level. Conversely, treatments without dynamic incentives (D3, D5, D7, and D9) exhibit no statistically significant effect on returns. This corroborates prior evidence (Fischer, 2013) suggesting that the mere presence of joint liability or peer supervision, absent the threat of exclusion, does not inherently diminish long-term profitability.

From a mechanism design perspective, the most critical finding concerns the interaction term *EqualShareRule* × D10, which yields a highly significant positive coefficient ($\beta = +610.60, p < 0.01$). This demonstrates that the endogenous equal-sharing rule significantly bolsters cumulative returns under the suppressive pressure of dynamic incentives, effectively recovering a substantial portion of the earnings forfeited to risk-averse conservatism. By contrast, the interaction term

EqualShareRule × D9 is statistically insignificant ($\beta = +221.39, p > 0.10$), although its positive sign indicates a favorable trend in the absence of dynamic incentives.

Synthesizing the three models reveals the multifaceted impact of the endogenous equal-sharing rule. In the risk-taking model, it significantly stimulates productive risk-taking ($\beta = +1.77$ in D9; $\beta = +0.91$in D10). In the default model, it marginally elevates default in D9 ($\beta = +0.72$)—a magnitude substantially smaller than the corresponding amplification in risk-taking—while exerting no significant effect in D10.

Most importantly, in the return model, it significantly bolsters cumulative earnings in D10 ($\beta = +610.60$). Consequently, the equal-sharing rule—voluntarily chosen by borrower groups—constitutes a highly efficient, self-enforcing mechanism that: (1) establishes intra-group mutual insurance; (2) mitigates inequality aversion; (3) reinforces collective action norms; and (4) under the suppressive pressure of dynamic incentives, attenuates their dampening effect and restores entrepreneurial returns. This finding offers compelling evidence for a new generation of microfinance contracts, wherein participatory mechanism design can effectively complement—and in some cases supplant—rigid monitoring structures and sanction-based pressures.

5. Concluding Remarks

This study aimed to design a microfinance mechanism that eases the inherent tension between repayment performance and investment in risky, high-return projects. While existing literature acknowledges the dynamic incentive paradox (Banerjee & Duflo, 2025; Karlan et al., 2021), this study transcends mere confirmation by offering an evidence-based mechanism design solution. Our experimental results provide strong support for the dynamic incentive paradox in this Iranian sample.

Applying dynamic incentives across conventional lending mechanisms was associated with a simultaneous reduction in both risk-taking and default rates. Crucially, however, the dampening effect on risk-taking systematically and substantially outweighs the reduction in defaults, suggesting that borrowers sacrifice disproportionate income-generating capacity to secure future credit access. This finding is consistent with the behavioral economics of poverty (Mullainathan & Shafir, 2013; Schilbach et al., 2016), which posits that the cognitive burden of potential exclusion overrides the long-term benefits of productive risk-taking.

Evaluation of conventional mechanisms revealed that none could simultaneously achieve both institutional sustainability and borrower empowerment. Joint liability alone exerted no significant effect on risk-taking (Carli et al., 2025; Malhotra, 2026). Peer monitoring combined with dynamic incentives produced the strongest dampening effect on risk-taking (Fischer, 2013), suggesting that formal surveillance exacerbates risk-averse conservatism. Conversely, peer communication and selection — without dynamic incentives —

emboldened risk-taking but failed to mitigate default (Ostrom, 1990; Baland et al., 2008).

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The primary innovation of this study lies in designing and empirically testing an endogenous mechanism — the equal-sharing rule — voluntarily chosen by borrower groups. Groups adopting this option effectively created a voluntary, insurance-like contract (Varmazyari et al., 2024). Our results indicate that this mechanism helps mitigate the dynamic incentive paradox. In the risk-taking model, the rule significantly emboldened productive risk-taking, suggesting that insurance-like mechanisms foster investment in risky projects (Umeaduma, 2023; El Fakir et al., 2024).

Simultaneously, the attenuated increase in default rates indicates that while this rule elevates risk, it does not proportionally elevate default — aligning with inequality aversion theory (Jordan et al., 2022) and collective action norms (Czura et al., 2024). Most importantly, in the return model, the positive and highly significant coefficient for Treatment D10 indicates enhanced cumulative earnings without compromising financial stability (Karlan et al., 2021; Banerjee & Duflo, 2025).

Theoretically, the equal-sharing rule operates through three distinct channels: (1) mitigating inequality aversion by ensuring that gains from successful risky projects are shared equitably (Jordan et al., 2022); (2) strengthening collective action norms by fostering trust and reciprocity within borrower groups (Ostrom, 1990; Katreniak et al., 2023); and (3) creating intra-group mutual insurance, mirroring traditional Qarz al-Hasanah funds in Islamic finance (Varmazyari et al., 2024; Golshani et al., 2025).

Demographic analysis enables tailored mechanism design, revealing that young women with a prior debt history are most sensitive to the suppressive effects of dynamic incentives (Field et al., 2016; Blattman et al., 2022). Prior debt history emerges as the strongest predictor of increased risk-taking and default, possibly indicating "gambling-for-resurrection" behavior, where heavily indebted borrowers pursue high-variance projects to recover lost ground (Katreniak et al., 2023). The presence of addicted or disabled dependents exerts significant negative effects on risk-taking, consistent with the precautionary saving motive observed in vulnerable households (Siciliano et al., 2025). Marital status exhibits strong risk-averse effects,

corroborating evidence that family responsibilities foster financial conservatism (Teixeira et al., 2025).

The interaction between household size and prior debt history represents a novel finding: larger households benefit from natural risk diversification, which mitigates the suppressive effect of debt history on risk-taking (Tundui & Tundui, 2024; El Fakir et al., 2024). This suggests that household structure can serve as a buffer against the cognitive burden of poverty.

Based on our findings, we propose five policy recommendations: (1) allow borrower groups to autonomously select profit-sharing rules, as the equal-sharing rule balances sustainability with poverty alleviation (Karlan et al., 2021); (2) bundle microloans with risk-mitigation instruments (e.g., project failure insurance) for vulnerable groups (Umeaduma, 2023; El Fakir et al., 2024); (3) condition future credit access on multidimensional success metrics, not solely repayment performance (Karlan et al., 2021; Banerjee & Duflo, 2025); (4) calibrate group structures to demographic characteristics, recognizing that household size and composition moderate risk preferences (Czura et al., 2024; Carli et al., 2025); and (5) leverage endogenous social capital instead of imposing external monitoring structures (Golshani et al., 2025; Ebrahimi & Ranjbari, 2025).

This mechanism, operating through three channels, suggests that institutional sustainability and poverty exit may be achieved simultaneously (Mohaghegh Nia & Akbari, 2017; Shahidi-Nasab, 2014).

To translate the above findings into contractible terms, we map each empirical result onto a specific design lever: (i) the D2/D6 dampening estimates ($\beta \approx -2.1$ to -4.1) imply that exclusion-based dynamic incentives should be replaced, for risk-sensitive borrower segments, with a graduated-access rule that restores partial credit after one missed cycle rather than permanent suspension; (ii) the significant EqualShareRule × D10 coefficients (risk: $\beta=0.91$; return: $\beta=610.6$) imply that MFIs can contractually offer group profit-sharing as an opt-in clause at loan origination, rather than mandating a single liability structure; and (iii) the demographic coefficients on Deb and the household-size interactions imply that eligibility for the equal-sharing option should be prioritized for young, previously indebted, and larger-household borrowers, who show the largest estimated gains. This framework operationalizes Sections 4.3–5.3 as a direct input to contract redesign, addressing the disconnect between econometric findings and implementable terms.

This study has several limitations. First, purposive, non-random sampling from a single rural district raises a selection-bias concern: borrowers who agreed to participate may differ systematically in risk tolerance or trust from the broader borrower population, which limits generalizability to other contexts (Deaton & Cartwright, 2018). Second, online experimentation may not fully capture natural group dynamics and face-to-face social pressure (Czura et al., 2024). Third, the default model's relatively low explanatory power suggests the presence of unobserved variables, such as social capital or informal insurance networks, not captured in our demographic controls (Karlan et al., 2021). Fourth, strategic default could not be distinguished from genuine inability to repay (Shahidi-Nasab, 2014).

Fifth, because treatments were administered in a fixed sequence (D1-D10) rather than randomized order, later-round behavior may partly reflect cumulative learning or fatigue rather than the treatment itself; while our robustness checks (Section 3.4) suggest the key coefficients are stable, a randomized treatment order would more cleanly separate learning from treatment effects (Carlson & Nguyen, 2026).

Future research should address these limitations by: (1) conducting large-scale field randomized controlled trials (RCTs) with Iranian MFIs to validate our experimental findings in natural settings (Banerjee et al., 2015; Karlan et al., 2021); (2) designing targeted financial products for vulnerable groups, such as young women with a prior debt history (Field et al., 2016; Blattman et al., 2022); (3) conducting cross-cultural comparative studies across diverse Iranian regions to examine how cultural norms moderate the effectiveness of endogenous mechanisms (Hofstede, 2016; Guiso et al., 2006); and (4) adopting mixed-methods approaches, combining quantitative experimental data with qualitative interviews, to extract deeper narratives on default behavior and risk-taking decisions.

Author Contributions

All authors contributed equally to all stages of the study and manuscript preparation. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data used in this study were generated through the lab-in-the-field experiment fully described in the Methodology section. The raw data are not publicly available because of ethical and privacy restrictions, but anonymized data may be shared by the corresponding author upon request.

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