Group versus individual liability: Short and long term evidence from Philippine microcredit lending groups[☆]

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ABSTRACT

Group liability in microcredit purports to improve repayment rates through peer screening, monitoring, and enforcement. However, it may create excessive pressure, and discourage reliable clients from borrowing. Two randomized trials tested the overall effect, as well as specific mechanisms. The first removed group liability from pre-existing groups and the second randomly assigned villages to either group or individual liability loans. In both, groups still held weekly meetings. We find no increase in short-run or long-run default and larger groups after three years in pre-existing areas, and no change in default but fewer groups created after two years in the expansion areas.

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1. Introduction

Group liability is often cited as a key innovation responsible for the expansion of access to credit for the poor in developing countries (Armendariz de Aghion and Morduch, 2010; Daley-Harris, 2009; Morduch, 1999). This contract feature purports to solve a credit market failure by mitigating adverse selection and moral hazard problems while facilitating mutual insurance. Under group liability, clients have an incentive to screen other clients so that only trustworthy individuals with good projects are allowed into the program. In addition, clients have incentives to make sure that funds are invested well and that effort is exerted. Finally, repayment enforcement is enhanced as clients face both legal and peer pressure. Thus, by effectively shifting the responsibility of certain tasks from the lender to the clients, group liability claims to overcome information asymmetries typically found in credit markets, especially for poor households without collateral.
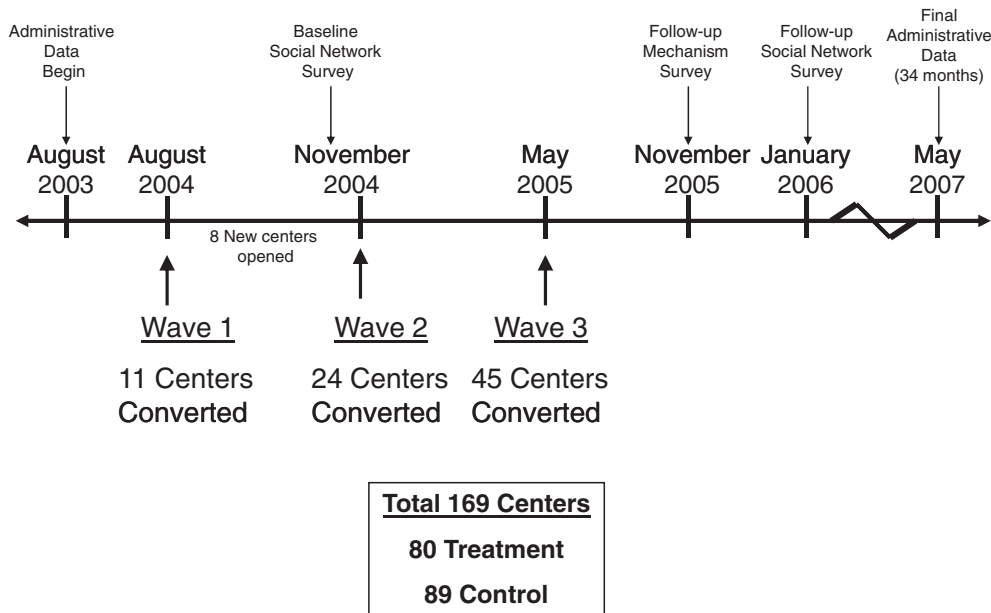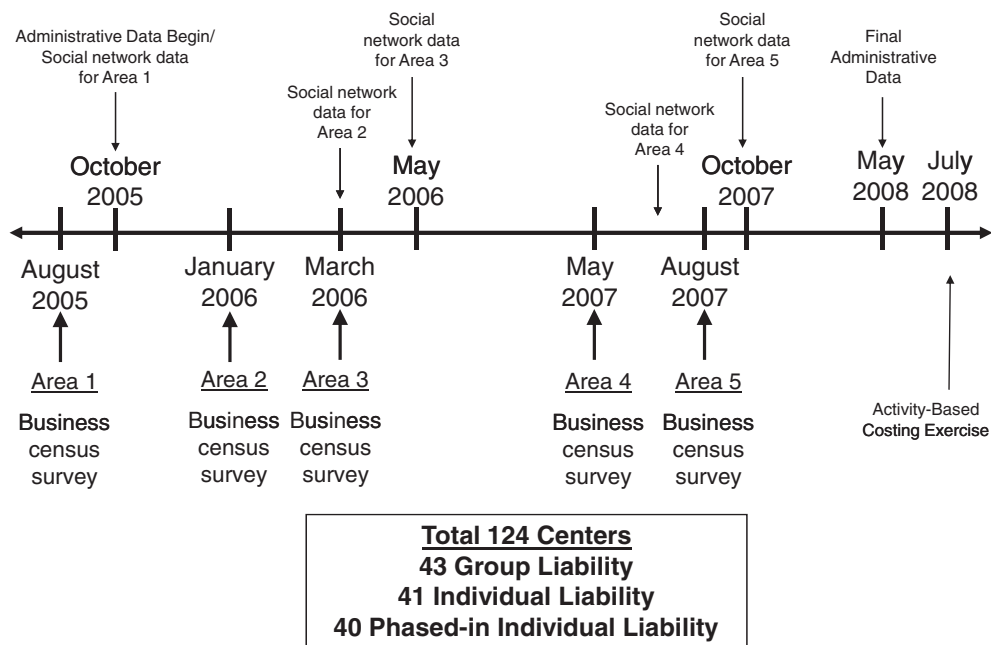
Fig. 1. Experimental design trial #1.

Fig. 2. Experimental design trial #2.

Group liability may also affect the interest rate charged by non-profit and for-profit institutions (De Quidt et al., 2012a) and certainly the *effective* rate paid by borrowers once the implicit "tax" from the group liability is taken into account. Although evidence on interest rate elasticities is scant, the existing evidence suggests elasticities that are sizeable (Attanasio et al., 2008; Karlan and Zinman, 2008, 2013). Measuring the elasticity of demand with respect to group versus individual liability is important both in order to understand the net "demand" effect of this crucial loan characteristic, but also for designing credit market policies to help deepen the quantity and quality of access to finance.

The basic empirical question of the relative merits of group versus individual liability has remained unanswered for many reasons of endogeneity. As Banerjee (2013) points out, merely comparing the performance of one product versus another, within or across lenders, fails to establish a causal relationship between the contract terms and outcomes such as repayment, selection, or welfare. There are countless unobserved characteristics that drive individual selection into one contract or the other, as well as institutional choices on what to offer, and how. Lenders typically chose the credit contract based on the context in which they operate. This may explain why the evidence on the relative performance of group liability contracts is inconclusive, as documented in the microfinance reviews of Morduch (1999), Armendariz de Aghion and Morduch (2010) and more recently Banerjee (2013).[1]

One solution for sidestepping endogeneity problems is to employ laboratory experiments. They have the advantage of allowing for

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[1] See also Adams and Ladman (1979) and Desai (1983). On anecdotal evidence on the limits to joint liability, see Matin (1997), Woolcock (1999), Montgomery (1996) and Rahman (1999).

Table 1A
Baseline summary statistics, conversion areas.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	Group liability	Individual liability	p-Value on t-test of difference: (2) − (3)	Treatment			p-Value on F-test for (5), (6) and (7)
					Wave 1	Wave 2	Wave 3	
Panel A. Center performance, pre-invention (Aug 2004)								
Total number of active accounts	20.23 (11.23)	20.26 (11.41)	20.19 (11.11)	0.964	20.73 (8.787)	18.67 (12.30)	20.78 (11.19)	0.914
Number of new clients (May–Aug 2004)	3.166 (4.681)	3.641 (5.242)	2.658 (3.969)	0.190	2.800 (4.614)	1.350 (2.277)	3.233 (4.353)	0.274
Number of dropout clients (May–Aug 2004)	1.603 (2.587)	1.551 (1.870)	1.658 (3.194)	0.802	1 (0.943)	0.700 (0.801)	2.256 (4.012)	0.124
Retention (May–Aug 2004)	0.904 (0.142)	0.900 (0.150)	0.909 (0.134)	0.685	0.944 (0.0600)	0.949 (0.0781)	0.883 (0.160)	0.282
Proportion of missed weeks over cycle (May–Aug 2004)	0.0603 (0.0807)	0.0541 (0.0743)	0.0677 (0.0876)	0.332	0.113 (0.138)	0.0542 (0.0609)	0.0633 (0.0828)	0.264
Past due (maturity)/scheduled total amortization due (in 100s)	0.0925 (1.080)	0.000 (0.000)	0.193 (1.561)	0.258	0.000 (0.000)	0.00471 (0.0216)	0.329 (2.040)	0.397
Past due (30 days)/scheduled total amortization due (in 100s)	0.000614 (0.00779)	0.000 (0.000)	0.00128 (0.0113)	0.298	0.000 (0.000)	0.00471 (0.0216)	0.000 (0.000)	0.082
Past due (90 days)/scheduled total amortization due (in 100s)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	–	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	–
Total loan amount	122,903.7 (87,159.1)	124,107.1 (96,987.8)	121,590.9 (75,608.8)	0.853	110,636.4 (59,129.1)	108,500 (71,551.4)	130,377.8 (81,005.1)	0.771
Average loan size	6033.8 (1998.2)	5997.2 (2021.4)	6073.7 (1985.1)	0.806	5196.8 (1569.5)	6030.0 (1879.0)	6308.5 (2095.8)	0.425
Number of other lenders, Nov 2007	3.673 (1.562)	3.776 (1.571)	3.563 (1.556)	0.411	3.548 (1.670)	3.600 (1.603)	3.556 (0.882)	0.876
Number of other lenders with individual liability program, Nov 2007	2.211 (1.523)	2.303 (1.479)	2.113 (1.573)	0.452	2.095 (1.635)	2.350 (1.565)	1.667 (1.323)	0.612
Number of other rural banks and NGOs, Nov 2007	1.653 (0.816)	1.763 (0.922)	1.535 (0.673)	0.0908	1.619 (0.661)	1.400 (0.681)	1.444 (0.726)	0.267
Number of other rural banks and NGOs with individual liability program, Nov 2007	0.537 (0.743)	0.605 (0.767)	0.465 (0.714)	0.253	0.405 (0.665)	0.600 (0.883)	0.444 (0.527)	0.525
Number of active centers, August 2004	161	85	76		11	21	44	
Number of centers in the sample	169	88	81		11	24	46	
Panel B. Individual-level performance, pre-intervention (Aug 2004)								
Proportion of missed weeks over cycle	0.062 (0.124)	0.059 (0.117)	0.065 (0.131)	0.324	0.083 (0.195)	0.065 (0.0917)	0.059 (0.113)	0.185
Indicator for having at least one missed week	0.483 (0.500)	0.467 (0.499)	0.501 (0.500)	0.190	0.343 (0.476)	0.557 (0.499)	0.537 (0.499)	0.000
Proportion of past due balance, at maturity date	0.080 (2.123)	0.040 (0.622)	0.125 (3.035)	0.439	0.000 (0.000)	0.0621 (0.612)	0.184 (3.839)	0.674
Past due balance, 30 days past maturity date (binary)	0.000668 (0.0259)	0.000 (0.000)	0.001 (0.0378)	0.286	0.000 (0.000)	0.00820 (0.0905)	0.000 (0.000)	0.010
Total excess savings	319,924.5 (2,814,998.3)	286,583.4 (2,336,838.7)	357,940.0 (3,277,516.7)	0.625	223,869.7 (896,716.4)	216,725.5 (638,886.3)	441,811.5 (4,113,395.3)	0.740
Loan amount	6107.2 (3747.8)	6143.6 (3805.6)	6069.1 (3687.3)	0.570	5558.4 (3164.3)	5772.7 (3801.0)	6368.7 (3776.8)	0.003
Number of active clients, August 2004	3285	1708	1577		298	394	885	

In Panel A, the number of active centers is less than 169 in August 2004 because there are 8 centers that started after the first conversion and added to the sample. p-Values reported in Column (4) are the probability of (Column (2) − Column (3)) being zero. p-Values in Column (8) are the probability that each treatment wave is jointly equal to zero. The associated F-statistic comes from a regression of the outcome variable of interest on a set of indicator variables for each of the treatment waves. The exchange rate at the time of the experiment was 52 pesos = US$1. Standard deviations are in parentheses.

many contract structures to be tested one at a time, in the same setting. Work along these lines includes Abbink et al. (2006), Cassar et al. (2007), Fischer (2013), and Giné et al. (2010). Of these, Fischer (2013) and Giné et al. (2010) are closest to the field setting studied here. Aside from these laboratory experiments, we still lack thus far good evidence that isolates the relative importance of group liability vis à vis the other mechanisms, such as dynamic incentives, regular public repayments, etc., found in "group lending" schemes. Quoting Armendariz de Aghion and Morduch (2010), "The best evidence would come from

well-designed, deliberate experiments in which loan contracts are varied but everything else is kept the same."

This is precisely the goal of the paper. We use two randomized control trials conducted by the Green Bank of Caraga in the Philippines to evaluate the efficacy of group liability relative to individual liability on the monitoring and enforcement of loans. We test whether the removal or absence of group liability, while keeping all other aspects of the group lending program, leads to higher or lower repayment rates, client retention and to changes in group cohesion.

Table 1B
Baseline summary statistics, new areas.

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Group liability	Individual liability	Phased-in individual liability	p-Value on t-test of difference: (2) − (3)	p-Value on t-test of difference: (2) − (4)
Panel A: All barangays identified as feasible						
Total number of businesses	110.347	103.047	118.902	109.425	0.480	0.764
	(8.976)	(14.674)	(16.955)	(15.257)		
Average weekly business revenue (in 1000 pesos)	2.112	2.233	2.084	2.010	0.554	0.361
	(0.099)	(0.181)	(0.172)	(0.160)		
Proportion of business owners who want to borrow now	0.465	0.438	0.490	0.469	0.132	0.410
	(0.014)	(0.026)	(0.022)	(0.026)		
Average number of household members involved in businesses	0.858	0.876	0.897	0.797	0.865	0.529
	(0.049)	(0.089)	(0.081)	(0.087)		
Average number of non-household members involved in businesses	0.138	0.154	0.124	0.134	0.397	0.569
	.01373	(0.026)	(0.023)	(0.022)		
# of barangay		43	41	40		
Panel B: Barangays identified feasible and entered by Green Bank						
Total number of businesses	83.338	81.630	98.217	66.889	0.495	0.465
	(9.173)	(15.042)	(19.252)	(9.374)		
Average weekly business revenue (in 1000 pesos)	2.087	2.186	2.048	1.989	0.689	0.592
	(0.140)	(0.246)	(0.234)	(0.249)		
Proportion of business owners who want to borrow now	0.404	0.385	0.456	0.366	0.083	0.661
	(0.017)	(0.028)	(0.029)	(0.031)		
Average number of household members involved in businesses	1.014	1.053	0.947	1.041	0.478	0.940
	(0.061)	(0.110)	(0.095)	(0.115)		
Average number of non-household members involved in businesses	0.161	0.174	0.120	0.192	0.322	0.763
	(0.023)	(0.038)	(0.037)	(0.044)		
# of barangay		27	23	18		

Panel A includes all barangays (villages) identified as feasible by Green Bank staff. Panel B reports on only those barangays where a center was created. Data comes from the enterprise census. p-Values reported in Column (5) are the probability of (Column (2) − Column (3)) being zero. p-Values in Column (6) are the probability of (Column (2) − Column (4)) being zero. The exchange rate at the time of the experiment was 52 pesos = US$1. Standard errors are in parentheses.

Throughout this paper we maintain an important distinction between "group liability" and "group lending". "Group liability" refers to the term of the credit contract whereby individuals are both borrowers and simultaneously guarantors of other clients' loans in the same group. "Group lending" merely means there is some group aspect to the lending process or program, perhaps only logistical, like the sharing of a common meeting time and place to make payments. Indeed, this group process may help the lender lower its transaction costs (by consolidating and simplifying loan disbursal and collection logistics) while possibly maintaining some but not all of the peer screening, monitoring or enforcement elements due to reputation and shame.

In the first trial, half of Green Bank's existing group-lending centers in Leyte, an island in central Philippines, were randomly converted to individual liability but maintained all other features of group lending. This implies that the clients already receiving loans at the time of the conversion had been already screened using group liability. As a result, we examine whether after the peer screening, group liability has any additional effect on the mitigation of moral hazard through improved monitoring or enforcement.

This design allows us to separate selection from moral hazard, one of the most difficult empirical challenges when studying information asymmetries in credit markets.[2] The "surprise" factor of this design, created by generating a sample of borrowers that select under one contract regime but then monitors and enforces repayment under another, allows for a cleaner test of theory than offering one method to some individuals and another method to other individuals. This is useful both academically and practically in the design of products. However, it also limits the immediate policy prescriptions since the treatment can only inform existing group liability lenders about the efficacy of switching to individual liability. For example, individuals selected under group liability may be different (e.g., safer) than those selected under individual liability. Indeed, if group liability only worked through this selection effect (Ghatak, 1999, 2000), then removing the joint liability would have no additional effect on baseline ("surprise") clients. For this reason, we also present results from members that joined the program after the removal of the joint liability clause and conduct a second trial as the Green Bank of Caraga expands into new areas.

In this second trial, villages were randomly assigned to be offered either centers with group liability, centers with individual liability or centers with phased-in individual liability (centers that would start with group liability and then convert to individual liability after successful completion of one loan cycle). This experiment combines selection, monitoring and enforcement and therefore evaluates the overall effect of the liability structure on all three mechanisms. It is thus less precise in testing specific mechanisms, but more policy-relevant in that the intervention is replicable without engaging in ongoing "surprises".

For the first trial we collected data over three years (a total of nine loan cycles if a client continuously borrows). We find no change in repayment for those centers converted to individual liability, and we are able to estimate this nil effect accurately. We also find higher client growth in converted centers driven by a higher probability that new clients remain in the program. New members in converted centers are less likely to know existing members but do not have higher default rates. Loan sizes for all clients are however smaller, with no increase in overall disbursement. To avoid a confound in default rates from the lower loan size rather than the liability per se, we also examine the initial "hump" loan which was disbursed prior to the conversion to individual liability but was due after the conversion and still find no change in default.

We note that by shifting the responsibility back to the bank, individual liability likely resulted in behavioral changes of *both* clients and bank staff. Both are important, and so our results should be interpreted as the net effect of both behavioral responses. Although the theoretical literature on microfinance has typically abstracted from the role of bank staff, we provide here some evidence of their behavior. In net, credit officers did not spend more time in converted centers. We thus conclude that individual liability did not worsen overall profitability but that it led to higher client growth. In auxiliary data collected on internal procedures, we find direct evidence that individual liability leads to less monitoring of each other's loan (although as noted, this lowered monitoring does

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[2] See Karlan and Zinman (2009) for an interest rate experiment which also separately identifies adverse selection and moral hazard in a South Africa credit market.

Table 2A
Institutional impact at the loan cycle level, conversion areas.

Explanatory variable	(1) Proportion of missed weeks	(2) Indicator for having at least one missed week	(3) Proportion of past due balance, at maturity date	(4) Indicator for having past due, at maturity date	(5) Proportion of past due balance, 30 days after maturity date	(6) Indicator for having past due, 30 days after maturity date	(7) Total excess savings	(8) Loan size
Panel A: Baseline clients								
All loans								
Individual liability	0.005	−0.004	−0.001	0.008	−0.000	0.011	−309.973**	−924.722***
	(0.014)	(0.034)	(0.001)	(0.012)	(0.001)	(0.011)	(131.414)	(317.470)
Observations	14,333	14,333	14,333	14,333	14,182	14,182	14,333	14,333
R-squared	0.102	0.099	0.036	0.227	0.024	0.243	0.303	0.166
Mean of dependent variable	0.075	0.430	0.002	0.045	0.001	0.031	842.3	6844.4
'Hump' loans only: disbursed before and matured after the conversion date								
Individual liability	0.003	0.012	−0.001	0.006	−0.000	−0.000	−51.803*	−540.902
	(0.015)	(0.052)	(0.001)	(0.009)	(0.000)	(0.000)	(28.772)	(359.792)
Observations	2985	2985	2985	2985	2985	2985	2985	2985
R-squared	0.158	0.130	0.010	0.033	0.006	0.006	0.061	0.202
Mean of dependent variable	0.073	0.445	0.001	0.010	0.000	0.000	248.3	7947.0
Panel B: New clients								
Individual liability	0.005	0.006	−0.002	0.013	−0.000	0.025	−239.652	−817.838***
	(0.006)	(0.025)	(0.001)	(0.019)	(0.001)	(0.018)	(170.740)	(195.273)
Observations	6049	6049	6049	6049	5662	5662	6046	6049
R-squared	0.096	0.110	0.016	0.093	0.014	0.114	0.063	0.068
Mean of dependent variable	0.069	0.385	0.008	0.168	0.003	0.129	1895.4	5284.3

Treatment variable equals one if the loan cycle ends after the conversion in treatment centers; zero otherwise. All regressions use fixed effects for each credit officer and month of the maturity date. The sample frame for Panel A is baseline clients, i.e., those who were active at the first conversion in August 2004; the sample frame for Panel B is new clients, i.e., those who joined the program after August 2004 in the control group or after the conversion in each of the treatment groups. The sample size for Columns (5) and (6) are smaller because these regressions exclude loans that matured within the past 30 days. Proportion of missed weeks is calculated by the number of weeks in which the client did not make the full install-ment divided by the number of installments for completed loan cycles (i.e., excluding active loans). Total excess savings is defined by the excess amount of savings that the client deposits beyond the required savings amount over a loan cycle (the value takes zero if the total deposit does not reach the required savings amount). Robust standard errors clustered by lending centers in parentheses.
 * Significant at 10%.
 ** Significant at 5%.
 *** Significant at 1%.

not lead to higher default). Lastly, we find that those with weaker social networks prior to the conversion are more likely to experience default problems after conversion to individual liability, relative to those who remain under group liability.

In the second trial, on new areas, we find no statistically or econom-ically significant difference in repayment rates across any of the three groups. We do however find that credit officers are less likely to create groups under individual liability, and qualitatively this is reported to us as caused by unwillingness of the credit officer to extend credit with-out guarantors in particular areas.

The adverse selection story of Ghatak (1999, 2000) is consistent with results from baseline clients in the first trial but not consistent with the lack of default among members that joined after neither the conversion nor the results from the second trial. So what else could be driving the results? One explanation is that the liability structure may not have affected repayment in either trial because credit groups had enough social capital to ensure that members would informally insure each other anyway (De Quidt et al., 2012b; Feigenberg et al., 2013). Put differently, peer pressure without legal pressure may have been suf-ficient. Breza (2013) makes this point using data from a microfinance institution before and after a mass default episode in southern India. She finds that when collections eventually resumed, individuals in groups where other members were closest to receiving a new loan were more likely to repay even after the suspension of joint liability. In a related paper, Giné et al. (2011) exploits a fatwa issued by Muslim organization that forced Muslims to default on their microfinance loans. Focusing on borrowers with multiple loans from groups of differing densities of Muslims, they find evidence in favor of the hypothesis of

Besley and Coate (1995) that borrowers that would otherwise repay under individual liability decide to default strategically when they can-not cover the total group repayment. Indeed, borrowers tended to de-fault on loans from groups with relatively more Muslims, where the repayment burden was higher. As in Breza (2013), the strategic default could be driven by peer pressure rather than joint liability per se. But while 80% of the credit groups had repayment rates of either 0 or 100%, a clear indication of strategic default, only 20% of the neighbor-hoods did, suggesting that joint liability operating at the group (but not neighborhood) level played a role rather than peer pressure that may have operated both at the group and neighborhood levels.

More generally, institutions may use several instruments to mini-mize default, such as group meetings with public repayment, frequent installments, increasing loan sizes, etc. and thus relaxing any one of them, may not have any marginal effect on repayment behavior or on other outcomes.

Attanasio et al. (2011) conducted a field experiment in Mongolia similar to our second trial but one in which other contract features changed alongside the liability structure. For example, individual loans had collateral requirements and repayment was done at the branch rather than in group meetings. This makes comparison to our results more difficult, however they also find no difference in repayment rates. Carpena et al. (2012) studies a conversion similar to that of our first trial but in the opposite direction: a microfinance institution in India switched from individual to joint liability loans. Unfortunately for the sake of comparing cleanly to the result here, other contract fea-tures changed as well, including the interest rate, installment amounts and mode of payment. As a result, the reduction in missed payments

Table 2B
Institutional impact at the loan cycle level, new areas.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Proportion of missed weeks	Indicator for having at least one missed week	Proportion of past due balance, at maturity date	Indicator for having past due, at maturity date	Proportion of past due balance, 30 days after maturity date	Indicator for having past due, 30 days after maturity date	Loan size
Panel A: All cycles							
Individual liability	−0.004	0.002	−0.005	−0.018	−0.002	−0.018	−139.556[***]
	(0.016)	(0.054)	(0.006)	(0.026)	(0.004)	(0.014)	(177.596)
Phased-in individual liability	−0.001	0.067	−0.004	−0.010	−0.004	−0.015	−237.521
	(0.016)	(0.054)	(0.006)	(0.026)	(0.004)	(0.013)	(179.535)
Number of observations	4869	4869	4869	4869	4704	4704	5356
R squared	0.151	0.227	0.115	0.138	0.123	0.187	0.138
Mean of dependent variable	0.098	0.493	0.023	0.122	0.014	0.068	4390.067
Panel B: All cycles, controlling for baseline loan size							
Individual liability	−0.002	0.003	−0.005	−0.017	−0.002	−0.017	35.678
	(0.016)	(0.054)	(0.006)	(0.026)	(0.004)	(0.014)	(128.479)
Phased-in individual liability	0.001	0.068	−0.004	−0.010	−0.003	−0.014	31.713
	(0.016)	(0.054)	(0.006)	(0.026)	(0.004)	(0.013)	(140.579)
Number of observations	4869	4869	4869	4869	4704	4704	5356
R squared	0.153	0.227	0.115	0.138	0.123	0.187	0.470
Mean of dependent variable	0.098	0.493	0.023	0.122	0.014	0.068	4390.067
Panel C: First cycle only							
Individual liability	−0.002	0.023	0.002	−0.013	0.002	−0.011	−139.239
	(0.015)	(0.053)	(0.007)	(0.035)	(0.005)	(0.016)	(144.602)
Phased-in individual liability	0.002	−0.005	−0.003	−0.011	−0.004	−0.009	−232.650[**]
	(0.017)	(0.062)	(0.006)	(0.030)	(0.005)	(0.014)	(110.370)
Number of observations	2137	2137	2137	2137	2112	2112	2207
R squared	0.274	0.332	0.258	0.211	0.254	0.258	0.236
Mean of dependent variable	0.086	0.420	0.024	0.125	0.015	0.072	3685.998
Panel D: Second cycle and after							
Individual liability	−0.013	−0.037	−0.013	−0.030	−0.007	−0.031[*]	−303.452
	(0.020)	(0.066)	(0.008)	(0.026)	(0.004)	(0.016)	(218.557)
Phased-in individual liability	−0.002	0.097	−0.006	−0.009	−0.004	−0.020	−254.054
	(0.020)	(0.064)	(0.008)	(0.031)	(0.005)	(0.018)	(223.441)
Number of observations	2732	2732	2732	2732	2592	2592	3149
R squared	0.120	0.175	0.032	0.121	0.017	0.184	0.099
Mean of dependent variable	0.107	0.551	0.023	0.119	0.013	0.064	4883.519

All regressions use fixed effect for credit officers and months of maturity dates. Panel A reports on all loan cycles, Panel B uses the first loan while Panel C uses subsequent loans. Robust standard errors clustered by lending centers in parentheses.
  * Significant at 10%.
 ** Significant at 5%.
*** Significant at 1%.

found in converted groups may have been caused by the combination of different contract terms changing simultaneously.

The rest of the paper proceeds as follows. Section 2 reviews recent trends in microfinance and the theoretical literature on the liability structure. Section 3 presents the experimental design of both trials. Section 4 discusses the empirical strategy and the main results. Then, Section 5 provides additional results on specific mechanisms and social networks. Finally, Section 6 concludes.

2. Background

2.1. Microfinance trends

In recent years, some micro-lenders, such as the Association for Social Advancement (ASA) in Bangladesh, have expanded rapidly using individual liability loans but still maintaining group meetings for the purpose of coordinating transactions. Others, like BancoSol in Bolivia, have converted a large share of its group liability portfolio into individual

Table 3A
Institutional impact at the center level, conversion areas.

Panel A: Center growth	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Active accounts	New accounts	Retention rate	Number of dropouts	Loan Disbursement	Coefficient of variation of loan amount
Specification	OLS	OLS	OLS	OLS	OLS	OLS
Individual liability	2.828**	0.840***	0.025	0.199	3566.337	−0.021
	(1.396)	(0.263)	(0.016)	(0.332)	(9934.659)	(0.024)
Mean of dependent variable	15.36	2.51	0.80	3.16	98387.23	0.44
Observations	2507	2017	2017	2017	2507	2130
Number of centers	169	169	169	169	169	169
R-squared	0.21	0.06	0.28	0.18	0.25	0.09

Panel B: Center dissolution			
Dependent variable:		Dissolved center	
Specification:		OLS	Probit
Individual liability		−0.013	−0.137*
		(0.012)	(0.078)
Mean of dependent variable		0.03	0.37
Observations		2017	169
Number of centers		169	
R-squared		0.080	

"Treatment" is an indicator variable equal to one if the center has been converted for a given observation. All regressions except Panel B, Column 2 use fixed effects for credit officers and months of maturity dates, and standard errors are clustered by lending centers. Every center has an observation on each outcome for every three month between August 2003 and May 2007. Panel B, Column 6 uses fixed effects for credit officers and reports the marginal effects for the coefficient on treatment. Total loan amount is the aggregated loan amount disbursed in a center, and average loan amount is the average loan size per client. Both numbers are in pesos (1 US $ = 52 pesos). Panel A, Columns 2–4 excludes centers that had been dissolved in the previous time periods; the sample for Panel A, Column 1 is active centers in which there are matured accounts in each time period. Robust standard errors are in parentheses.

  * Significant at 10%.
 ** Significant at 5%.
*** Significant at 1%.

liability lending. Even the Grameen Bank in Bangladesh, whose founder Mr. Yunus won the 2006 Nobel Peace Prize, relaxed the group liability clause in the Grameen II program by allowing defaulters to renegotiate their loans without invoking group pressure (Dowla and Barua, 2006). Many of these groups (e.g., ASA) have made this shift while still preserving the group meetings, as group meetings have been shown to be beneficial in theory (Rai and Sjostrom, 2013) and in practice (Feigenberg et al., 2013).[3]

Naturally many organizations remain using group liability, and many new organizations opt for group liability (including, for example, organizations as diverse as the self-help groups in India and Grameen USA). Anecdotes of course are easier to come by than systematic data on contract choice. This is complicated by the fact that many group liability lenders do not enforce the liability, thus blurring any categorization based on the liability structure.

The most cited source on the relative importance of the lending methodology among microfinance institutions is the MIX data (Cull et al., 2009). However, it defines group lending based on the mode of delivery rather than the use of group liability. As a result, many institutions that use group meetings to disburse and collect repayment could indeed do so while employing individual liability loans, not group liability loans. With this caveat, the fraction of institutions in the MIX data using individual lending rose from 25.8% in 2007 to 36.6% in 2009. The fraction of institutions that use group lending fell from 22.6% in 2006 to 13.4% in 2009. Finally, institutions that offered loans under both lending methodologies remained stable at around 50%.

According to De Quidt et al. (2012a), the relative rise in individual liability lending can be explained by the recent shift from non-profit toward for-profit lenders. The intuition is that for-profit firms may find individual liability more profitable as they do not need to compensate borrowers for the implicit tax from group liability. Non-profit lenders, in contrast, would offer the efficient joint liability contracts as they maximize social welfare.

2.2. Theoretical considerations

The theoretical literature has almost exclusively focused on the repayment problem, taking the view that lenders are too weak to enforce repayment.[4] The models of Stiglitz (1990) based on ex-ante moral hazard, and of Ghatak (2000) based on adverse selection show how group liability contracts can be used to provide incentives to group members to achieve higher repayment. In the presence of ex-ante moral hazard, joint liability can induce borrowers to take the safe investment option thus lowering the interest rate. In the presence of adverse selection, joint liability encourages the assortative matching of borrowers by type. Even when lenders only offer one contract with a single liability amount and interest rate, relatively safe borrowers will prefer to join other safe borrowers as the liability "tax" will be paid relatively infrequently. In contrast, riskier borrowers will pay it more often.

In the context of ex-post moral hazard, Besley and Coate (1995) show that borrowers may impose powerful non-pecuniary social sanctions to enforce repayment. However, they also point out that borrowers who would repay under individual liability may not do so under group liability if successful borrowers cannot repay the debt obligations of unsuccessful ones. In this situation, no further loans will be granted and thus members that could otherwise repay decide to default.

In this context, Rai and Sjostrom (2004) shows that both individual and group liability alone can be dominated by a contract that elicits truthful revelation about the success of the peers' project. The bank uses cross-reports to discriminate between willful and involuntary defaults, imposing non-pecuniary punishments to members that default willfully. In practice however, it is unclear whether credit officers elicit cross-reports from borrowers about each other's repayment ability, even when public repayment meetings take place (Banerjee, 2013).

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[3] Feigenberg et al. (2013) find that weekly rather than monthly meetings lead to increased risk sharing and social interaction outside of meetings.

[4] This literature builds on a contract theory literature from the early 1990s that studied when a principal should contract with a group of agents to encourage side-contracts between them as opposed to contracting individually with each agent. Examples of this literature include, but are not limited to Holmstrom and Milgrom (1990), Varian (1990) and Arnott and Stiglitz (1991).

Table 3B
Institutional impact at the center level, new areas.

Panel A: Center growth (OLS)

	(1)	(2)	(3)	(4)	(5)	(6)
Sample restriction	Villages entered	All villages	Villages entered	Villages entered	All villages	Villages entered
Dependent variable	Active accounts	Active accounts	Number of dropouts	Loan disbursement	Loan disbursement	Coefficient variation of loan amount
Fixed effects	Credit officers & time	Branch & time	Credit officers & time	Credit officers & time	Branch & time	Credit officers & time
i. All cycles						
Individual liability	−1.111	−4.603	−0.490	−4752.657	−16,507.088	−0.039**
	(2.024)	(3.240)	(1.313)	(5771.786)	(10,932.061)	(0.019)
Phased-in individual liability	−0.267	−6.796**	−0.930	−3382.424	−23,697.554**	−0.037
	(2.073)	(3.301)	(1.449)	(6114.229)	(11,165.225)	(0.028)
Mean of dependent variable	13.32	6.48	10.10	35,052.11	17,057.45	0.25
Number of observations	637	1309	430	637	1309	498
R squared	0.29		0.27	0.17		0.30
ii. 1st cycle only						
Individual liability	−1.071	−4.276***	0.514	283.389	−4546.128***	−0.000
	(1.178)	(0.413)	(0.434)	(1812.303)	(1238.885)	(0.019)
Phased-in individual liability	−0.438	−4.314***	0.369	−193.932	−10,758.573***	0.040
	(1.295)	(0.419)	(0.313)	(1605.058)	(1227.969)	(0.027)
Mean of dependent variable	6.71	4.55	1.34	7699.35	5161.01	0.15
Number of observations	633	934	404	612	913	324
R squared	0.29		0.21	0.26		0.29
iii. 2nd cycle and after						
Individual liability	−0.057	−1.840	−1.209	−4740.906	−19,073.315***	−0.068***
	(0.948)	(1.675)	(1.205)	(4325.853)	(1753.286)	(0.022)
Phased-in individual liability	0.163	−3.042*	−1.450	−2049.841	−15,156.451***	−0.072**
	(0.839)	(1.700)	(1.419)	(4941.040)	(1747.800)	(0.030)
Mean of dependent variable	6.99	4.67	9.07	22,595.17	14,875.37	0.26
Number of observations	606	907	419	580	881	362
R squared	0.25		0.25	0.23		0.24

Panel B: Center creation and dissolution (probit)

Dependent variable	Created	Dissolved
Individual liability	−0.054	0.155
	(0.096)	(0.115)
Phased-in individual liability	−0.168*	0.089
	(0.088)	(0.135)
Number of observations	124	77
R squared	0.286	0.319

Regressions in Panel A use fixed effects for credit officers and months of maturity dates, and standard errors are clustered by lending centers. In Columns (1)–(2), every center has an observation on each outcome for every three months between center opening and August 2008. In Columns (3) and (6), only active center has an observation on the outcome for every three month. Note that the number of dropouts is not calculated for the initial three month after center opening (hence the smaller sample size). Regressions in Col (1)–(3) in Panel A and B control for the number of active accounts in the previous time period. Robust standard errors are in parentheses.
 * Significant at 10%.
 ** Significant at 5%.
 *** Significant at 1%.

Chowdhury (2005) studies a similar ex-ante moral hazard setup to assess the role of sequential lending as originally introduced by the Grameen Bank. He compares a setup where borrowers in a group do not all get the loan at the same time but sequentially and a setup with monitoring by the lender combined with joint liability. Both setups make group-lending contracts feasible. Despite being less efficient than peer monitoring, if monitoring by the lender is not too costly, then contracts that stipulate only monitoring by the lender may also be feasible, such as the individual liability contract of the Green Bank of Caraga in the Philippines studied here (and put forward by ASA in Bangladesh), which keeps the group "logistical" aspects of the program but removes the joint liability.[5] All in all, in the presence of market imperfections joint liability has benefits as well as costs and so it will be the best solution in some contexts but not in others.

Thus far the focus has been on repayment although other outcomes such as the ability to retain good borrowers and attract new ones are equally important to assess overall profitability. Indeed, an institution with perfect repayment may be less profitable than another with lower repayment but a larger client base. Although far less explored theoretically, there are reasons to believe that group liability may lead to lower client retention compared to individual liability.

Group liability, for example, may cause tension among clients that may lead to voluntary dropouts and the destruction of social capital among members, which is particularly important for the existence of safety nets. In addition, group liability may be more costly for clients that are good risks because they are often required to repay the loans of their peers. This may again lead to higher dropout and more difficulty in attracting new clients. Finally, as groups mature clients typically diverge in their demand for credit. Heterogeneity in loan sizes can cause tension within the group as clients with smaller loans are reluctant to serve as a guarantor for those with larger loans. In sum, while repayment may improve under group liability, outreach to otherwise

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[5] In related papers, Madajewicz (2011) and Conning (2005) study when monitoring is best done by the lender and when it is best left to the peers. They both find that wealthier clients prefer individual liability loans because given their deeper pockets they would cover their poorer peers more often under joint liability. We cannot test the validity of this prediction because in this field experiment, loans are not backed by any form of physical collateral, so comparable (and relatively poor) borrowers are subject to one or the other form of liability.

Table 4
Activity-based costing analysis: time spent on different activities by center.

	(1) Time on expansion	(2) Time on reloan	(3) Time on expansion/reloan	(4) Time on repayment activities	(5) Time on loan monitoring	(6) Time on following up with delinquent clients	(7) Time on loan enforcement
Panel A: Conversion areas							
Individual liability	0.927	11.438	12.365	−2.374	−4.712	−4.347	−7.696***
	(1.812)	(10.464)	(9.999)	(12.882)	(4.187)	(3.405)	(4.369)*
Mean of dependent variable	3.04	29.47	32.51	155.88	10.43	9.50	12.18
Observations	146	146	146	146	146	146	146
R-squared	0.00	0.11	0.11	0.23	0.09	0.07	0.08
Panel B: New areas							
Individual liability	−1.957	−60.142	−61.561	90.086**	−9.715	20.963	9.110
	(1.866)	(41.156)	(42.037)	(36.120)	(6.648)	(14.635)	(7.463)
Phased-in individual liability	−1.419	−25.512	−26.704	12.932	−9.043	10.603	5.904
	(2.090)	(45.302)	(46.272)	(40.455)	(7.446)	(16.392)	(8.358)
Mean of the dependent variable	0.682	51.091	51.773	108.273	9.409	17.455	8.159
Number of observations	44	44	44	44	44	44	44
R-squared	0.201	0.207	0.208	0.290	0.418	0.245	0.171

Each cell reports the average time in minutes spent on an indicated activity per center in a given week in January 2006. Expansion includes marketing activities, orientation for potential clients, and conducting trainings for new clients. Reloan includes conducting credit evaluation, filling/reviewing of loan forms, and releasing the loan. Repayment includes preparing for center meetings, travel time, center meetings, and handling the collection. Monitoring involves making reports, answering clients' questions; enforcement includes loan utilization check and following up with delinquent clients. Robust standard errors are in parentheses. All regressions use fixed effect for credit officers.

   * Significant at 10%.
  ** Significant at 5%.
 *** Significant at 1%.

profitable and credit constrained clients may be smaller, so the effect on lender's overall profitability and the poor's access to financial markets is ambiguous.

3. Experimental design and data collected

3.1. Trial #1: Experimental design in pre-existing areas

The Green Bank of Caraga, a for-profit, regulated rural bank operating in the Philippines, conducted a field experiment in which they removed the group liability component of their Grameen-style[6] group liability program, called BULAK, in 2004.[7] Typically a lending center starts with 15–30 individuals residing in the same barangay (community). Centers grow in size as demand increases, without predetermined maximum sizes. Within each center, members divide into groups of five. Under the normal group liability system, those in the group of five are the first layer of liability for any default. Only if those five fail to pay the arrearage of an individual is the center as a whole responsible for an individual. New members joining an existing center are also assigned into groups after mutual agreement is reached. If there are enough new members to form a new group of five, they may do so. This trial was conducted on the island of Leyte, and all 169 centers on the island were included in the sample frame.

All loans under the BULAK program are given to micro-entrepreneurial women for their business expansion. The initial loan

is between 1000 and 5000 pesos (roughly $18–$90). The increase in loan size depends on repayment of their last loan, attendance at meetings, business growth, and contribution to their personal savings. The interest rate is 2.5% per month, calculated over the original balance of the loan. The client has between 8 and 25 weeks to repay the loan, but payments must be made on a weekly basis during the center meeting.

As part of the BULAK program, clients are also required to make mandatory savings deposits at each meeting. At loan disbursal, each member deposits 100 pesos plus 2% of the loan amount into savings. In addition, each member must pay an additional 10% of their weekly due amount (principal plus interest) into their individual savings account. Member savings may be used to repay debts and also act as collateral, although in this last case there are no fixed rules. Finally, 20 pesos ($0.18) per meeting are required for the group and center collective savings account (10 pesos for the group and 10 pesos for the center savings accounts). The center savings cover mostly the construction of the center meeting building (a small house or hut in the village) and other center activities, or as a last resort to repay member loans if the center is being dissolved and default remains.[8] The group savings is held as collateral to cover arrearage within each group.

In the first trial, the Green Bank randomly converted *existing* centers with group liability loans to individual liability loans. Clients were informed that group liability would no longer be enforced but were told that all other aspects of the program remained the same (including attendance at center meetings and weekly payment made in groups).[9] Clients were not told that this was an experiment, and thus had no

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[6] This is a Grameen "style" program since the bank conducts some basic credit evaluation, and does not rely entirely on peer selection. The bank's evaluation steps include essentially two components: physically visiting the business or home to verify the presence of the enterprise and its size, and an assessment of the repayment capacity of borrowers based on the client-reported cash-flows of their enterprise.

[7] Bulak ("flower" in Tagalog) stands for "Bangon Ug Lihok Alang sa Kalambuan", meaning "Strive for Progress."

[8] In our observation, this never occurred.

[9] Although the choice was effectively voluntary (a group could complain about the switch and remain with group liability), no group complained. Researchers often observed groups clapping when the announcement was made.

Table 5
Center activities, conversion areas.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Anniversary		Christmas parties	
	Total penalties	Total enforced penalties	No activity	Likelihood of having a party	Amount spent, conditional on having a party	Likelihood of having a party	Amount spent, conditional on having a party
	OLS	OLS	Probit	Probit	OLS	Probit	OLS
Sample framework: Wave 2 and 3 centers only							
Individual liability	−10.095*	−9.548*	−0.004**	−0.066***	−582.518	−0.002	−695.057*
	(5.583)	(5.613)	(0.059)	(0.096)	(871.233)	(0.076)	(396.256)
Mean of dependent variable	47.85	47.58	0.12	0.46	2047.93	0.76	1218.34
Standard error of dependent variable	2.94	2.96	0.03	0.04	438.30	0.04	198.92
Observations	131	131	131	131	60	131	99
R-squared	0.19	0.20			0.30		0.14

Penalties include not attending, leaving early from, being late to the meeting, and missing payments. All regressions use fixed effect for credit officers. Sample contains wave 2 and 3 centers only because data was collected during social network survey. Standard errors are in parentheses.
 * Significant at 10%.
 ** Significant at 5%.
 *** Significant at 1%.

information from the bank to suggest that a failure to repay could lead to a reversal of the change. Besides the group liability, the savings rules also changed.[10] By removing the group liability, no member is held liable for another member's default. Thus, members are no longer forced to contribute toward the repayment of other members in default and no longer required to sign as co-maker of others' loans. This allows us to isolate the impact of group liability by comparing the behavior of *existing* clients in group-liability centers and converted centers.

It is important to note that although this change removed the group liability rules, it did not remove all social influences on repayment. Group payments were still done at the weekly meeting. After the conversion, group meetings did not include a discussion or review of who was in default, but the fact that all were at the meeting provided ample opportunity for people to learn of each other's status. Thus, many clients may still repay not out of social pressure, but rather out of concern for their social reputation (De Quidt et al., 2012b; Rai and Sjostrom, 2013). One's reputation is important, for instance, in order to secure informal loans in the future from their peers, outside the scope of the lending program.

The second change concerned the savings policy. At the time of conversion, the group and center savings were dissolved and shifted into individual savings accounts. The total required savings deposits remained the same.[11] With the conversion of group and center savings into individual savings, there no longer were funds set aside to pay for center activities and had to be paid from individual accounts on a per-activity basis. In January 2006, 2 years after the conversion to individual liability the Green Bank removed the group savings requirement and increased the mandatory savings toward personal savings account to 20% of weekly amortization for all clients, both treatment and control. Thus from 2006 onwards, all center activities, were paid out of individual accounts.

Our sample includes 169 BULAK centers in Leyte, handled by 11 credit officers in 6 branches. Among these, 161 had been created before August 2004, when the experiment started. Green Bank's main competitors are NGOs (such as Taytay Sa Kauswagan, Inc. or TSKI) which mostly offer group-liability loans and cooperatives (such as the Ormoc Community Credit Cooperative Inc or OCCCI) which offer individual liability loans. At the time of the first conversion, about 28% of the existing centers were located in barangays with no other competitor, 53% of the centers were in barangays with at least one NGO and 47% of the barangays with Green Bank presence had at least one individual liability lender.[12]

Fig. 1 shows the timeline of the first trial and data collected. In August 2004, we implemented the first wave of conversions in 11 randomly selected centers (one center per field officer). Three months later, in November 2004, we randomly selected 24 more centers to be converted to individual-liability (wave two). In the sample frame for this randomization, we included 8 additional centers formed after August 2004. Finally, nine months after wave one, in May 2005 we randomly selected 45 more centers from the 125 remaining (wave three). As of May 2007, 34 months after the start of the experiment, the final month for which we have administrative data, there are 56 converted centers and 50 original (group-liability) centers (26 converted and 37 original centers were dissolved in the past three years). Conversions were done in three waves because of operational and repayment concerns. We stratified the randomization by the 11 credit officers in order to ensure a fair implementation across credit officers in terms of potential workload and risk and also to generate orthogonality to treatment with respect to credit officer characteristics. In addition, we periodically checked with credit officers and conducted surprise visits to center meetings and clients' homes to confirm that converted centers had individual liability and that control centers still had group liability.[13]

3.2. Trial #2: Experimental design in new areas

The second trial had two important differences as compared to the first trial. First, it was conducted as part of a three year expansion into new geographic areas, hence individuals were informed whether the loan would be group or individual liability *before* borrowing. Second, there was a new experimental group, a phased-in individual liability group.

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[10] All other loan terms remained the same in both treatment and control groups, including the dynamic incentives, the interest rates, the lack of collateral, the length of the loan, the frequency of the payment, etc. If Green Bank had enforced a stricter group liability rule, the change to individual liability would also have entailed the issuing of new loans when other clients were in default. In practice, however, as in all microfinance institutions with joint liability that we are aware of, loans are already being issued to clients in good standing even when other individuals were in default.

[11] The new Personal Savings quota is the previous amount of Personal Savings (based on the loan amount), plus P20, the amount previously given for center and group savings.

[12] We run separate regressions for barangays with individual liability lenders and barangays with group liability lenders. The results do not differ significantly from those in Table 5 using all barangays and thus are not reported.

[13] Because the conversion was phased-in clients in centers converted later could have anticipated the change. To address this concern, we run separate regressions by wave and the results do not differ significantly and hence are not reported. Anecdotal evidence from credit officers suggests that clients were genuinely surprised, so anticipation effects are not likely.

Table 6
Knowledge about other members of the center, conversion areas.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Knowledge about new members only		Knowledge about all other members									
Sample frame	Baseline clients	New clients	Baseline clients	New clients	Baseline clients	New clients	Baseline clients	New clients	Baseline clients	New clients	Baseline clients	New clients
Dependent variable	Knew the new member well when they entered the center		Knew business		Negative absolute value of difference between reported and actual amount of installment		Negative absolute value of difference between reported and actual number of defaults		Knew whether or not the client defaulted		Predicted default	
	Ordered probit	Ordered probit	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Individual liability	0.317***	−0.278**	0.006	0.038	−4.585	−1.970	−0.091*	−0.259**	0.000	−0.014	−0.018	−0.059**
	(0.105)	(0.124)	(0.018)	(0.024)	(5.582)	(6.363)	(0.048)	(0.100)	(0.021)	(0.028)	(0.024)	(0.029)
Observations	1692	970	4353	2306	2902	1376	4128	2178	4353	2306	3684	1926
R-squared			0.058	0.054	0.027	0.055	0.293	0.187	0.122	0.148	0.11	0.09
Mean of Dependent variable	1.28	1.13	0.482	0.406	81.924	79.838	−0.672	−0.647	0.743	0.719	0.74	0.78

Dependent variable for regressions in Columns (1) and (2) is a categorical variable for how well the respondent knew the new member before she joined the program; 0 if did not know at all, 1 if knew a little, 2 if knew well, 3 if knew very well. Note that the sample size in Columns 5–8 and 11–12 is lower due to dropping individuals who responded "do not know." In separate tests, not shown, we find no statistically significant correlation between assignment to treatment and responding "do not know" and thus was omitted from the specifications in Columns 5–8 and 11–12. Robust standard errors clustered by respondents in parentheses. Marginal coefficients reported for the probit specifications. All regressions use fixed effect for credit officers.
Clients were asked about (a) how well they knew incoming members who joined the center, and (b) other members' performances over three months prior to the survey.
Sample frame: Clients who were present at the survey which took place during a center meeting in November 2005
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 7
Current borrowing from other lenders, conversion areas.

Sample frame: Clients who were present at the survey which took place during a center meeting in November 2005								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample frame	Barangays with NGOs offering group-liability loans only				Barangays with Coops offering individual-liability loans only			
Dependent variable	Baseline clients	New clients	Baseline clients	New clients	Baseline clients	New clients	Baseline clients	New clients
	Has loan from competitor		Loan size from competitor		Has loan from competitor		Loan size from competitor	
	Probit	Probit	Tobit	OLS	Probit	Probit	Tobit	OLS
Individual liability	0.062*	−0.021	5039.8***	−70.7**	−0.049	−0.028	−8703.4*	−541.3*
	(0.034)	(0.051)	(1907.1)	−284.2	(0.035)	(0.029)	(4856.9)	(287.2)
Observations	474	269	474	269	476	257	476	257
R-squared	0.07	0.14		0.11	0.07	0.10		0.09
Mean of dependent variable	0.11	0.16	653.38	912.64	0.10	0.06	1303.361	464.98

Dependent variable for Columns (1)–(2) is binary variable equal to one if the client currently has loans from NGOs; that of Columns (3)–(4) is binary variable equal to one if the client currently has loans from Coops. Robust standard errors clustered by lending center in parentheses. Marginal effects reported for the probit specifications. All regressions have fixed effect for credit officers.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Fig. 2 shows the timeline of the second trial and data collected. Credit officers in these newly established branches first conducted a market survey to identify feasible communities for Green Bank to enter. The criteria for the community selection were the same as that of pre-existing areas—the number of enterprises and economic condition to gauge potential demand for credit, safety and accessibility. Between August 2005 and August 2007, 124 barangays served by eight branches in five provinces were identified by Green Bank as feasible and randomized. The selected barangays were then visited by an independent survey team for a baseline business census,[14] followed by Green Bank's marketing activities. Out of the 124 randomized barangays, the bank opened lending centers in 68 barangays. After the business census and

initial community orientations were conducted, 56 communities (45%) were deemed not feasible mainly due to lack of interest from female entrepreneurs and default or safety concerns by credit officers. We will examine this important selection issue in the analysis, given that the success of opening a center is correlated with treatment assignment.

The experimental design then randomly assigned all selected barangays into one of the three types of lending products: 1) group-liability (original BULAK program in pre-existing areas without group savings requirement), 2) individual-liability (original BULAK program, without group savings requirement nor group liability), and 3) phased-in individual-liability (group liability in the first loan cycle only, and then individual liability after successfully paying back the first loan). Similarly to pre-existing areas, all lending centers hold weekly mandatory meetings and payments are made in groups. If a new member joined a phased-in individual liability center after the center

[14] The baseline survey was conducted with all female household members who owned small businesses in the village. We collected information on business characteristics, revenue, household assets, demand for credit, and social network.

Table 8
Impact of social network on default, conversion areas.

Dependent variable: Proportion of past due balance at the maturity date										
Sample Frame: Clients who were present at the meeting during the baseline social network baseline survey										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Knowledge					Trust				
	Family	Friends	Buy products	Visit once a week	Knowledge index	Given loan	Voluntary help	Go for advice	Trust index	All
Individual liability	0.326	0.086	0.621**	0.188	0.860**	0.346	0.277	0.096*	0.116***	0.871**
	(0.294)	(0.366)	(0.295)	(0.344)	(0.384)	(0.307)	(0.282)	(0.412)	(0.429)	(0.405)
Social network measure	0.123	−0.007	0.218	−0.434	0.331	0.099	1.850	−0.416	−0.143	0.277
	(0.541)	(0.568)	(0.271)	(0.402)	(0.255)	(0.583)	(1.357)	(0.377)	(0.452)	(0.246)
Individual liability × Social network measure	−0.929	2.159	−0.980**	0.196	−1.197**	−2.077	−2.566	1.458	0.976	−1.170**
	(0.969)	(2.258)	(0.399)	(0.722)	(0.493)	(1.575)	(2.161)	(2.781)	(2.247)	(0.505)
Observations	4224	4224	4224	4224	4224	4224	4224	4224	4224	4224
Number of center fixed effects	154	154	154	154	154	154	154	154	154	154
R-squared	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Mean of social network measure	0.111	0.046	0.291	0.132	0.411	0.363	0.015	0.072	0.093	0.419
Standard error of social capital measure	(0.003)	(0.002)	(0.006)	(0.004)	(0.006)	(0.006)	(0.001)	(0.003)	(0.003)	(0.006)

Social network variable is defined by the number of indegree links over maximum number of links possible. This measure reports how prestigious is the member in relation to the group size from a degree perspective (the member has more prestige if he/she receives many links). In Column 1, Family is defined as "Have known this person since either one was a child (grandparents, parents, siblings, spouses, children, grandchildren, and cousins)." In Column 2, Friends is defined as "Have known this person since either one was a child (non-family members/relative)". In Column 3, Buy products is defined as "Have bought products or services from this person". In Column 4, Visit once a week is defined as "Visit this person's house for social purposes at least once a week". In Column 5, the Knowledge index is the aggregate of Columns 1 through 4. In Column6, Given loan is defined as "Have given this person a loan outside of BULAK". In Column 7, Voluntarily helped is defined as "Have voluntarily helped this person repay loans in BULAK". In Column 8, Go for advice is defined as "Turn to this person for advise or help for any type of life problem; health, financial, or emotional". In Column 9, the Trust index is the aggregate of Columns 6 through 8. Finally, Column 10 reports the aggregate of 1through columns 4, and 6 through 8. Robust standard errors clustered by lending center are in parentheses.
  * Significant at 10%.
 ** Significant at 5%.
*** Significant at 1%.

had already been formed, then the new member had to be accepted by all center members, and the existing members were liable for new members' *first* loan only. Thus, the third product design tries to balance between group and individual liability: it relies on peer selection mechanism, while removing the potentially excessive peer pressure that may lead to good clients from dropping out of the program in the long run.

3.3. Data collected

The first experiment, in pre-existing areas, uses data from five sources. First and most importantly, we use the Green Bank's full administrative data on repayment, savings, loan sizes, number of clients, and client retention rates. We have the data for all 3285 clients who were active members of the 161 centers at the time of the first randomization in August 2004, as well as the eight new centers opened after August 2004 under group liability and then included in the second randomization wave. We use the data from one year prior to the first wave of the experiment to 24 months after the last wave of experiment, thus enabling us to incorporate center-level fixed effects in our analysis with pre and post observations. Second, we use the data from an activity-based costing exercise that credit officers conducted, where for a given week, they had to keep a log of how they allocated their time across the different tasks they typically perform (e.g., attending meetings, assessing new clients, enforcing repayments, etc.). The data were collected in January 2006. Third and fourth we use the data from a baseline and follow-up social network survey, conducted in November 2004 and January 2006.[15] Finally, we use a survey of clients in pre-existing areas designed to understand the observed differences between converted and control centers. This survey was conducted in November 2005 (about one year after the start of the experiment in pre-existing areas) and asked about loans from other lenders and clients' knowledge on businesses and repayment performance of other members.

The second experiment, in new areas, uses four sources of data. First, we use the complete administrative data for all 68 centers in new areas from the time of center establishment up to May 2008. Second, prior to Green Bank's program introduction in treatment villages, we conducted a census of all households with enterprises. Third, we conduct an activity-based costing exercise in July 2008 that is similar to that conducted in the first experiment. Fourth, we conducted a social network survey of the initial members of each formed center. These social network surveys were collected by credit officers during the first center meeting. Unlike the first experiment, due to budgetary reasons we did not conduct a follow-up social network survey, or activity survey about specific monitoring and enforcement activities in each center.

Table 1A presents summary statistics and orthogonality checks for the clients and centers in the conversion area samples. It shows that the randomization yielded observably similar treatment and control groups, when treatment groups are pooled in pre-existing areas. This holds when we examine center-level measures (Panel A) as well as individual level measures (Panel B). Table 1B presents summary statistics for the second experiment. Panel A and Panel B verify that the initial randomization in new areas also created assignment groups that are similar in village characteristics, in nineteen out of the twenty tests reported in Columns 5 and 6.

4. Empirical strategy and primary results

We begin by examining key variables that affect bank profitability at the loan or borrower level, such as repayment, loan size and savings deposits held at the Green Bank by borrowers (Tables 2A and 2B). For each set of outcomes, we first show the results for the pre-existing areas (the first experiment) in tables labeled A (for both the full set of loans of baseline clients, as well as simply the 'hump' loans which were outstanding at the time of the conversion), and then for the new areas (the second experiment) in tables labeled B. We then turn to center level outcomes such as number of active accounts, client retention, dropouts and loan portfolio (Tables 3A and 3B). All of the above analyses are conducted with the bank's administrative data. To examine center

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[15] Note that the social network baseline was conducted after the first wave of conversions but before the second and third waves, hence the social network analysis will not include the first wave of the sample frame.

Table 9
Impact on center-level social network, conversion areas.

OLS, difference-in-difference

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Knowledge				Knowledge index	Trust			Trust index	All
	Family	Friends	Buy products	Visit once a week		Given loan	Voluntary help	Go for advice		
Individual liability	−0.006	−0.001	−0.019	0.006	−0.018	0.017	0.022	0.011	0.005	−0.012**
	(0.041)	(0.005)	(0.041)	(0.026)	(0.045)	(0.020)	(0.020)	(0.024)	(0.024)	(0.043)
Post	−0.015	0.054***	0.002	0.112***	−0.040	0.052***	0.004	0.072***	0.073***	0.066*
	(0.033)	(0.009)	(0.036)	(0.028)	(0.039)	(0.014)	(0.008)	(0.024)	(0.024)	(0.035)
Individual liability × Post	−0.031	0.000	0.030	−0.048	0.018	−0.045*	−0.018	−0.035	−0.029	0.013
	(0.045)	(0.012)	(0.050)	(0.037)	(0.051)	(0.024)	(0.022)	(0.036)	(0.037)	(0.050)
Observations	273	273	273	273	273	273	273	273	273	273
R-squared	0.09	0.35	0.24	0.27	0.26	0.17	0.07	0.22	0.21	0.28

The dependent variable, social network density, is calculated by the number of links divided by the maximum number of possible links. Baseline social network data collected in November 2004. Follow-up data collected in January 2006. All regressions use fixed effect for credit officers. See definition of variables in the notes to Table 8. Robust standard errors clustered by lending center are in parentheses.

  * Significant at 10%.
 ** Significant at 5%.
*** Significant at 1%.

profitability we then assess the difference in the costs of managing individual versus group liability centers, using the data from activity-based cost exercises (Table 4). In Section 5 we report the rest of the analyses using survey data on social network, other loans, and members' knowledge about repayment performance of others. We analyze the mechanisms through which activities changed within the bank in pre-existing areas; this provides evidence of the experimental design being implemented as designed, and also evidence of specific peer screening, monitoring and enforcement activities (Tables 5 and 6). Then we examine heterogeneous treatment effects by social network on default (Table 7) as well as impacts on social networks themselves in pre-existing areas (Tables 8 and 9). Lastly, we test the treatment effect on the strength of social network in newly established centers in expansion areas (Table 10).

Table 2A Panel A presents the primary results for the first experiment. The specifications use individual loan cycle level data, with standard errors clustered at the center level, the unit of randomization. Throughout the analysis, we define a "treated" loan to be one that matures after the conversion from group to individual liability. In other words, we consider loans that have any exposure to individual liability as treated loans. The sample frame includes only clients that were borrowers at the time of the initial randomization. This allows us to focus on the ex-post changes in behavior generated by group versus individual liability, holding constant a sample frame of individuals screened under the group liability regime.

Specifically, we estimate a difference-in-difference (using pre–post and treatment–control data) model using OLS and clustering standard errors at the center level, the unit of randomization:

$$y_{ict} = \alpha + \beta T_{ct} + \delta_t + \theta_c + \varepsilon_{ict},$$

where the subscript i refers to the individual, c the center, and t the time period, T is an indicator variable if center c is under an individual liability regime at time t, δ_t are time fixed effects and θ_c are center fixed effects. Thus, β is the coefficient of interest.

Table 2A (Panel A, Columns 1 through 6) shows that the conversion to individual liability had no adverse effect on repayment for the baseline clients, regardless of the measure of default used, and regardless of whether we restrict the sample frame to all loans of baseline clients, or just 'hump' loans that were outstanding at the time of the conversion. Given that the default rate is very low, especially in Columns 3 to 6, the impact of conversion can be seen as a one-sided test, where at best there is no increase in default. Not only is the point estimate close to zero, but also most economically significant effects can be ruled out: the 95% confidence bound on proportion of loan balances in default at the time of

maturity (Column 3) is −0.1% ± 0.2% and the 95% confidence bound on the likelihood of any default 30 days after maturity (Column 6) is −1.1% ± 2.2%. Thus, we do not find strong enough evidence to support the "social collateral" story of Besley and Coate (1995) that predicts higher repayment for group liability loans on average.[16] However, as noted elsewhere, the conversion to individual liability does not remove all "social collateral" since repayment is still public, and someone may repay in order to protect their reputation in the community.

Table 2A Panel B shows similar results for the *new* clients. In this sample frame, selection is confounded with monitoring and enforcement. Yet even here, those selected under individual liability and given individual liability loans are also no more likely to default than those selected under group liability and given group liability loans. The 95% confidence bounds also allow us to rule out economically large effects, although they are slightly larger than those for the baseline clients in Panel A. The second experiment in new areas speaks to this question as well, and we find similar (null) results.

Table 2A Columns 7 and 8 show savings behavior and loan sizes for both baseline and new clients. We find a reduction in voluntary savings (i.e., savings over and beyond the required cash collateral that they have to pay along with loan payments) and a reduction in loan size for all clients. Since the expected return on savings is higher under individual liability as they are no longer used as collateral for other members' loans, one may have expected higher savings in individual liability if the substitution effect were larger than the income effect. Greater reduction in loan sizes on new clients under individual liability could be due to several mechanisms: an indication of the selection of new entrants (poorer individuals were screened out under group liability, and are now able to join); more restrictive lending by credit officers, and/or lower appetite for larger loans since borrowers no longer rely on the implicit insurance that group liability provides. In qualitative interviews, credit officers said that they did not restrict loan sizes of clients in individual liability centers. Instead, they told us anecdotally a different story: since savings were no longer set aside for center activities, they accumulated more quickly for the clients in converted centers and so they decided to withdraw it for various purposes at the end of the loan cycle. This, in return, lowered their capacity to borrow in the subsequent loan cycles. While this may not be a favorable outcome for the bank profitability, the client may be better off by relying on savings instead of borrowing. Consistent with this story, the follow-up survey asked baseline clients whether they agreed with the statement "I would like to borrow more but the credit officer does not approve".

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[16] Below, we will examine heterogeneous treatment effects (Table 9) where we will find evidence that default increases for those with lower baseline measures of social collateral.

Table 10
Social network among clients who formed centers, new areas.

OLS					
Dependent variable:	(1)	(2)	(3)	(4)	(5)
	Proportion of other members in the group for whom this member knew the directions to their house	Proportion of other members in the group who were known to these members since childhood.	Proportion of other members in the group who have bought products or services from this member	Proportion of other members in the group who have given this member a loan outside of BULAK	Proportion of other members in the group who turn to this member for advise or help for any type of life problems
Individual liability	−0.018	−0.199***	−0.064**	0.036*	−0.005
	(0.028)	(0.072)	(0.070)	(0.048)	(0.075)
Phased-in individual liability	−0.031	−0.099	−0.075	0.065	0.101
	(0.030)	(0.073)	(0.098)	(0.069)	(0.100)
Mean of dependent variable	(0.049)	(0.098)	(0.140)	(0.103)	(0.113)
Observations	571	571	571	571	571
R-squared	0.24	0.54	0.23	0.68	0.63
Mean of dependent variable	0.94	0.69	0.62	0.21	0.42

Regressions in Columns (1)–(5) include initial members of the lending centers when they were first formed. Dependent variable in Column (6) is the Herfindahl index of microenterprises among the initial members of the centers. The regression controls for the Herfindahl index at the barangay level. Robust standard errors are in parentheses. Standard errors in Columns (1)–(5) are clustered by lending centers and all regressions use fixed effect for branch.
  * Significant at 10%.
 ** Significant at 5%.
*** Significant at 1%.

We find that clients in converted centers tend to disagree *more* when compared to clients in control centers, but the difference is not statistically significant (p-value is 0.36).

In order to isolate the effects of individual liability on repayment, Panel A of Table 2A also reports the results using only loans that were outstanding at the time of conversion. Because these loans were issued prior to the conversion, there should be no difference in loan size or excess savings in converted relative to control centers. The results confirm that loan sizes do not change but excess savings are slightly lower in converted centers. The magnitude of the point estimate is, however, small. More importantly, we do not find any significant difference in repayment performance, and point estimates are roughly comparable to the similar analysis using all loans.

The conversion to individual liability implies both a reduction in peer pressure and a potential increase in bank pressure to repay (see Chowdhury, 2005). The above empirical analysis concludes that the net effect is nil. To confirm that in fact the conversion was adhered to and group liability was not imposed in the treatment centers, we ask the current members about the reason that others left. Appendix Table 1 shows these results. Under individual liability, individuals are less likely to be forced out of the center in net (Column 1), but importantly Column 2 shows that individuals are less likely to be forced out by their peers and more likely by the credit officer. This could be simply a bookkeeping effect, or could be capturing a behavior change by the credit officer as they worked harder to screen out defaulters. Credit officers did perceive a bonus based on maintaining a high repayment rate. Credit officers also may have changed their behavior with regard to enforcement of project choice, i.e., restricting credit to borrowers with safer productive activities. In the November 2005 follow-up survey, we collected the type of business and weekly sales, but we cannot reject equality across treatment and control. We also test whether the variance of sales differs between treatment and control centers, and also cannot reject equality.[17] In addition, it is not part of the training of credit officers (either before or after the experiment) to engage in

discussions with the clients about how they are investing their funds and so this seems an unlikely explanation for the findings.

We now turn to the results for the second experiment in Table 2B. The specifications use individual loan cycle level data, with standard errors clustered at the center level. Because the second trial took place in expansion areas and there is no pre-intervention data, we simply compare the post-intervention outcomes across treatment and control groups, using the credit officer and time fixed effects. Table 2B Panel A shows the average effects on default and loan size for all loans. Similarly to the pre-existing areas, the coefficients are close to zero and not statistically significant.

Table 2B Panels B and C show the same analysis separately for the first cycle loans and repeat loans. The results in Panel B are consistent with the overall analysis in Panel A—coefficients are small and not statistically significant, indicating that there is no difference in repayment performance across group, individual, phased-in individual liability clients. Table 2B Panel D shows that repeat loans under individual liability actually have a *lower* probability of defaulting by 3 percentage points at the 30 days after maturity date (Column 6), although this is the only significant result out of six measures of default, and two sample frames, and thus it is not robust.

Table 3A examines the main outcomes at the center level in preexisting areas. We estimate the following specifications using OLS:

$$y_{ct} = \alpha + \beta T_{ct} + \delta_t + \theta_c + \varepsilon_{ct},$$

where y_{ct} is either center size, retention rate,[18] new accounts, number of dropouts, total loan disbursement, or center dissolution for center g at time t, δ_t is an indicator variable equal to one for time period *t* (time fixed effect), θ_c is a center fixed effect, and T_{ct} is an indicator variable equal to one if center c at time t had been converted to individual liability. The time fixed effects refer to three-month time periods (since individuals within centers do not get issued loans at the same time). The coefficient of interest is β. We test whether the liability rule matters by examining whether the coefficient β is significantly different from zero. Because the unit of observation is the center (at a certain point

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[17] Type of business and the standard deviation of weekly sales are only proxies for the underlying borrower riskiness. We consider the measurement of riskiness an important question, but for which we still lack a convincing methodology.

[18] The retention rate between t and t + 1 is defined as the percentage of clients at t that are still clients at t + 1.

New Clients   Baseline Clients
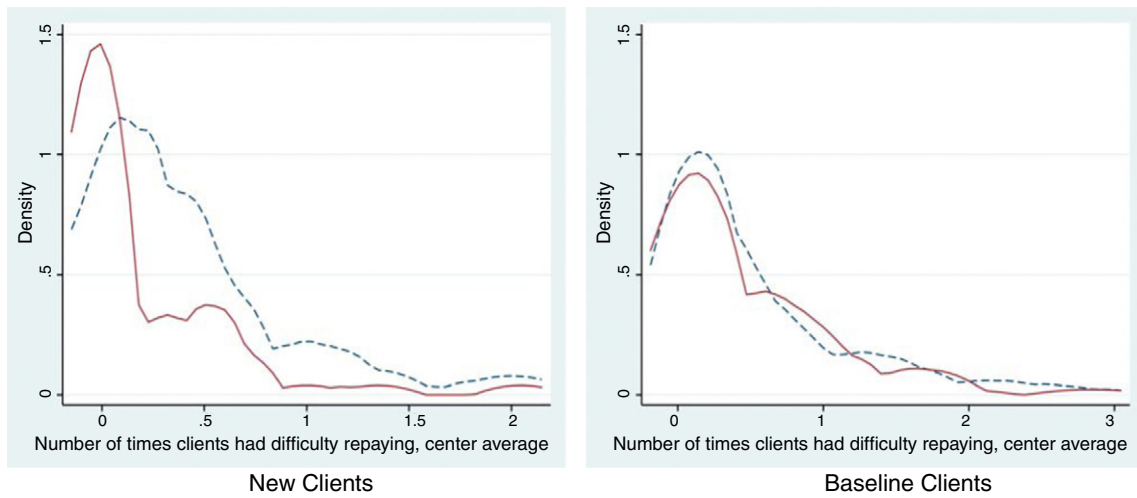
Kolmogorov-Smirnov Test

	New Clients	Baseline clients
P-value	0.109	0.556
(corrected value)	0.076	0.494

Fig. 3. Kernel density: Number of weeks that clients had difficulty repaying 3 months prior to the November survey, center average. The left panel shows the kernel densities of the center average of the number of weeks in difficulty repaying over the three months prior of the survey in November 2005 for treatment centers (solid) and control centers (dashed). The right panel plots the same distribution for baseline clients. The sample includes clients who attended the center meeting when the survey was conducted.

in time), we use information from *all* clients who belonged to the center between August 2003 and May 2007.

We find that individual liability is much better at attracting new clients (Panel A, Column 2), leading to larger centers (Column 1) and that individual liability makes existing centers 13.7% points less likely to be dissolved (Panel B, Column 2). This final result is the largest, and has important practical implications, since dissolution of groups after two to three years is a commonly cited concern among microfinance institutions. Total loan disbursement (Column 5) however did not increase, perhaps because the increase in the number of clients is offset by smaller loan sizes (Column 8 in Table 2A).

Table 3B shows the center-level analysis on institutional outcomes in the second experiment. The center-level analyses are also conducted with all loans (Panel A.i), first cycle loans only (Panel A.ii), and repeat loans only (Panel A.iii). Since 46% of the villages randomized were not entered by Green Bank, the analyses on active accounts and loan disbursement are conducted for villages successfully entered by Green Bank (Columns 1 and 4) as well as for all villages randomized (Columns 2 and 5). While there is no significant difference in the center size and total loan size at the center-level across three product groups when restricting the analysis to the villages entered by Green Bank, the analyses with all randomized villages including those not entered by Green Bank show that the center size is significantly smaller on average for both individual liability and phased-in individual liability groups. This is a consequence of either Green Bank staff reluctance or inability to enter villages assigned to individual liability and phased-in individual liability (see discussion in the next section). A village-level regression on the likelihood of Green Bank entering (Panel B) confirms that Green Bank was less likely to enter the villages assigned to individual or phased-in individual liability on average, although this effect on individual liability is not statistically significant.

Now that we have reviewed some of the main components of profitability, we turn to the results of the activity-based costing exercise completed by the credit officers in order to measure whether individual liability led to changes in credit officers' effort. If credit officers spend more time screening, monitoring or enforcing loans in converted centers, then we need to account for the additional time cost when computing center profitability. To measure time allocation, each credit officer kept a detailed diary of all activities for one week that were later divided into either repayment (preparing for center meetings plus collection and processing of repayments outside of the meetings), center meeting, monitoring, enforcement and/or re-loan activities. Table 4 Panel A and Panel B report these results.

In pre-existing areas (Table 4, Panel A) we find no statistically significant differences in the way credit officers allocated their time, and furthermore the point estimates are actually the opposite of what one may have expected on enforcement. On approval and processing of new loans (Column 3), credit officers do spend more time under individual liability, although again this result is not statistically significant. Given that credit officers did not spend more time in converted centers, and that repayment was unaffected, profitability is related to disbursement only. As mentioned, we find a positive but not significant effect of individual liability on disbursement.[19]

In new areas (Table 4, Panel B) credit officers spent more time on repayment activities (center meetings) in individual liability centers than in group liability centers. There are no statistically significant differences between time spent in phased-in individual liability centers and group lending centers. Although not statistically significant, the shifting of time from marketing to repayment activity is consistent with the lower probability of forming an individual liability center discussed above. In this experiment, given that the probability of starting a center

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[19] Since overall savings were lower in converted centers, one could argue that they should be included in the calculation of profitability. An increase in savings raises the amount the lender needs to pay in deposit interest, but lowers the amount the lender needs to borrow from elsewhere to on-lend. For Green Bank, the cost of capital is about 10% and the interest paid on deposits is about 4%.

is lower for the phased-in individual liability and that once the center is formed, credit officers are spending more time in repayment activities of individual liability centers, profitability seems higher under joint liability.

5. Additional results on specific mechanisms

We now turn to three sets of auxiliary data. First, for just the first experiment, we examine the results of a client follow-up survey conducted in November 2005 (over one year after the initial conversion) on clients in both the treatment and control groups. These survey questions were designed to tell us more about three possible mechanisms that could be influenced by the liability structure: center activities, selection and the flow of information (monitoring). The survey was conducted during center meetings and was administered using a stratified random sampling from 1) baseline clients, 2) clients who joined the program over the three months prior to the survey, and 3) clients who dropped out within the three months prior to the survey.[20] Second, for the first experiment we use social network data collected before the intervention and again one year later to examine the impact on social networks, as well as heterogeneous treatment effects for groups with different preexisting levels of social networks. Third, for the second experiment, we use baseline social network data to examine how screening differed across treatment groups.

5.1. Center activities, survey conversion areas

The client follow-up survey asked questions about center penalties for missing meetings, leaving early and missing payments as well as various activities such as anniversary, Christmas and snacks during the meeting. Table 5 reports changes in penalties (Columns 1 and 2) and activities between treatment and control centers. We find that treatment centers impose lower penalties, possibly because meetings run smoother now that there is less need to enforce peer pressure among clients. However, the conversion to individual liability may have resulted in lower center cohesion as evidenced by the lower probability of social events (not significant) and the lower amount spent (significant for Christmas parties).[21]

5.2. Selection and monitoring, conversion areas

Four sets of analysis provide insight into the changes in the selection of clients and monitoring resulting from the change in liability. We asked each member how well they knew the new members that had joined the center since intervention began. Table 6 Columns 1 and 2 show these results. We find that the prior members are *more* likely to know new members well under individual liability than under group liability. This is striking, given the typical assumption that group lending programs encourage peers to screen each other. However, this is consistent with evidence that the depth of family relations within a group is correlated with default (Ahlin and Townsend, 2007). Under individual liability, peers no longer fear the acrimony of having to punish someone close to them if there is default, and hence are more willing to invite in their closest friends and family. New members, on the other hand, are *less* likely to know the other new members. Since new members are typically not the ones who bring in new members, this indicates that groups are making fewer *group* decisions on whom to admit and instead individuals are inviting their close friends or family. Thus prior members

are closer to the new members, and new members are more distant to the other new members. This is also consistent with the fact that new members in treatment centers are less concerned with screening and monitoring other new clients.

Second, we examine how well individuals know the "type" of the other members in the group. We report these results in Table 6 Columns 3–12. We asked each individual five questions: (1) What is the business of person X? (Columns 3 and 4), (2) What is the required installment amount for person X? (Columns 5 and 6), (3) How many weekly installments did person X miss over the past three months? (Columns 7 and 8), (4) Did person X miss any payments over the past three months? (Columns 9 and 10), and (5) Do you think person X will miss some payments over the next three months? (Columns 11 and 12). We do not find any change in ability to report the peers' businesses, but we do find *lower* levels of ability to report who has missed payments (hence suggestive evidence of reduced monitoring, although also explained by simply not having to participate in repaying that person's missed payments) and lower levels of ability to *predict* who will or will not default. Again, this is evidence of lower monitoring, since it implies that individuals are less informed about the status of each other and, hence, their ability to repay their loans.[22]

The third result on selection looks at the distribution of *ability to pay* among existing clients and new clients in treatment and control centers. We asked how many times in the last 3 months they had difficulty in repaying the loan, regardless of whether or not they ended up completely repaying the loan installment. Unlike observed default from the lender's administrative records, this measure captures the combination of "type" (selection) and ex-ante moral hazard (effort): being in default is only observed when the member does not have enough cash *and* other members fail to contribute toward the installment. Since side contributions are compulsory in control centers but only voluntary in treatment centers, differences in default rate would come not only from different abilities to repay but also from different contribution levels from fellow group members.

In a world where creditworthiness is verifiable through a costly screening process, there are two groups of borrowers that would only join individual liability centers. On one end of the creditworthiness distribution, bad risks would be screened out and rejected from group liability centers, but could be allowed into individual liability centers because current borrowers lack the incentive to screen and the lender may be unable to screen as effectively as the peers. On the other end of the distribution, good risks may decide not to join group liability centers because they have little to gain and much to lose from the implicit tax imposed by group liability. Yet, they join individual liability centers because repayment only depends on their performance. The left panel in Fig. 3 plots the distribution of the number of times that new clients had difficulty making their payments, while the right panel plots the same distributions for baseline clients (those borrowing at the time of conversion, hence screened under group liability). Interestingly, the distributions of baseline clients in treatment and control centers look alike, but the distribution of new clients is more concentrated around zero in treatment centers than in control centers. This suggests that good risks were reluctant to join group liability centers but do so after these centers are converted to individual liability. We do not find evidence of bad risks also joining individual liability centers. A Kolmogorov–Smirnov test of equal distributions between treatment and control centers is rejected at 10% for new clients but not for baseline clients.

The fourth and last result on selection focuses on the interaction between demand and the competitive setting. Did individuals increase or decrease their borrowing with other lenders after the Green Bank converted to individual liability? The results are reported in Table 8,

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[20] Since meeting attendance is compulsory, we should not be concerned with having a biased sample of survey respondents. In any event, compared comparison of past repayment between respondents and non-respondents in converted and control centers yields no statistical differences across samples (largest t-stat is 0.82).

[21] We note that treatment centers did not have the group savings requirement from the time of conversion to January 2006 when the group savings requirement was removed in all centers. As a result, it may have been harder to fund group level activities since funds had to come from the individual accounts.

[22] Note, Chowdhury (2005) and Ghatak and Guinnane (1999) use the term monitoring to denote information about project choice, while we measure knowledge about missed payments, perhaps closer to auditing.

where it is clear that the answer depends entirely on whether the other lender is a group or an individual liability lender. If we restrict the analysis to barangays in which the competition is engaged in *group* lending, then we find that baseline Green Bank clients are more likely to borrow from them after their group is switched to individual liability. This indicates perhaps that *some* individuals among baseline clients prefer group liability (perhaps for the risk-sharing component of group liability) and hence when the group liability is removed they remain with the Green Bank but also then seek a loan from a separate group liability program. On the other hand, when the competition only offers individual liability, we see a *reduction* in the likelihood that baseline clients seek a loan (although this result is only significant in the tobit specification on loan size, and has a p-value of 0.17 for the probit specification). This indicates that when the Green Bank switches to individual liability, individuals who prefer individual liability are more satisfied, and individuals who prefer group liability seek supplementary loans from other group lending programs. Results are less conclusive for the new clients, perhaps due to the lower sample size.

5.3. Heterogeneous treatment effects with respect to social networks, conversion areas only

The shift to individual liability may have worked better or worse in groups with different levels of preexisting social networks. If social collateral keeps repayment high, then "releasing" the collateral by converting to individual liability (and replacing the social collateral with bank pressure and mere public disclosure of default, but not group liability) may lead individuals with higher social capital to have lower repayment rates. On the other hand, if individuals have higher social capital because of their stronger and more trustworthy characters, then the shift to individual liability should not influence their decision to repay because they are a "trustworthy" type, perhaps irrespective of whether social collateral is at stake or not.

We test the net effect of these possible mechanisms in Table 8 by interacting treatment with one of various social network measures. The social network data were collected during the center meetings in between the first and second wave of the randomization. As a result, the first wave centers are removed from this analysis, since their "baseline" occurred *after* the treatment began). The survey procedure was simple. In the public meeting, a surveyor asked an individual to stand up and then asked all other members in the group to raise their hand if their answer to a specific question about their relationship with this person was "yes." This method prevents one from asking highly personal questions (e.g., "Would you lend to X if they asked you?") but does allow for higher precision on questions which are of public knowledge (since one has the attention of everyone in the group to facilitate answering the questions). We aggregate the social network questions into two rubrics: "knowledge" and "trust". "Knowledge" includes: family, friend since childhood, buys products or services, or visits once a week for social purposes. "Trust" includes "Has given a loan to the other person outside of the Green Bank program", "Voluntarily helped them pay their Green Bank loan", or "Turns to this person for advice or help".[23]

We then examine the primary repayment measure: percentage of loan past due at the time of maturity. We find that default is lower for those with *stronger* social networks relative to those with weaker social networks. This is true both for "knowledge" measures of social capital (Column 5) and the pooled aggregate index (Column 10), but not for the "trust" measures (Column 9).

These results may be an indication that those identified as having stronger "trust" social networks are in fact a more trustworthy "type," hence the shift to individual liability has no adverse effect on their

likelihood of repaying. In other words, being "trustworthy" is a personal characteristic that determines one's social networks and also leads to higher repayment of loans. This is consistent with results from Karlan (2005), in which trustworthy behavior in a lab experiment in the field predicted repayment of loans one year later to a microcredit organization in Peru. An alternative hypothesis is that those with stronger social networks must repay their loan in both setups in order to protect their social networks. Those with weaker social networks have less to lose from the "shame" of being seen in default (less social collateral, in the model of Besley and Coate, 1995), and hence the shift to individual liability generates higher default. Although, we cannot say conclusively why this result is heterogeneous, it does suggest that the existing literature on the link between social capital and repayment within group lending is important and that more needs to be learned about the impact of social capital on repayment and growth.

5.4. Impact on social networks, conversion areas only

Next, we examine how the liability structure affects the social network among center members in conversion areas. In Table 9 we show the results of the analysis on changes in social network in pre-existing areas. As we have both baseline and follow-up data on social networks, we are able to employ a difference-in-difference empirical specification. We find only one social network channel to have changed: likelihood to help another person with a side-loan in order to help her make her loan payment. Social networks could change under individual liability relative to group liability for many reasons. First, with fewer incentives to monitor, the *quantity* of interaction may fall (e.g., in that vein, Feigenberg et al. (2013) finds that higher frequency meetings leads to higher risk-sharing). On the other hand, the *quality* of the interaction may increase since they no longer have to pressure each other to repay. From the selection, as found earlier, we find groups more connected because individuals are inviting closer friends and family to join the center. However, in net, we find no significant impacts on social networks, except the reduction in side loans.

5.5. Selection effects with respect to social networks, new areas only

When entering into new areas, we examine how the liability rules influence the social capital that exists among the initial members. The theoretical prediction is ambiguous. One may expect group liability centers to have a stronger social network, because members are directly held liable for other members' loans. Alternatively, if group liability imposes excessive pressures on members, close friends and neighbors may be more likely to join individual liability centers, where they do not have to risk their social capital. Table 10 presents the effect of the liability structure on the social networks among those who borrow. The results show that there is no consistent and significant difference in the social network among center members across group, individual, and phased-in individual liability centers, with the exception that those who join individual liability centers have a lower average proportion of members who know other members since childhood. This is consistent with the finding in conversion areas where new members were less likely to know each other well, but since this is the only one of five social network measures that finds a difference, we consider this result suggestive at best.

6. Conclusion

The choice of group or individual liability is perhaps one of the most basic questions that lenders make in the design of loan products in credit markets for the poor. Despite the importance of this decision, past empirical research on group and individual liability has not provided policymakers and institutions the evidence needed to determine the relative merits of the two methodologies. We use two randomized

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[23] The use of these questions is becoming standard. For other examples, see Ambrus et al. (forthcoming), Attanasio et al. (2012) and Giné et al. (2010).

control trials to evaluate the impact of group liability on the performance of clients and the profitability for the lending institution. Naturally, these are from one lender in a few regions of the Philippines.[24] As with all empirical research, many questions persist as to whether these findings will hold in other countries, in other cultures and with other lenders, and in particular whether theory that incorporates the underlying level or structure of social capital, e.g., can predict successfully whether group or individual liability will perform better. Although this decision by the bank to shift from group to individual liability is not isolated, we still must ask whether the culture or macroeconomic conditions, for instance during the three year time period of this study, led to similar outcomes for both individual and group borrowers, and whether under different external conditions differences in repayment would arise. Social science, just like physical sciences, needs theory-led replication and extension in order to solve these issues.

With those caveats in mind, the results are striking in three respects. First, for the pre-existing groups we find that individual liability compared to group liability leads to no change in repayment (both in the long run, as well as the immediate short-run of the outstanding loans converted mid-contract). The conversion to individual liability did lead to larger lending groups, hence further outreach. Average loan sizes were however smaller, leading to no change in total disbursement and ultimate profitability. Second, in new areas, we found that bank officers are *less* willing to open groups despite no increase in default. Thus the supply constrained the growth of the lending program, whether for good cause or unwarranted fear by the employee is outside the scope of our data to assess. Third, we do find statistically significant evidence of some of the *mechanisms* discussed in the group liability literature, such as screening and monitoring, but we simply do not find that it adds up in an economically meaningful way to higher default in the context and timing studied here. This could be, perhaps, because the mechanisms matter only in extreme circumstances, and extreme circumstances did not occur enough in the three-year time period of the study to generate a change in means across groups.

Our findings are also consistent with the work of Greif (1994) in a rather different context. He suggests that collectivist societies, like joint liability institutions in our setting, are based on the ability to impose social sanctions to players that deviate from the agreed norms of conduct. But this requires a level of trust and knowledge among players that may hinder expansion of the set of players thus leaving efficient trades unrealized. A more individualistic society requires fewer exchanges of information among players and is thus able to grow faster. It does necessitate, however, well-functioning formal institutions to enforce contracts. In our context, shifting some of the burden from clients to credit officers strikes this balance successfully. The institutional enforcement is sufficient to recover loans without group liability, and the individual liability allows for more growth and outreach for the lender.

We also see this study as one of many steps that lenders can make toward more flexible product designs. The standard microcredit product is fairly rigid and structured, with immediate and regular repayment, with limited flexibility on loan size, and homogenous legal terms and conditions. Yet clients likely need different products, depending on their purpose of borrowing (Karlan and Mullainathan, 2007). As other studies have begun to explore, relaxing different terms and conditions of the loans can be welfare enhancing for clients, with mixed results for the lenders (Field et al., 2012, 2013). More work is needed to understand how more flexible product designs can help deepen outreach, improve the quality of loans offered, and yet still maintain profitability for lenders.

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[24] The selection of firms willing to conduct such experiments may itself be a problem, if such firms or contexts in which they operate are different in ways that are correlated with other unobserved variables. For example, firms could be better managed and thus could better adjust lending practices to either form of liability, thus minimizing the differential impact of any such test. See Allcott and Mullainathan (2012) for an analysis of the selection of firms willing to engage in experimentation.

Appendix A

Appendix Table 1
Reasons for dropout, conversion areas.

Sample frame restricted to clients who dropped out from the program within the three months prior to the follow-up survey.

	(1)	(2)
	Forced out	Forced out by center or credit officer
	Probit	Multinomial logit
Dependent variable: Forced out		
Individual liability	−0.089[***]	
	(0.006)[**]	
Dependent variable: Forced out by center members		
Individual liability		−0.521[***]
		(0.032)[*]
Dependent variable: Forced out by credit officer		
Individual liability		0.621[***]
		(0.060)
Observations	550	550
R-squared	0.007	0.016

The omitted variable for the multinomial-logit model in Column (2) is voluntary dropout. "Forced out" and "Forced out by center members" include those clients who "voluntarily" dropped out because she was embarrassed for her bad performance. Dependent variable in Column 1 is a categorical variable which equals to one if any respondent reported that the client was forced out by center members or by credit officers, and zero otherwise. Dependent variable in Column 2 is a categorical variable which equals to one if any respondent reported that the client was forced out by center members, equals to two if anyone reported that the client was forced out by credit officer, and zero otherwise. Robust standard errors clustered by respondents are in parentheses. Marginal coefficients reported for the probit specifications.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

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