Appendix

A The model

A.1 Description

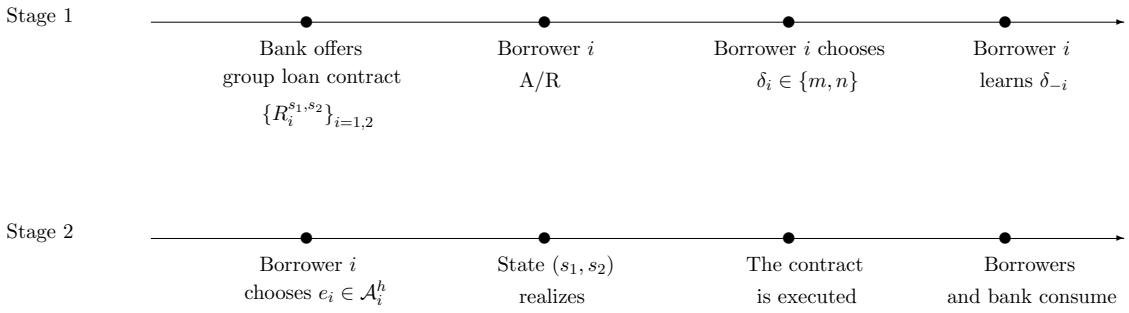
In the model of Carli and Uras (2017) two borrowers choose between a *good* and a *bad* investment project and a lender (an MFI) decides whether to lend. For a unit of cash investment, each project generates a verifiable financial return of 0 in the case of failure, or θ in the case of success. The good project has a higher success probability (p) than the bad project (p_B), i.e., $p > p_B$, whereas the bad project provides an unpledgeable private benefit of $B > 0$ to the borrower, unlike the good project.

Both borrowers need 100% external MFI finance to operate an investment project. Because the project choice is not observed by the MFI, in the absence of the right incentives, borrowers may prefer projects that are not necessarily profit-maximizing for the MFI. Key in the model is that the MFI can incentivize the borrowers' investment choices by relying on *peer monitoring*. Peer monitoring refers to the borrowers' costly monitoring of one another. Because peer monitoring is not observable to the MFI, and thus non-contractible, delegating monitoring to borrowers is not trivial.

The sequence of events corresponds to a dynamic game consisting of two stages, described in Figure A.3. We first discuss the second stage and then move to the first stage. In the second stage, each borrower privately selects a project conditional on the first-stage outcomes. Formally, given a first-stage history h, borrower i's feasible actions in the second stage are described by the set $\mathcal{A}_i^h \subseteq \{0, B\}$. The action B corresponds to the borrower investing in the bad project, with success probability p_B and private benefit B. The action 0 corresponds to the borrower investing in the good project, with success probability p and no private benefit. At the end of the second stage the borrowers' investment outcomes realize. We define $s_i \in \{H, L\}$ to be the realization of borrower i's project with H denoting the high state with return θ and L the low state with zero return. Afterward, borrowers repay, and agents consume.

In the first stage, the MFI offers a group lending contract to the borrowers. A group lending contract is a collection of repayments, $\left(R_i^{s_1,s_2}\right)_{i=1,2}$, where individual-specific repayments can be conditioned on the realization of one's own project as well as the

Figure A.3: Timing



peer's project outcomes. For instance, $R_1^{H,L}$ is borrower 1's repayment when her project return is in the high state, $s_1 = H$, while borrower 2's project return is in the low state, $s_2 = L$. If both borrowers accept the group lending contract, they choose the monitoring effort $\delta_i \in \{n, m\}$, where $\delta_i = m$ if borrower i monitors his peer and $\delta_i = n$ if he does not. By exerting monitoring effort a borrower incurs a disutility of ψ but eliminates the bad project from the set of feasible investments of the peer. Formally, the first-stage monitoring outcome determines the first-stage history, i.e., $h \in \{n, m\} \times \{n, m\}$, which in turn dictates the borrowers' set of feasible actions in the second stage, $\mathcal{A}_i^h$, for $i = 1, 2$. The MFI cannot observe or verify the extent of peer monitoring.

Under the restrictions on the parameter space that we discuss in Section A.2 of the Appendix, the optimal contract has two important features (Proposition 5.4 and Lemmas 5.5 and 5.6 in Carli and Uras, 2017). First, it exhibits joint liability, i.e., $R_1^{HL} > R_1^{HH}$, $R_2^{LH} > R_2^{HH}$. Borrowers are liable for their peer's low investment return; if not, they would have no incentives to monitor. Indeed, if $R_1^{HH} = R_1^{HL}$ and $R_2^{HH} = R_2^{LH}$, no borrower would monitor her peer. Second, the contract includes an asymmetric treatment of *ex ante* identical borrowers, i.e., $R_1^{HH} < R_2^{HH} < R_2^{LH} = R_1^{HL}$. In particular, borrower 1 (the leader) gets rewarded with a lower required repayment when both borrowers succeed and, thus, her expected repayments are smaller than those of borrower 2.[21] Asymmetric treatment of borrowers is part of the optimal contract, and yields a unique

[21] Without loss of generality, we are assuming here that the optimal contract selects borrower 1 to be the group leader. The leader selection process can be easily performed through a fair lottery, in which case borrowers have equal chances of becoming the leader. When this is the case, the optimal contract consists of repayments $R_1^{HL} = R_2^{LH} = 0$ and $R_1^{HH} = \theta - \frac{\psi}{p_B(p-p_B)} < \theta - \frac{\psi}{p(p-p_B)} = R_2^{HH}$.

equilibrium in the monitoring subgame.

If the contracts were symmetric, there would be a second Nash equilibrium in the borrowers' monitoring subgame because of the strategic complementarities between borrowers' monitoring decisions (Proposition 6.1 in Carli and Uras, 2017).[22] In this second equilibrium each borrower chooses not to monitor her peer and then invests in the bad project yielding private benefit B. Therefore it can be expected that the extent to which borrowers monitor each other, and repay, is (weakly) lower if no asymmetry is included in the contracts.

A.2 Optimality of asymmetric contracts

We first discuss the restrictions on the parameter space that we assumed in the characterization of the optimal group loan contract. Specifically, whether asymmetry of contractual terms has an effect on the monitoring choice of the borrowers is theoretically relevant if and only if the following assumptions hold:

A1. $p\theta > 1 > p_B\theta$.

A2. $\dfrac{p}{p-p_B}B > p\theta - 1$.

A3. $\psi \leq \min\left\{\dfrac{p_B B}{p}, \theta p_B(p-p_B), \dfrac{2p_B(p\theta-1)(p-p_B)}{p^2+pp_B}\right\}$.

A4. $\psi \leq \min\left\{\dfrac{p_B}{p+p_B}B, \left(\dfrac{p-p_B}{p}\right)^2 p_B\theta\right\}$.

Assumption A1 guarantees that the good project has positive net present value whereas the bad project's pledgeable portion has negative net present value, making the implementation of the latter undesirable to the MFI. Assumption A2 ensures that the MFI can incentivize borrowers' diligent behavior only through peer monitoring, i.e., by using a group loan contract. Individual lending is not profitable because the information rents that the MFI needs to give to a borrower in order to take the good project exceed the project's net present value. Assumptions A3 and A4 together provide necessary and sufficient conditions for the existence and the optimality of a group loan contract that motivates both borrowers to monitor the peer borrower.

[22] Specifically, the optimal contract that implements the monitoring equilibrium in subgame-perfect strategies consists of repayments $R_1^{HL} = R_2^{LH} = 0$ and $R_1^{HH} = R_2^{HH} = \theta - \frac{\psi}{p(p-p_B)}$.

A.3 MFI profits under the symmetric and asymmetric contracts

Formally, in a monitoring equilibrium the MFI obtains

$$EV^{A}_{MFI} = \underbrace{\left\{p\theta - 1 - \frac{p}{p_B}\cdot\frac{p}{p-p_B}\psi\right\}}_{Borrower1} + \underbrace{\left\{p\theta - 1 - \frac{p}{p-p_B}\psi\right\}}_{Borrower2},$$

$$EV^{S}_{MFI} = \underbrace{\left\{p\theta - 1 - \frac{p}{p-p_B}\psi\right\}}_{Borrower1} + \underbrace{\left\{p\theta - 1 - \frac{p}{p-p_B}\psi\right\}}_{Borrower2},$$

where EV^{A}_{MFI} is MFI's expected profits with asymmetric contracts and EV^{S}_{MFI} is MFI's expected profits with symmetric contracts, when both borrowers monitor their peer. In both expressions the first term is the expected repayment of borrower 1 (the leader) and the second term is the expected repayment of borrower 2. Given that $p > p_B$, borrower 2's expected repayment is the same in both cases whereas borrower 1's expected repayment is lower with asymmetric contracting. In the equilibrium with symmetric contracts where borrowers do not monitor their peer the MFI's expected profits are equal to

$$EU^{S}_{MFI} = \underbrace{\left\{p_B\theta - 1 - \frac{p_B}{p}\frac{p_B}{p-p_B}\psi\right\}}_{Borrower1} + \underbrace{\left\{p_B\theta - 1 - \frac{p_B}{p}\frac{p_B}{p-p_B}\psi\right\}}_{Borrower2} < 0.$$

B Instructions in the experiment

B.1 Treatment *Symmetric Random Matching*

GENERAL

- Please read these instructions closely.
- Do not talk to your neighbours and remain quiet during the entire experiment.
- If you have a question, raise your hand. We will come up to you to answer it.
- Your earnings are measured in "Points." The number of points that you earn depends on the decisions that you and other participants make.
- At the end of the experiment one round will be randomly selected to be paid in euros.

- Your identity will remain anonymous to us as well as to the other participants.

INSTRUCTIONS

The experiment will take 20 rounds. At the beginning of each round, you will be randomly matched with another participant.

Each round in the experiment will consist of 2 stages:

1. In the first stage you and the other participant will simultaneously choose between two options: option A or option B.
2. In the second stage the points you earned that round will be revealed.

PAYOFFS

In the table below you can find the points you and the other participant receive based on the decisions you both make:

	You receive	The other participant receives
Both choose A	5	5
You choose A and the other chooses B	8	4.5
You chooses B and the other chooses A	4.5	8
Both choose B	8.5	8.5

In other words:

- If you both choose A, you will receive 5 points, and the other participant will receive 5 points.
- If you both choose B, you will receive 8.5 points, and the other participant will receive 8.5 points.
- If you choose A and the other participant chooses B, you will receive 8 points, and the other participant will receive 4.5 points.

- If you choose B and the other participant chooses A, you will receive 4.5 points, and the other participant will receive 8 points.

B.2 Treatment with *Asymmetric* contracts and *Random partners*

GENERAL

- Please read these instructions closely.
- Do not talk to your neighbours and remain quiet during the entire experiment.
- If you have a question, raise your hand. We will come up to you to answer it.
- Your earnings are measured in "Points." The number of points that you earn depends on the decisions that you and other participants make.
- At the end of the experiment one round will be randomly selected to be paid in euros.
- Your identity will remain anonymous to us as well as to the other participants.

INSTRUCTIONS

The experiment will take 20 rounds. At the beginning of each round, you will be randomly matched with another participant.

Each round in the experiment will consist of 3 stages:

1. In the first stage you will randomly be assigned a type. You can either be Type 1 or Type 2.
2. In the second stage you and the other participant will simultaneously choose between two options: option A or option B.
3. In the third stage the points you earned that round will be revealed.

PAYOFFS

In the table below you can find the points you and the other participant receive based on the decisions you both make:

	You receive	The other participant receives
Both Types choose A	9	5
Type 1 chooses A and Type 2 chooses B	10	4.5
Type 1 chooses B and Type 2 chooses A	6	8
Both Types choose B	9.5	8.5

In other words:

- If you are Type 1 and the other participant is Type 2:

- If you both choose A, you will receive 9 points, and the other participant will receive 5 points.
- If you both choose B, you will receive 9.5 points, and the other participant will receive 8.5 points.
- If you choose A and the other participant chooses B, you will receive 10 points, and the other participant will receive 4.5 points.
- If you choose B and the other participant chooses A, you will receive 6 points, and the other participant will receive 8 points.

- If you are Type 2 and the other participant is Type 1:

- If you both choose A, you will receive 5 points, and the other participant will receive 9 points.
- If you both choose B, you will receive 8.5 points, and the other participant will receive 9.5 points.
- If you choose A and the other participant chooses B, you will receive 4.5 points, and the other participant will receive 10 points.
- If you choose B and the other participant chooses A, you will receive 8 points, and the other participant will receive 6 points.

B.3 Treatment with *Symmetric* contracts and *Same partner*

GENERAL

- Please read these instructions closely.
- Do not talk to your neighbours and remain quiet during the entire experiment.
- If you have a question, raise your hand. We will come up to you to answer it.
- Your earnings are measured in "Points." The number of points that you earn depends on the decisions that you and other participants make.
- At the end of the experiment one round will be randomly selected to be paid in euros.
- Your identity will remain anonymous to us as well as to the other participants.

INSTRUCTIONS

The experiment will take 20 rounds. At the beginning of the first round, you will be randomly matched with another participant. You will remain matched with this participant for 20 rounds.

Each round in the experiment will consist of 2 stages:

1. In the first stage you and the other participant will simultaneously choose between two options: option A or option B.
2. In the second stage the points you earned that round will be revealed.

PAYOFFS

In the table below you can find the points you and the other participant receive based on the decisions you both make:

	You receive	The other participant receives
Both choose A	5	5
You choose A and the other chooses B	8	4.5
You chooses B and the other chooses A	4.5	8
Both choose B	8.5	8.5

In other words:

- If you both choose A, you will receive 5 points, and the other participant will receive 5 points.
- If you both choose B, you will receive 8.5 points, and the other participant will receive 8.5 points.
- If you choose A and the other participant chooses B, you will receive 8 points, and the other participant will receive 4.5 points.
- If you choose B and the other participant chooses A, you will receive 4.5 points, and the other participant will receive 8 points.

B.4 Treatment *Asymmetric Partner Matching*

GENERAL

- Please read these instructions closely.
- Do not talk to your neighbours and remain quiet during the entire experiment.
- If you have a question, raise your hand. We will come up to you to answer it.
- Your earnings are measured in "Points." The number of points that you earn depends on the decisions that you and other participants make.
- At the end of the experiment one round will be randomly selected to be paid in euros.
- Your identity will remain anonymous to us as well as to the other participants.

INSTRUCTIONS

The experiment will take 20 rounds. At the beginning of the first round, you will be randomly matched with another participant. You will remain matched with this participant for 20 rounds.

Each round in the experiment will consist of 3 stages:

1. In the first stage you will randomly be assigned a type. You can either be Type 1 or Type 2.
2. In the second stage you and the other participant will simultaneously choose between two options: option A or option B.
3. In the third stage the points you earned that round will be revealed.

PAYOFFS

In the table below you can find the points you and the other participant receive based on the decisions you both make:

	You receive	The other participant receives
Both Types choose A	9	5
Type 1 chooses A and Type 2 chooses B	10	4.5
Type 1 chooses B and Type 2 chooses A	6	8
Both Types choose B	9.5	8.5

In other words:

- If you are Type 1 and the other participant is Type 2:

- If you both choose A, you will receive 9 points, and the other participant will receive 5 points.
- If you both choose B, you will receive 9.5 points, and the other participant will receive 8.5 points.
- If you choose A and the other participant chooses B, you will receive 10 points, and the other participant will receive 4.5 points.
- If you choose B and the other participant chooses A, you will receive 6 points, and the other participant will receive 8 points.

- If you are Type 2 and the other participant is Type 1:

- If you both choose A, you will receive 5 points, and the other participant will receive 9 points.
- If you both choose B, you will receive 8.5 points, and the other participant will receive 9.5 points.
- If you choose A and the other participant chooses B, you will receive 4.5 points, and the other participant will receive 10 points.
- If you choose B and the other participant chooses A, you will receive 8 points, and the other participant will receive 6 points.

C Parametrization of the model in the experiment

First, we choose parameters in the experimental games such that assumptions A1-A4 hold. The only additional feature that we introduce relative to the optimal contract by Carli and Uras (2017) is that monitoring is a strictly dominant strategy for the group leader. We do this by reducing the group leader's repayment, R_1^{HH}, by ϵ. We choose ϵ small enough to guarantee that the profit of MFI are still positive when both borrowers exert monitoring activity.

Second, we take into account that risk dominance is an important determinant of behavior in games with multiple equilibria (Battalio, Samuelson, and Huyck, 2001; Cooper, DeJong, Forsythe, and Ross, 1990; Schmidt, Shupp, Walker, and Ostrom, 2003). Specifically, we choose parameters such that the non-monitoring equilibrium in the symmetric monitoring game is not risk dominant by making sure that the basin of attraction of the non-monitoring choice is the same as that of the monitoring choice (i.e., equal to 0.5). Our aim is to avoid the non-monitoring equilibrium becoming an attractor of behavior simply due to its risk dominance. Following Battalio, Samuelson, and Huyck (2001); Dubois and Prade (2012), we define the basin of attraction, q, for the non-monitoring choice as follows:

$$q = (E^{M,NM} - E^{NM,NM})/((E^{NM,M} + E^{M,NM} - E^{NM,NM} - E^{M,M}),$$

where E^{C^1,C^2} is defined as the expected earnings for a player given her choice C^1, and her partner's choice C^2.

An overview of the parameters used in the experimental games is shown in Tables B.1 and B.2. Tables B.3 and B.4 show the resulting payoffs in the case of symmetric and asymmetric contracts depending on the monitoring choice of the borrowers in the first stage of the game (monitor versus not monitor) and their choice of projects in the second stage (good versus bad).[23] The equilibria are highlighted in bold.

[23] We rounded the parametrized model to the nearest 0.5.

Table C.1: Parameters of the model

Variable		Variable description
p	0.85	Probability of success for the good investment project
p_b	0.41	Probability of success for the bad investment project
ψ	0.19	Monitoring costs
B	0.56	Private benefit yielded by the bad investment project
θ	1.84-2.43	Investment return in case successful
E	1	Endowment
ϵ	0.18	used to relax binding 6b

Table C.2: Repayments resulting from calibrated model

	Symmetric repayment terms	Asymmetric repayment terms
R_1^{HH}	1.15-1.74	0.61-1.20
R_2^{HH}	1.15-1.74	1.15-1.75
R_2^{LL}	0	0
R_1^{LL}	0	0
R_1^{HL}	1.84-2.43	1.84-2.43
R_1^{LH}	0	0
R_2^{LH}	1.84-2.43	1.84-2.43
R_2^{HL}	0	0

Table C.3: Payoffs in the two-stage symmetric game

		M		N	
		Good	Bad	Good	Bad
M	Good	**5 , 5**	.	5 , 7	.
	Bad	.	.	**8 , 4.5**	.
N	Good	7 , 7	**4.5 , 8**	7 , 7	4.5 , 10
	Bad	.	.	10 , 4.5	**8.5 , 8.5**

For each second-stage continuation game (i.e. each subgame following an outcome of the monitoring choices in the first stage), the unique Nash equilibrium is indicated with bold font.

Table C.4: Payoffs in the two-stage asymmetric game

		M		N	
		Good	Bad	Good	Bad
M	Good	**9 , 5**	.	9 , 4.5	.
	Bad	.	.	**10 , 4.5**	.
N	Good	11 , 5	**6 , 8**	11 , 7	6 , 10
	Bad	.	.	12 , 4.5	**9.5 , 8.5**

For each second-stage continuation game (i.e. each subgame following an outcome of the monitoring choices in the first stage), the unique Nash equilibrium is indicated with bold font.

D Supplementary tables and figures

Table D.1: Effect of asymmetry on monitoring

	(1) All		(2) *Random partners*		(3) *Same partner*	
	Est. (S.E.)	M.E	Est. (S.E.)	M.E	Est. (S.E.)	M.E
Constant	-1.147 (0.276)		-0.774 (0.191)		-1.073 (0.331)	
Strangers	0.122 (0.078)	0.122				
Asymmetric	1.541 (0.210)	0.546***	1.616 (0.252)	0.581***	1.425 (0.426)	0.496***
Pseudo R^2	0.242		0.259		0.200	
Observations	2560		1520		1040	
Clusters	34		8		26	

Notes: Estimation results (including marginal effects, M.E.) are reported from probit regressions with standard errors clustered at the level of independent observations. The dependent variable is a binary variable equal to one if a participant-borrower in a round chooses to monitor, and equal to zero otherwise. *Asymmetric* is a binary variable equal to 1 in the treatments with asymmetric contracts and *Strangers* is a binary variable equal to 1 in the treatments with *Random partners*. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table D.2: Effect of asymmetry on MFI profits

	(1) All	(2) *Random partners*	(3) *Same partner*
	Est. (S.E.)	Est. (S.E.)	Est. (S.E.)
Constant	-0.262 (0.075)***	-0.126 (0.077)	-0.248 (0.095)**
Strangers	-0.146 (0.075)*		
Asymmetric	0.337 (0.071)***	0.355 (0.0.083)***	0.309 (0.131)**
R^2	0.222	0.246	0.142
Observations	2560	1520	1040
Clusters	34	8	26

Notes: Estimation results are reported from linear regressions with standard errors clustered at the level of independent observations. The dependent variable is the MFI profit associated to the monitoring choices made by a pair of participant-borrowers in a round. *Asymmetric* is a binary variable equal to 1 in the treatments with asymmetric contracts and *Strangers* is a binary variable equal to 1 in the treatments with *Random partners*. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table D.3: Effect of asymmetry on profit of borrowers

	(1) All Est. (S.E.)	(2) *Random partners* Est. (S.E.)	(3) *Same partner* Est. (S.E.)
Constant	7.965 (0.219)***	7.560 (0.238)***	7.946 (0.287)***
Strangers	-0.418 (0.206)*		
Asymmetric	-0.371 (0.200)*	-0.395 (0.244)	-0.335 (0.357)
R^2	0.022	0.011	0.009
Observations	2560	1520	1040
Clusters	34	8	26

Notes: Estimation results are reported from linear regressions with standard errors clustered at the level of independent observations. The dependent variable is equal to the profit made by a participant-borrower in a round. *Asymmetric* is a binary variable equal to 1 in the treatments with asymmetric contracts and *Strangers* is a binary variable equal to 1 in the treatments with *Random partners*. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure D.4: Evolution of monitoring rate