Kasetsart Journal of Social Sciences 41 (2020) 407–414

Kasetsart Journal of Social Sciences

journal homepage: http://kjss.kasetsart.org

Joint-liability and dynamic incentive mechanisms in microlending: Evidence from lab-in-the-field experiments in Thailand

Rawadee Jarungrattanapong

Sukhothai Thammathirat Open University, Nonthaburi 11120, Thailand

Article Info

Article history:
Received 16 April 2018
Revised 31 July 2018
Accepted 30 August 2018
Available online 18 September 2018

Keywords:
dynamic incentives,
joint-liability lending,
lab-in-the-field experiment,
microlending,
risk preferences

Abstract

The mechanisms of joint liability and dynamic incentive in microfinance institutions are often cited as the key factors that lead to the low default rate in loan repayment in developing countries. The study tested the effects of joint-liability lending and dynamic incentive mechanisms on risk preferences and loan repayment. Through the conduct of microfinance lab-in-the-field experiments with 256 microfinance clients in Thailand, this study found that joint liability without dynamic incentive performs better than individual lending in terms of loan repayment. The dynamic incentive mechanism reduces risk-taking behavior and promotes loan repayment, however, combination of joint-liability and dynamic incentives enhances moral hazard through risk-taking. Further, participants tended to be more risk-taking when they perceived that their partners were risk-lovers.

© 2018 Kasetsart University. Publishing services by Elsevier B.V.

Introduction

Microfinance institutions provide low-income people with access to credit. The idea of microfinance arose in the 1970s when Mohammad Yunus launched in Bangladesh a pilot program of joint liability lending schemes for villagers who lack collateral and had no access to traditional loans (Yunus, 2001). He proceeded to establish the Grameen Bank to implement a lending scheme for the poor on a larger scale, and its success has encouraged the growth of the concept of joint liability lending throughout the world (Armendáriz de Aghion & Morduch, 2005).

In the joint liability lending schemes, the key mechanisms of joint liability and dynamic incentive are employed to secure high loan repayment rates; such lending contracts mitigate problems created by informational asymmetries such as adverse selection, moral hazard, and repayment enforcement (Morduch, 1999; Stiglitz & Weiss, 1981). For instance, in a joint-liability scheme, all members of a group of borrowers are treated to be in default if anyone in their group does not repay the loan on time, thus making all of them jointly liable for each other's debts (Ghatak, 1999). In addition, the dynamic incentive mechanism prohibits a group of borrowers in default from securing additional loans if the previous loan of any member in their group remains unsuccessfully repaid. This mechanism is an incentive to repay by promising access to future loans.

Some early works show that the joint-liability mechanism can improve repayment rates. Stiglitz (1990) investigated how joint liability lending can encourage borrowers in a group to take the safe investment option and monitor each other, which therefore lessens moral hazard problems. Ghatak (1999) found that joint liability lending practices encourage borrowers to group by type, with relatively safe borrowers preferring to group with other safe borrowers and riskier borrowers tending to form a group together (called self-selection bias). The joint-liability mechanism

E-mail address: rawadee@gmail.com.
Peer review under responsibility of Kasetsart University.

https://doi.org/10.1016/j.kjss.2018.08.009
2452-3151/© 2018 Kasetsart University. Publishing services by Elsevier B.V.

also relies on the peer pressure generated within groups of borrowers to ensure high repayment rates.

Even though joint liability lending is still important in microfinance practice, an increasing number of microfinance institutions are moving towards individual lending schemes (Giné, Harikaya, Karlan, & Nguyen, 2006). Among the reasons for this shift may be the unexpected difficulties faced by borrower groups in a joint-liability mechanism. Besley and Coate (1995) pointed out that joint-liability schemes may pressure borrowers to default; if they realize that they cannot repay the loan as a group, which means no further loans will be available to them, then all members may decide to simply default. Further, Ahlin and Townsend (2007) noted that social ties may negatively affect repayment performance in a joint-liability lending scheme since such ties can promote collusion by making possible agreements to not use excessively strict penalties when someone defaults.

In addition, Kumar (2012) conducted the survey of the microfinance clients in Karnataka, India. He found that the progressive lending as dynamic incentives, by providing an additional larger amount of loan if the previous loan is successfully repaid, increased their loan sizes by 684 percent of the initial loan. Further, limiting the access of the borrower to future loans can serve as a punishment strong enough to mitigate the future default risks (Shapiro, 2015). In the case of Thailand, there have also been reports that some microfinance institutions allow the clients to refinance their loan even if it has not been fully repaid (Meagher, 2013). This practice puts at risk the sustainability of microfinance institutions. The study therefore found it interesting to test to what extent the dynamic incentive mechanism affects loan repayment in order to obtain further evidence on this issue and to help better understand the factors that motivate loan repayment.

Thus, this study investigated the impact on investment decisions and loan repayment of joint-liability lending (by comparing this with the impact of individual liability lending) and dynamic incentive mechanism, as key incentives of the joint liability lending scheme, as well as demographical factors within lab-in-the-field experiments with Thai rural villagers. The experimental design was built on the experimental game originally developed by Giné, Jakiela, Karlan, and Morduch (2010) in Peru, namely Microfinance games.

This study found that the dynamic incentive mechanism had significant power to reduce the risk-taking behavior and promote higher loan repayment. It was also found that a combination of dynamic incentives and joint-liability encouraged participants to take more risks. Further, participants tended to be more risk-taking when they perceived that their partners also were risk-taking. The contribution of this paper is to test whether the findings in Giné et al. (2010) hold for Thai participants. It is interesting to see how people in a different context behave by comparing Peruvian and Thai people because cultural differences exist between Peru and Thailand. These differences might translate into differences of measured risk preferences, as there is evidence that cultural backgrounds might matter for risk preferences. Further, the findings of this study can be drawn for potential implications of microfinance in term of loan repayment for Thailand. Even though some treatments of Giné et al. (2010) were not included in this study, this paper might be the first study of its kind in Thailand.

Methods

Experimental Design

As mentioned earlier, this study focuses on the impact of joint-liability lending and dynamic incentives, key features of microfinance institutes, on investment decisions. The experimental design in this study was set up adapted from the Microfinance games by Giné et al. (2010) with some modifications and adjustments depending on particular treatments. By following the design of Giné et al. (2010), the effects of joint-liability lending (by comparing this with the effect of individual liability lending) and dynamic incentives on investment decisions can be tested. The treatments in the experimental design by Giné et al. (2010) differ in terms of the loan contract - individual liability (IL) or joint liability (JL), with or without dynamic incentives (DI) and the extent to which borrowers within joint-liability groups were informed which project their partners had chosen at the end of each round (monitoring treatment: M) or borrowers were not given this information (imperfect information treatment: II) or borrowers were allowed to communicate with their partners (communication treatment: C) or borrowers were allowed to choose their partners before the game began (partner-choice treatment: PC). The difference between the experimental design in this study and the original experiment is that imperfect information treatment or treatments without monitoring was not included in this study. In imperfect information treatment by Giné et al. (2010), participants received only their own information and were not informed about their partner's project choices, whereas all participants in this study were informed about their own outcomes and their partner's project choices. The reason to not include imperfect information treatment in this study is because borrowers under a joint liability mechanism in real life, at least in the context of Thai society, are likely to observe and perceive what the project's choice of their partner is.

The experiments were comprised of multiple rounds of borrowing. In each round, a bank (or the experimenter) lends each borrower 50 tokens of capital to invest in either a safe or a risky project. This study avoided calling projects as either “safe” or “risky” but rather called them a “blue project” or an “orange project”, respectively, to prevent the name of the project from affecting the investment decision as suggested by Giné et al. (2010). Returns from the safe project are 200 tokens (with certainty) while returns from the risky project are either 600 tokens or 0, both with a 50 percent probability. In the game, loan repayment was due at the end of each round and the amount to be repaid automatically includes an interest of 50 tokens and a principal of 50 tokens. Therefore, the expected net return of the safe project was 100 tokens. The risky project had an expected net return of 200 tokens. The parameters for the

model were chosen as such to make the risky project choice appealing.

The study focuses on how joint-liability and dynamic incentive mechanisms affect the likelihood that borrowers will be able to repay and is not interested other factors, such as cheating, motivate borrowers to default. Thus, it was imposed that borrowers will repay if they are able to. The study is aware that the wealth effect is inevitable because payoffs were accumulated over all rounds. To mitigate wealth effects, payoffs cannot be transferred over different rounds. This means that participants whose projects failed in a particular round and therefore could not repay their loan in that round cannot use the wealth gained from previous rounds. This design is to alleviate risk-averse borrowers from selecting the risky project. Thus, loan repayment only depended on whether a safe project or a risky project was chosen. The accumulated net returns of all rounds are the total game payoffs for each individual.

The experimental design of all treatments is shown in Figure 1. Treatment combinations of the loan contracts can be either individual or joint liability with or without the use of the dynamic incentive mechanism. This study conducted individual liability treatments: one with dynamic incentives and one without dynamic incentives. Payoffs of individual liability treatments depended only on participants' project choices and their chances to succeed. Participants in both individual liability and joint liability treatments received feedback of their payoffs at the end of each round, while all participants in the joint liability treatments also receive information about their partner's project choice at the end of each round. The joint liability treatment combinations were further subdivided into three treatments that control the interaction between borrowers partnered together, thus mimicking two other characteristics of microlending: (i) having a choice on who to group with and (ii) being able to communicate with your partners. In these sub-treatments, participants were matched with a borrowing partner. The participants were either: (i) not allowed to communicate with their randomly assigned partner (*without communication treatment*); (ii) assigned a seat next to their randomly assigned partner and allowed to communicate (*with communication treatment*); and (iii) allowed to choose their own partner with whom they could communicate (*partner-choice treatment*). In the last two joint-liability sub-treatments, while the partners may communicate with each other, they were instructed that they cannot disclose their investment choice with each other.

Each participant played a sequence of games for both the treatments without and with dynamic incentive mechanisms. This allowed us to control for risk preferences and separate other lending mechanisms on risk taking and loan repayment. In the treatments without dynamic incentive, the total number of rounds in each session was varied between five and six rounds to avoid the end-game effect of participants in the later sessions anticipating the number of rounds to be played, therefore, only the first five rounds in this treatment were included in the sample. In the treatments with dynamic incentive, subjects were told that the experiment would end either when they could not repay the loan or when the experiment leader decided to end the game, but that this end time was unknown (to avoid an end game effect) for both the treatments with and without dynamic incentives.

In the individual liability lending treatments, each participant individually bore the responsibility of both a project choice decision and their own repayment; therefore each received information in relation to their own choices only. On the other hand, participants in the joint-liability treatments were also liable for their partner's loans as well as their own.

In the treatments without dynamic incentive, participants were allowed to play all rounds regardless of whether they were able to repay their loans in previous rounds. On the other hand, in the treatments with dynamic incentive, participants who defaulted in any round were not allowed to continue playing the remaining rounds of the game.

Experimental Procedure

Participants of the study are villagers in the rural area of two provinces who represent microfinance clients in Thailand, namely Phra Nakhon Si Ayutthaya province (hereafter referred to as “Ayutthaya”) and Kalasin province, respectively. The same design of the experiment was applied in both sites. In the experimental design, all

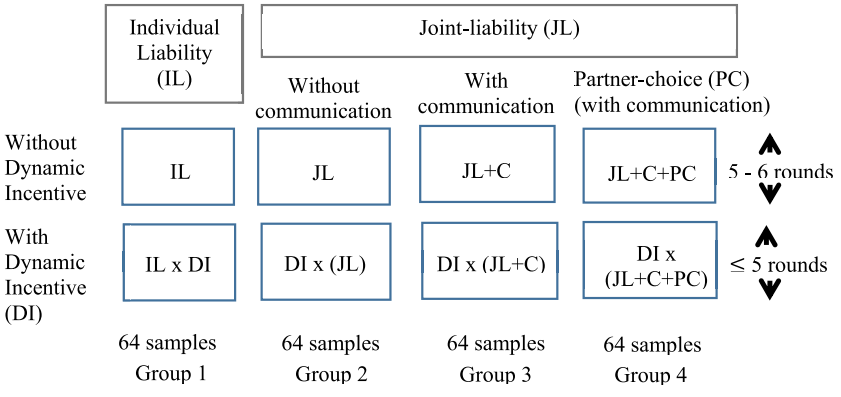


Figure 1 Experimental treatments

participants are assumed to be equally qualified as loan creditors to avoid adverse selection or moral hazard problems (El-Komi & Croson, 2013).

Appointments were arranged with local villagers who are microfinance clients with the help of local government staff. Towels were given as a show-up fee instead of money, because money could more likely be seen as a financial windfall, and possibly unduly influence the decisions they make in the games. Participants also earned additionally on average 300 Baht (average total earnings ~ which correspond to a daily minimum wage in Thailand, corresponding to approximately, 9 US dollars). Each session lasted approximately two and a half hours and each subject participated only once. All participants were also informed that their decisions in the experiment and their interview responses would be kept anonymous. Participants were asked to sign consent forms before the games started to indicate their voluntary participation in the experiments. The experiments were conducted manually with pen and paper. After playing the games, the villagers were then asked to individually complete a questionnaire to gather information about their pertinent demographic characteristics.

The experiments were conducted in early May 2014 in Ayutthaya province and early May 2015 in Kalasin province. An experimental lab was set up in a seminar room in the local government office in each area. One hundred twenty-eight (128) villagers from each province were invited to the experiments. Total sample is 256 villagers. In each treatment session, the 16 participants were seated abreast of each other with foam plates dividing them so that their decisions remained confidential. Participants drew lots to decide their seat number. At the beginning of each game, participants were provided with the game instructions and these were also explained out loud. Participants could ask questions anytime and the experimenter would answer privately. Two practice rounds were conducted before the real experiment was started. On average, monthly income of participants is approximately 6,378 Baht (approximately 190 US dollars). More women (67 percent) than men showed up to participate in the experiment and most of participants are farmers (44 percent). In the regression, some key variables (e.g. gender, age and income) were controlled to avoid bias in estimation.

Results and Discussion

This study first investigated the rate of risky project choice and the rate of repayment across the different treatments indicated in Figure 1. This study also examined the determinants of risky project choices and loan repayment using the logit regressions. However, this study also tested for robustness of the estimation by running the probit regressions and found that both methods yield similar (though not identical) inferences. Thus, only logit regressions were presented. The rate of risky project choices and the rate of repayment were calculated as follows:

$$\textit{Rate of risky project choices} = \frac{\textit{Total rounds that subject i chose risky projects}}{\textit{Total rounds that subject i played the game}}$$

$$\textit{Repayment rate} = \frac{\textit{Total rounds that subject i repaid the loan}}{\textit{Total rounds that subject i played the game}}$$

Descriptive Statistics of Rates of Risky Project Choices

As predicted, this study found that adding dynamic incentives significantly decreased the rate of risky project choices in the individual-liability lending treatments ($U = 1450.50$: p-value $< .01$, Table 2) from 43 percent of choices to 24 percent (Table 1). However, adding dynamic incentives in joint-liability treatments affected the rate of risky project only when communication was allowed ($U = 1642.50$: p-value $< .05$ in Table 2).

In game sessions where communication between partners was allowed, the rate of risky project choices for joint-liability treatments with dynamic incentives (.27) is significantly lower than that in treatments without it (.40, $U = 1642.50$: p-value $< .05$ in Tables 1 and 2). However, there was no statistically significant difference between the rates of risky project choices of joint-liability treatments with dynamic incentives and without dynamic incentives (regardless communication). This implies that dynamic incentives strongly reduce risk-taking behavior in individual-liability lending treatments but its effect on risk-taking behavior in joint-liability lending treatments is not as obvious.

In the absence of dynamic incentives, there was no significant difference between the rates of risky choices in joint-liability lending treatments with and without communication (Table 3). This implies that communication

Table 1
Rates of risky project choices and repayment rates across experimental treatments

Treatment	Average (%)			
	This study		Giné et al. (2010)	
	Without dynamic incentive	With dynamic incentive	Without dynamic incentive	With dynamic incentive
1. Rates of risky project choices				
IL	.43	.24	.61	.34
JL	.32	.24	.61	.47
JL + C	.40	.27	.68	.58
JL + C + PC	.41	.32	.69	.53
2. Repayment rates				
IL	.76	.83	.68	.82
JL	.98	.96	.90	.95
JL + C	.92	.96	.87	.91
JL + C + PC	.95	.94	.89	.94

Note: IL = individual liability, JL = joint liability, C = communication, PC = partner-choice

Table 2
Significant differences in mean ranks of the rates of risky project choices and repayment rates between treatments with and without dynamic incentive mechanism

Treatment	Rates of risky project choices		Repayment rates	
	U	p-value	U	p-value
IL and IL_{DI}	1450.50	.002***	1486.50	.003***
JL and JL_{DI}	1788.50	.170	1936.00	.291
JL + C and $(JL + C)_{DI}$	1642.50	.044**	1768.00	.057*
JL + C + PC and $(JL + C + PC)_{DI}$	1792.00	.201	1942.00	.458

Note: 1. IL = individual liability, JL = joint liability, C = communication, PC = partner-choice, DI = dynamic incentive
2. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively
3. U = a Mann Whitney-U test

Table 3
Significant differences in mean ranks of the rates of risky project choices and repayment rates across treatment combinations

Treatment	Rates of risky project choices		Repayment rates	
	U	p-value	U	p-value
Without dynamic incentive mechanisms				
IL and JL	1722.00	.104	924.00	.000***
JL and JL + C	1773.50	.172	1688.00	.014**
JL + C and JL + C + PC	2042.00	.977	1920.00	.422
With dynamic incentive mechanisms				
IL and JL	1975.50	.678	1627.00	.002***
JL and JL + C	1832.00	.255	1920.00	.228
JL + C and JL + C + PC	1959.50	.652	2004.00	.729

Note: 1. IL = individual liability, JL = joint liability, C = communication, PC = partner-choice, DI = dynamic incentive
2. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively
3. U = a Mann Whitney-U test

in joint-liability lending might not enhance moral hazard through risk-taking and free-riding; this contradicts the findings of Giné et al. (2010) who found that communication in joint-liability mechanism induces moral hazard through higher risk-taking investments.

Consistent with the findings of Giné et al. (2010), rate of risky choices was found to be uninfluenced by partner choice; that is, the rate of risky project choices when participants were allowed to choose their partner (.41, Table 1) was not significantly different from that when participants were assigned a partner (.40, Table 1). The insignificance of the partner-choice treatment on the rate of risky choices might be because this study was conducted in villages where people may know each other well. There might be no strangers among them.

Descriptive Statistics of the Repayment Rate

When considering the rate of loan repayment in the treatments without dynamic incentives, the repayment rate from the joint-liability lending treatments (.98) is significantly higher than that from the individual lending treatments (.76, U = 924.00: p-value < .01 in Tables 1 and 3). Moreover, this study found that allowing communication in the joint-liability lending treatment significantly reduced the rate of payments from 98 percent to 92 percent but this effect is not statistically significant. In addition, allowing participants to choose their partner in the joint-liability lending treatment with communication does not significantly increase repayment rate (.95, Table 1) if compared with the no partner choice treatment (.92, Table 1).

The repayment rate resulting from the individual liability treatments with dynamic incentives (.83, Table 1) is significantly higher than that resulting from treatments without dynamic incentives (.76, Table 1) at 1 percent significance level (U = 1482.5: p-value < .01, Table 2) thus supporting the results of Giné et al. (2010) (Table 1). Contrariwise, adding dynamic incentives to the joint-liability lending treatments does not lead to a significantly higher repayment rate (Table 2). However, joint-liability treatments with communication has significantly higher repayment rates if with dynamic incentives (.96, Table 1) than if without (.92, U = 1768.00: p-value < .1 in Tables 1 and 2).

Determinants of Risky Project Choices

In this section, this study examined whether project choices and loan repayment were affected by treatments and individual characteristics. The predictions of the risky project choice model in regressions were tested and provided more statistically significant results using panel data regression techniques (Table 4). To test whether participants in two sites are similar demographic distribution, a Wilcoxon rank-sum test (Mann–Whitney) was applied. Only occupation variable (a farmer variable in particular) between the two study areas were statistically different at 1% significance level ($z = -10.814$, $Prob > |z| = .000$), whereas other demographic variables (e.g. age, income and education) were not statistically significant difference. Therefore, the occupation variable (a farmer variable in particular) represented the difference of the study area characteristics. The logit regressions, where the dependent variable in all Models is the risky project choices in each round, were estimated with clustered standard errors at the individual level to account for the fact that the datasets have multiple observations from the same individual. The period-level variable was used to control for a learning effect. In Model I, all samples were tested to ascertain whether they had an effect on risky project choices. Model II and Model III show the results for the treatments without dynamic incentives and with dynamic incentives, respectively. The last two columns of Table 4 show the results when only samples of the individual-lending treatments (Model IV) and joint-liability lending treatments (Model V) were analyzed.

The results show that the coefficients on dynamic incentive are negative at a 1 percent significance level (Model I, Table 4), implying that the dynamic incentive mechanism highly and significantly reduced the participants' choices of the risky project. It is indicated that adding dynamic incentives to any loan mechanism decreases the probability that participants choose the risky choice by 34.1 percent. All joint-liability contracts without dynamic incentives have no significant effect on the risky project choice. Coefficient estimates on the interaction

Table 4
Marginal effects from the binomial logistic regressions on the choice of risky projects

Variables	dy/dx				
	All samples (Model I)	Without DI (Model II)	With DI (Model III)	Individual lending (Model IV)	Joint-liability lending (Model V)
DI	−.341*** (.045)	–	–	−.323*** (.043)	−.076*** (.022)
JL	−.082 (.055)	−.091 (.066)	.149* (.078)	–	–
JL + C	−.035 (.054)	−.038 (.063)	.170** (.072)	–	.044 (.068)
JL + C + PC	−.012 (.057)	−.008 (.065)	.212*** (.076)	–	.071 (.068)
DI x JL	.292*** (.071)	–	–	–	–
DI x (JL + C)	.255*** (.069)	–	–	–	–
DI x (JL + C + PC)	.279*** (.068)	–	–	–	–
Period no.	−.001 (.005)	.003 (.007)	−.005 (.007)	−.021* (.011)	−.006 (.009)
Married	.029 (.047)	.039 (.053)	.018 (.046)	−.074 (.097)	.065 (.053)
Farmer	−.109** (.044)	−.144*** (.050)	−.069 (.042)	−.083 (.073)	−.112** (.053)
Gender (Male = 1)	−.074 (.048)	−.080 (.057)	−.065 (.045)	−.150** (.064)	−.0003 (.062)
Age	−.002 (.002)	−.004 (.003)	−.001 (.002)	−.008** (.003)	−.0008 (.003)
Education (years of schooling)	.010 (.006)	.014* (.007)	.006 (.006)	.012 (.010)	.015** (.007)
Monthly income	−2.73e-07 (.000)	−3.26e-07 (.000)	−1.88e-07 (.000)	1.45e-06 (.000)	−1.13e-06 (.000)
Partner's project choice in the previous round (risk choice = 1)	–	–	–	–	.384*** (.046)
Prob. > chi2	.000	.0015	.0124	.0000	.0000
Pseudo R-square	.073	.0575	.0451	.2171	.1539
Observations	2467	1273	1194	593	1492

Note: 1. IL = individual liability, JL = joint liability, C = communication, PC = partner-choice, DI = dynamic incentive
2. *, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively
3. Clustered standard errors at the individual level are in parentheses
4. Samples in Model IV refer to samples from an individual lending treatment
5. Samples in Model V refer to samples from all joint-liability treatments, including joint liability, joint liability with communication, and joint liability with partner's choice. In this Model, the joint-liability treatment without dynamic incentives was the base case of the treatments

between the indicators for dynamic incentives and joint liability show that the joint liability treatment with dynamic incentives increases the probability that participants select the risky project choice relative to the individual-liability contract with dynamic incentives by 29.2 percent (p-value < .01). This is explained by the fact that the joint-liability lending contract with dynamic incentives lowers expected costs of an individual default.

Without dynamic incentives, either joint-liability with communication or joint-liability with partner's choice has no significant effect on the risky project choice (Model II, Table 4). This implies that communication in joint-liability lending in this study might not enhance moral hazard through risk-taking and free-riding as mentioned earlier.

Surprisingly, the combination of dynamic incentives and joint-liability leads to increase the probability that borrowers choose the risky project choice relative to the individual-liability contract with dynamic incentives (Model III, Table 4). Borrowers may think that the joint-liability contract lowers expected costs of defaults and no further penalties applies for those whose projects failed, therefore, it is worth a risk. When considering only individual lending contract (Model IV, Table 4), dynamic incentives significantly reduce the probability that borrowers choose the risky project choice by 32.3 percent (p-value<.01).

Among joint-liability contracts (Model V, Table 4), dynamic incentives decreases the probability that participants choose the risky choice by 7.6 percent (p-value<.01). Interestingly, a decision on the risky project choice also depends on their partner's project choice in the previous round (p-value<.01). It is indicated that participants tended to be more risk loving when their partners chose the risky choices in the previous period. In contrast to the finding by Bolton, Ockenfels, and Stauf (2015), they found that participants who perceived that their partners are more risk averse tend to be more conservative, called conformity, but did not find the relationship in the opposite direction. The reason that the result of this study is different from Bolton et al. (2015) might be because payoffs of Bolton et al. (2015)'s study depends on only one partner and authors explained that he/she may have a social responsibility for their partners. While in this study, the payoffs of the participants depend on the decisions of both members, then they might think if their partners are risk-taking (and have a chance to receive higher payoffs), why would they still be risk averse and labile for their partner's debt if he/she fails?

Further, some demographic factors have significant effect on risky project choices. Farmers are more likely to be risk averse than other occupations in all joint-liability treatments. Under an individual lending treatment, younger participants tended to be more risk-seeking than older participants and women are significantly more likely to take risky choices (risk lovers) than men.

Determinants of Loan Repayment

Regression results on loan repayment in Table 5 were tested for robustness of the models. The logit regressions, where the dependent variable in all Models is whether the repayment succeeds or not in each round, were estimated with clustered standard errors at the individual level to account for the fact that the datasets have multiple observations from the same individual. The period-level variable was used to control for a learning effect. In Model I, all

Table 5
Marginal effects from the binomial logistic regressions on loan repayment

Variables	dy/dx				
	All samples (Model I)	Without DI (Model II)	With DI (Model III)	Individual lending (Model IV)	Joint-liability lending (Model V)
DI	.061*** (.013)	–	–	.145*** (.023)	.003 (.002)
JL	.051*** (.008)	.069*** (.011)	.034*** (.009)	–	–
JL + C	.043*** (.008)	.058*** (.010)	.009 (.012)	–	−.003 (.003)
JL + C + PC	.053*** (.009)	.072*** (.011)	.019** (.008)	–	.0007 (.002)
DI x JL	−.012 (.025)	–	–	–	–
DI x (JL + C)	−.070 (.045)	–	–	–	–
DI x (JL + C + PC)	−.072 (.044)	–	–	–	–
Period no.	.0008 (.002)	.003 (.003)	-.002 (.003)	.014 (.008)	−.0004 (.0006)
Married	−.004 (.009)	-.009 (.012)	.0004 (.011)	.021 (.034)	.0003 (.0021)
Farmer	.039*** (.010)	.065*** (.014)	.015 (.011)	.061** (.028)	.008** (.004)
Gender (Male = 1)	.031*** (.008)	.044*** (.011)	.022** (.010)	.082*** (.024)	.001 (.003)
Age	.0008** (.0004)	.001** (.0005)	.0004 (.00047)	.003** (.002)	.0000768 (.0001)
Education (years of schooling)	−.0002 (.001)	−.001 (.001)	.001 (.002)	−.004 (.004)	.0003 (.0003)
Monthly income	1.67e-08 (.000)	1.14e-07 (.000)	−8.17e-08 (.000)	−1.80e-07 (.000)	6.56e-08 (.000)
Partner's project choice (risk choice = 1)	–	–	–	–	−.080*** (.013)
Prob. > chi2	.0000	.0000	.0171	.0000	.0000
Pseudo R-square	.1601	.1824	.0619	.1633	.2739
Observations	2473	1273	1200	593	1874

Note: 1. IL = individual liability, JL = joint liability, C = communication, PC = partner-choice, DI = dynamic incentive
2. *, ** and *** indicate significance at 10%, 5%, and 1% levels, respectively
3. Clustered standard errors at the individual level are in parentheses
4. Samples in Model IV refer to samples from an individual lending treatment
5. Samples in Model V refer to samples from all joint-liability treatments, including joint liability, joint liability with communication, and joint liability with partner's choice. In this Model, the joint-liability treatment without dynamic incentives was the base case of the treatments

samples were tested to ascertain whether they had an effect on loan repayment. Model II and Model III present the results for the treatments without dynamic incentives and with dynamic incentives, respectively. The last two columns of Table 5 show the results when only samples of the individual-lending treatments (Model IV) and joint-liability lending treatments (Model V) were analyzed.

The results show that adding dynamic incentives to any loan mechanism (Model I, Table 5) increases the probability of successful loan repayment by 6.1 percent (p-value<.01). The results on the effect of the joint-liability mechanism on repayment are robust, even in the absence of dynamic incentives. The coefficient estimate (Model II, Table 5) suggests that including the joint-liability contract (regardless communication and partner's choice) increases successful loan repayment relative to the individual-liability contract without dynamic incentives by 6.9 percent (p-value<.01). Further, allowing borrowers to communicate (p-value<.01) and choose their partners (p-value<.01) in joint-liability treatments increases successful loan repayment (Model I, Table 5). In contrast to the finding by Giné et al. (2010), they found that communication under joint-liability treatments decreased loan repayment. Communication in Giné et al. (2010)'s study may lead to collusion resulting in higher loan default, whereas communication in this study may promote cooperation by mitigating the free-rider problem.

When considering only individual lending contract (Model IV, Table 5), dynamic incentives significantly increase the probability of successful loan repayment relative to the treatment without dynamic incentives by 14.5 percent (p-value<.01). Among joint-liability treatments (Model V, Table 5), the probability of successful repayment is lower when their partners are likely to be risk lovers by 8 percent (p-value<.01). Demographic factors also have significant impact on the repayment, farmers are more likely to succeed in loan repayment, which is consistent with an earlier finding that farmers tend to be risk averse. Results also indicate that older people are more likely to have higher successful repayment than younger people. Further, men tend to succeed in repayment more than women, which is in line with an earlier result that men are likely to be risk averse in individual liability contracts.

Conclusions and Recommendation

The main important findings of this replication study with the original study are: First, dynamic incentive mechanism exerts a significant power in reducing risk-taking behavior for both individual-liability and joint-liability treatments. Second, in the absence of dynamic incentives, joint-liability treatments reduce loan defaults compared to an individual lending. Third, the combination of dynamic incentives and the joint-liability treatment enhances moral hazard through risky-taking, which is in line with the original study. In contrast to the finding by Giné et al. (2010), this study finds that all joint-liability contracts without dynamic incentives have no significant effect on the risky project choice, however, the original study finds that joint-liability treatments under communication without dynamic incentives significantly increases risk-taking behavior leading to higher defaults. It is indicated that communication may either promote higher efforts by mitigating the internal free-rider problem or lead to collusion.

Further, there is evidence that borrowers tended to be more risk-taking when they perceived that their partners also were risk-taking, suggesting that an investment decision of individuals in joint-liability contracts also depends on a risk preference of their co-borrowers.

Based on the results, this study forwards the following recommendations to sustain the financial cash flow of microfinance institutions: First, the joint-liability contract should be promoted with caution because even though joint-liability can achieve higher repayment rates, the combination of the joint-liability and dynamic incentives may enhance moral hazard through risk-taking. Second, in cases when the transaction costs in forming self-select groups are too high, the individual liability contract can be made (instead of joint-liability) but it should apply the dynamic incentive mechanism to promote higher repayment rates.

Conflicts of interest

The author declares that no conflict of interest exists.

Acknowledgments

I wish to thank the Thai Health Promotion Foundation for their funding support. I would also like to thank Ammar Siamwalla, Worawan Chandoevwit, and Suparee Boonmanunt for their extensive suggestions and comments.

References

Ahlin, C., & Townsend, R. M. (2007). Using repayment data to test across models of joint liability lending. *Economic Journal, 117*(517), F11–F51.

Armendáriz de Aghion, B., & Morduch, J. (2005). *The economics of microfinance*. Cambridge, MA: The MIT Press.

Besley, T., & Coate, S. (1995). Group lending, repayment incentives and social collateral. *Journal of Development Economics, 46*, 1–8.

Bolton, G., Ockenfels, A., & Stauf, J. (2015). Social responsibility promotes conservative risk behaviour. *European Economic Review, 74*, 109–127.

El-Komi, M., & Croson, R. (2013). Experiments in islamic microfinance. *Journal of Economic Behavior & Organization, 95*, 252–269.

Ghatak, M. (1999). Group lending, local information and peer selection. *Journal of Development Economics, 60*, 27–50.

Giné, X., Harikaya, T., Karlan, D., & Nguyen, B. T. (2006). *Evaluating microfinance program innovation with randomized control trails: An example from group versus individual lending* (ERD technical note No. 16). Manila, Philippines: Economic and Research Department, Asian Development Bank.

Giné, X., Jakiela, P., Karlan, D., & Morduch, J. (2010). Microfinance games. *American Economic Journal: Applied Economics, 2*, 60–95.

Kumar, N. (2012). Dynamic incentives in microfinance group lending: An empirical analysis of progressive lending mechanism. *SAGE Open, 2*, 1–9.

Meagher, P. (2013). *Microfinance regulation and supervision: Recommendations report (Technical Assistance Consultant's Report)*. Gold Coast, Australia: Asian Development Bank.

Morduch, J. (1999). The microfinance promise. *Journal of Economic Literature, 37*, 1569–1614.

Shapiro, D. (2015). Microfinance and dynamic incentives. *Journal of Development Economics, 115*, 73–84.

Stiglitz, J. E. (1990). Peer monitoring and credit markets. *The World Bank Economic Review, 4*, 351–366.

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review, 71*, 393–410.

Yunus, M. (2001). *Banker to the poor: The autobiography of Muhammad Yunus founder of the Grameen bank*. New York, NY: Oxford University Press.