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The Threat of Exclusion and Relational Contracting

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Abstract

Relational contracts have been shown to mitigate moral hazard in labor and credit markets. A central assumption in most theoretical and experimental studies is that, upon misbehaving, agents can be excluded from their current source of income and have to resort to less attractive outside options. This threat of exclusion is unrealistic in many environments, and especially in credit and investment contexts. We examine experimentally the emergence and time structure of relational contracts when the threat of exclusion is weakened. We focus on bilateral credit relationships in which strategic default is possible. We compare a weak exclusion treatment in which defaulting borrowers can reinvest borrowed funds, to a strong exclusion treatment in which defaulting borrowers must liquidate borrowed funds. We find that under weak exclusion more relationships break down in early periods and credit relationships are more likely to "start small".

Keywords: Relational contracts, Starting small, Debt enforcement.

JEL: C73, G21, O16, F21, F34.

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1. Introduction

A large literature has shown that relational contracts can mitigate the problem of moral hazard in principal-agent relationships, where third-party enforcement is absent (for an overview see, e.g., Fehr et al. 2009). In labor, credit and investment relationships, principals can align agents' interests with their own, by threatening with the break-up of the relationship should the agent misbehave. If the relationship breaks up, the agent is often assumed to have to resort to a much lower outside option. This threat of exclusion from current income sources is a key feature of existing experimental work investigating relational contracting, which finds that relational contracts are indeed an effective tool to mitigate problems of moral hazard (e.g., Brown et al., 2004).

However, the threat of exclusion from current income sources is unrealistic in many environments. In the context of unsecured credit and investment relationships (Bond and Krishnamurthy, 2004, Bulow and Rogoff, 1989, Thomas and Worrall, 1994), defaulting borrowers may continue to reinvest borrowed funds. In the context of labor relationships in service sectors, such as in consulting, legal advice or wealth management, employees may persuade the firm's clients to follow them when they leave a firm.[1] In such cases, the threat of terminating the employment relationship may be seriously weakened. In this paper we experimentally investigate how relational contracts are affected when agents cannot be fully excluded from current income generating activities after misbehaving.

We focus on the emergence and time structure of credit relationships. In our experiment a lender and a borrower interact for 7 periods. In each period the lender decides how much to lend to the borrower and what repayment (principal plus interest) to request. If the borrower receives a loan he earns a deterministic investment return. The borrower then decides whether to make the repayment requested by the lender. In our main treatment, the Weak Exclusion

[1] It is e.g. estimated that 60%-90% of wealth management clients follow their advisor when they change firms (http://wealthmanagement.com/viewpoints/will-your-clients-follow-you).

treatment, a borrower who defaults can continue to use the borrowed funds to invest in future periods. In practice, this may occur because, upon default, there is an automatic stay on assets, and hence borrowers can continue using these.[2] It may also occur if borrowers can tunnel the assets (e.g. Johnson et al., 2000). Further, it occurs in personal bankruptcy, where many asset categories are exempt from the bankruptcy process (e.g. White, 1998).

In the control treatment defaulting borrowers cannot use the borrowed funds for investment in future periods. In this Strong Exclusion treatment a defaulting borrower must liquidate his investments and consume the proceeds in the same period. This yields a higher payoff in that period but excludes the borrower from future investment, if - as is commonly observed in existing experimental studies of the repeated investment game (for an overview, see, Camerer, 2003) - the lender refuses to extend further credit. By comparing the outcome of these two treatments we can examine how the ability of lenders to exclude of defaulting borrowers from current income sources affects credit relationships.

We derive predictions for our two treatments under the assumption that they constitute finite horizon games with imperfect information (Kreps et al., 1982). We hereby assume that there is a share of non-identifiable social borrowers, who repay loans even in a one-shot situation.[3] We show that in the Strong Exclusion treatment lenders and borrowers can establish long-term credit relationships, with maximum loan sizes and borrower repayment until the penultimate period: Borrowers have a strong incentive to repay, since they will otherwise be cut off from future loans and thus investment.

By contrast in the Weak Exclusion treatment the threat of discontinuing a credit relationship is a weaker disciplining device for borrowers, since, upon default, these can continue to invest the funds borrowed in previous periods. We show that in this environment,

[2] In many countries judicial procedures to enforce contracts are slow and costly and allow automatic stay on assets. Evidence can be found in the Doing Business indicators of the World Bank (www.doingbusiness.org).
[3] Such an assumption has been shown to hold in a wide range of experiments. Further, evidence of such types has been found in trust games and has been linked to actual repayment decisions in the field (Karlan, 2005).

two different types of equilibria can emerge. In the first type of equilibria lenders "start small" in credit relationships: they offer low initial loans and repayment-contingent loan increases in order to establish dynamic incentives for borrowers to repay. By contrast, in screening equilibria lenders offer high initial loans to borrowers in order to screen out selfish agents (who will default) and to offer surplus-maximizing contracts to non-defaulting borrowers in all subsequent periods. Hence, from a theoretical perspective, we show that an environment in which only a weak exclusion of defaulting borrowers is feasible should be characterized by either lower loan sizes or higher default rates in early periods of credit relationships.

Our results show that long-term active credit relationships, i.e. relationships with lending and repayment, are less frequent in the Weak Exclusion treatment. By the end of the second period, only 30% of all relationships are active in the Weak Exclusion treatment compared to 60% in the Strong Exclusion treatment. In the Weak Exclusion treatment lenders are more likely to offer small initial loans than in the Strong Exclusion treatment. Lenders in the Weak Exclusion treatment rightly fear offering large initial loans, as borrowers in this treatment are significantly more likely to default on large loans. Lenders strongly condition current loans on the past repayment of borrowers in both treatments. Over time, loan sizes exhibit stronger increases in the WE treatment than in the SE treatment, in line with the incentives needed for borrowers to repay in the WE treatment. However, lenders are more likely to stop lending and borrowers are more likely to default during the early periods of the relationship in the WE treatment, suggesting that it is more difficult to establish a successful relationship, potentially involving "starting small", in this treatment.

The main contribution of this paper is to document that, when principals cannot exclude agents from their current income sources, the emergence and time structure of relational contracts are strongly affected. The existing experimental literature has explored two conditions under which the threat of credit denial may be weak and thus relational contracts

may not be a perfect substitute for third-party enforcement: lender competition and stochastic investment returns. Competition between lenders, especially in the absence of comprehensive information sharing institutions (credit bureaus), could potentially weaken borrowers' incentives to repay a given lender as they may turn to other lenders after default. Similarly, stochastic investment returns may limit the scope for relational contracts as lenders cannot perfectly identify and punish strategic defaults. Brown and Zehnder (2007) show that, even in the presence of competition, relational contracts emerge and lead to large volumes of credit. Fehr and Zehnder (2009) find that even with stochastic investment returns relational contracts emerge and sustain high credit volumes.[4] In contrast to these studies, we document that when agents cannot be excluded from their current income sources relational contracting may be seriously impaired.[5]

A novelty of our study is that we experimentally examine how the ability of lenders to exclude defaulting borrowers from future investment impacts on the time structure of relational contracts. Previous theoretical work has examined the time structure of relational contracts, and suggests that asymmetric information about players' types may explain "starting small" in investment contexts (Ghosh and Ray, 1996 and 2001, Rauch and Watson, 2003 or Sobel, 1985) and in prisoners' dilemmas (see Watson, 1999 and 2002, Andreoni and Samuelson, 2006).[6] Starting small - or "progressive lending" - is commonly observed in contexts with limited ability of lenders to punish defaulting borrowers due to weak creditor protection – e.g., in microfinance (Morduch, 1999, Armendariz and Morduch, 2006). However, there is no evidence to date, documenting that weak creditor protection leads to

[4] Fehr and Zehnder (2009) also show that credit markets in which borrowers cannot default may be more subject to asset-substitution (the choice of risky versus safe projects) than credit markets in which borrowers can default strategically.

[5] Falk et al. (2008) show that dismissal barriers can prevent relational contracting in labor markets. Thus similar to our paper they examine how institutional changes affect the emergence of implicit agreements. In contrast to their paper, we examine institutional features inherent to the credit market (debt enforcement) and not only examine whether these institutions affect the emergence of implicit agreements, but also how these agreements are structured over time.

[6] Andreoni and Samuelson (2006) examine experimentally the emergence of starting small in prisoner's dilemmas.

"progressive lending". Our results show that lenders may indeed choose to "start small" in environments where they cannot prevent defaulting borrowers from appropriating and reinvesting borrowed funds. In this environment progressive lending – as widely practiced in microfinance (Armendariz and Morduch, 2006) is the only effective mechanism for punishing defaulting borrowers: they are denied the larger future loans promised to borrowers who repay.[7]

Finally, our paper contributes to the empirical literature on law and finance by identifying a causal impact of creditor protection on relational contracting and credit market performance. Following La Porta et al. (1997, 1998), cross-country studies have documented that better protection of creditor rights (Djankov et al., 2007), more efficient contract enforcement (Djankov et al., 2003) and debt enforcement (Djankov et al., 2008) are strongly related to aggregate financial development. Recent evidence for example from China (Allen et al., 2005) has cast doubt on the relationship between the legal environment and financial sector development, citing relational contracting as a substitute enforcement mechanism. Our results show by contrast that weak creditor protection affects the feasibility of relational contracts, and in particular the schedule of loan sizes provided over time in a credit relationship.[8]

The rest of the paper is organized as follows. Section 2 describes the experimental design. In Section 3, we outline the predictions. We report the experimental results in Section 4. Section 5 concludes.

[7] Starting small can also be rationalized by profit maximization of the principal who increases the stakes towards the end of the relationship, such that he can extract a greater surplus in the beginning (e.g. Ray, 2002), or by borrowing constraints which are endogenous to the dynamics of debt and thus make increasing loan sizes optimal (Albuquerque and Hopenhayn, 2004).

[8] We hereby complement the findings of Qian and Strahan (2007) who use data on corporate lending to firms in 49 countries and show that loan maturities are shorter in countries with weaker creditor protection.

2. Experimental design

2.1. Weak exclusion treatment

In each round of our main treatment - the **Weak Exclusion treatment (WE treatment -** one lender and one borrower are paired for 7 periods. We choose a finite horizon game because it allows us to identify the emergence of reputation-based implicit agreements.[9] We choose 7 periods rather than 2 or 3, to be able to clearly separate 'starting small' in loan sizes from the potential end-game effect, i.e. a reduction of loan sizes in the last periods of the game.

In each period $t = \{1,..,7\}$ the borrower has an investment opportunity: he can invest the amount $I_t \in \{0, 1, 2, 3, ..., 10\}$, which yields a certain gross return of vI_t, with v=3 in our experiment. We hold the investment opportunity of the borrower constant over time in order to examine credit rationing over the course of a relationship.[10]

The investment amount of the borrower in each period $I_t = C_t + S_t$ is equal to his capital C_t and the loan size S_t he receives from the lender. In period 1 the borrower starts off with zero capital C_1=0. The loan available to the borrower in each period t={1,..,7} and the capital of the borrower in periods t={2,..,7} are determined by the subsequent decisions of the lender and borrower. The decision structure in each period is as follows:

- **Loan offer:** The lender receives an endowment of 10 units at the beginning of each period. As the borrower can invest at most 10 units per period, the lender can offer a loan size of $S_t \in [0, 10\text{-}C_t]$ to the borrower. The lender also chooses her requested

[9] While reputation concerns are constant in an infinite horizon, they are strong at the beginning and very weak at the end with a finite horizon. As shown, for example, by Brown and Zehnder (2007), relational credit contracts can be identified as relationships in which the borrower repays in non-final periods and then defaults in the final period.

[10] If, for example, we observe that a lender offers a small loan in period 1 and she increases it over time, we know that the borrower was credit constrained in period 1. By contrast, when field studies observe rising loan schedules over time (e.g. Ioannidou and Ongena, 2010) they typically cannot distinguish whether this is due to increasing investment opportunities of the borrower over time or a relaxation of credit constraints. Kirschenmann (2010) examines credit constraints over the course of microfinance relationships by contrasting the desired loan size and granted loan size as reported in credit file data of a Bulgarian bank. However, her identification of credit constraints is based on the assumption that borrowers report their true financing needs.

repayment R_t. The requested repayment cannot exceed the income generated by the loan: $R_t \in [0, vS_t]$. When the lender has determined her offer (S_t, R_t), the offer is shown to the borrower.

- **Loan acceptance:** If the lender chooses an offer with a strictly positive loan $S_t > 0$, the borrower must decide whether to accept (A_t=1) or reject the offer (A_t=0).
- **Repayment decision:** If the borrower accepts a loan offer (S_t, R_t), he earns an investment income of $v(S_t+C_t)$. He then decides whether to make the repayment requested by the lender (D_t=0) or default (D_t=1). Partial repayments are not possible.[11]

As mentioned above, the borrower starts off with zero capital. However, if the borrower receives a loan and does not repay it he can keep the lender's funds for future investment. We assume that borrowers who default in period t automatically have the loan principal S_t added to their capital for all subsequent periods. We further assume that borrowers cannot liquidate their capital (and consume the proceeds) before the final period. The capital of a borrower in periods t={2,…,7} thus equals the sum of the loaned funds which he did not repay: $C_t = \sum_{k=1}^{t-1} D_k S_k$.

The fact that we force borrowers to reinvest funds that they keep after default, rather than allowing them to decide whether to consume or reinvest them, seems restrictive. We made this design choice for two reasons. First, we wanted to simplify the game as much as possible by abstracting from endogenous consumption / saving decisions.[12] Second, reinvestment of loaned funds is the optimal strategy of a borrower who has defaulted.

[11] In reality some borrowers obviously become delinquent without fully defaulting. However, due to the deterministic nature of investment earnings in our design we exclude partial repayments.

[12] Relative to existing experimental studies we introduce only one change, i.e. that the borrower reinvests funds upon which he defaulted, and hence there are no endogenous savings/consumption decisions in any of the treatments.

Both the lender and the borrower receive a symmetric "reservation" income of 10 points per period, if they decide not to trade. This design choice was made so that asymmetric reservation payoffs would not affect the decisions of lenders to offer credit. Thus, the income of the lender in each period is equal to her reservation payoff plus her net income from lending (R_t - S_t) if she lends.

$$\pi_t = \begin{cases} 10 & \text{if no loan } (S_t = 0 \text{ or } A_t = 0) \\ 10 - S_t + R_t & \text{if loan repaid } (S_t > 0, A_t = 1, D_t = 0) \\ 10 - S_t & \text{if loan default } (S_t > 0, A_t = 1, D_t = 1) \end{cases}$$

The income of the borrower is equal to his reservation payoff plus his gross investment income $v(C_t + S_t)$ minus the repayment he makes to the lender (R_t) and minus the capital which he keeps for the following period $C_{t+1} = C_t + D_tS_t$. As mentioned above, borrowers cannot liquidate their capital before the final period. In periods t={1,…,6} this amount is thus deducted from their gross income and transferred as capital to the following period.

$$u_{t=1,\ldots,6} = \begin{cases} 10 + vC_t - C_t & \text{if no loan } (S_t = 0 \text{ or } A_t = 0) \\ 10 + v(S_t + C_t) - R_t - C_t & \text{if loan repaid } (S_t > 0, A_t = 1, D_t = 0) \\ 10 + v(S_t + C_t) - (C_t + \quad S) & \text{if loan default } (S_t > 0, A_t = 1, D_t = 1) \end{cases}$$

At the end of period 7 the borrower can liquidate all of his capital and consume it. We make this assumption to ensure that repayment behavior in the final period of our main treatment has the same payoff implications as in our control treatment (described below) where loan defaults are feasible but the reinvestment of loan principal is not.

$$u_{t=7} = \begin{cases} 10 + vC_t & \text{if no loan } (S_t = 0, A_t = 0) \\ 10 + v(S_t + C_t) - R_t & \text{if loan repaid } (S_t > 0, A_t = 1, D_t = 0) \\ 10 + v(S_t + C_t) & \text{if loan default } (S_t > 0, A_t = 1, D_t = 1) \end{cases}$$

At the end of each period the lender is informed about the borrower's repayment decision. Each player gets to know his own and his partner's payoffs for this period and both players are informed about the borrower's capital for the following period.

2.1. Control Treatments

We contrast our main treatment with a control treatment - the **Strong Exclusion treatment (SE treatment) -** in which the borrower must liquidate his investment if he defaults. In this treatment the decision structure, information conditions and parameters are identical to the WE treatment. The only difference between the two treatments is the determination of the borrower's capital. In the SE treatment we impose that a defaulting borrower cannot keep the lender's funds and reinvest them in future periods. Thus, C_t =0 in each period.

Note that in both the WE treatment and the SE treatment borrowers can strategically default on their loans. The difference between the two treatments lies in what a borrower can do with the funds when he defaults. The SE treatment represents a legal environment in which loan default is possible, but debt enforcement occurs relatively quickly, such that the borrower can only evade repaying a loan if he liquidates his investment and consumes all the proceeds by the end of the period. In the WE treatment, by contrast, the borrower is not forced to liquidate his investment, if he defaults on a loan. The borrower continues using the loaned funds for investment purposes without having to surrender either his assets or his future profits from these assets to the creditor.

The SE treatment is closely related to the trust or investment game introduced by Berg et al. (1995). Repeated investment games have been studied intensively in the experimental literature (for a review see, e.g., Camerer 2003). They have also been adapted to lending relationships, for the study of experimental credit markets (Brown and Zehnder, 2007), and in a one-shot environment they have been shown to correlate to actual repayment behavior of microcredit borrowers (Karlan, 2005). We contribute to this literature by examining relationships in the WE treatment, which accounts for an inherent characteristic of many credit and investment environments where exclusion is weak: defaulting investees do not need to rely on repeated interaction with the investor to generate future income, but can continue to use the assets acquired with their previous loan.

Our second control treatment is the **One Shot Treatment** (**1-Shot Treatment**). Here the lending game lasts for 1 period only and borrowers have zero capital. This treatment serves as a benchmark for credit market performance when multi-period relationships are not feasible. Table 1 provides an overview of our experimental treatments.

Table 1 here

2.1. Procedures

At the beginning of each session participants are randomly assigned to the role of either a borrower or a lender. These roles are fixed for the whole session. Each player forms part of a matching group, composed of 3 lenders and 3 borrowers. Each player plays three rounds of our lending game: Each lender (borrower) repeats the lending game with the three different borrowers (lenders) in her/his matching group. As a consequence, we observe 9 lender-borrower relationships for each matching group.

In the WE and SE treatments, the lender and the borrower have an overview of the history of their bilateral interaction in previous periods for the current round. As mentioned above,

each round lasts 7 periods. For each past period in the current round they can see the loan size and requested repayment of the lender, whether it was accepted by the borrower and whether the borrower repaid. As a new round starts, lenders and borrowers are newly matched, and the history of play is consequently erased.

Behavior in our lending game might be affected by individual behavioral traits.[13] First, as shown by Schechter (2007), individual risk preferences affect decisions in investment games. Second, the level of strategic reasoning, i.e. the anticipation of what other subjects in the matching group might do, can affect behavior significantly (Nagel, 1995). Third, social preferences, i.e. reciprocal motives and fairness preferences of the borrower, as well as the anticipation of these preferences, i.e. trust by the lender, should affect behavior in our experiment.[14]

Before the lending game started, the participants took part in three pre-experiment games aimed at measuring their levels of risk aversion, strategic reasoning, trust and trustworthiness. Appendix A describes these pre-experiment games and provides summary statistics for their outcomes in our three treatments. We show there that there are no significant differences in behavior in these games between the treatments.[15] After the three pre-experimental games and before starting our lending experiment, each subject had to read a detailed set of instructions. The instructions can be found in Appendix C. The experimental instructions were framed in a credit context.[16] After reading the instructions participants had to pass a test with control

[13] Dohmen et al. (2009, 2010) document the role of behavioral traits in individual decision making in large representative population sample.

[14] Roe and Wu (2009) show that the behavior of players in a repeated gift-exchange game is related to their behavior in one-shot social preference games.

[15] Throughout the pre-experimental games subjects received no feedback. They were not informed about other subjects' decisions or their own payoffs until the end of the experiment. Subjects also knew that the decisions in each pre-experimental game had no effect on the lending game. The instructions for these games are available from the authors upon request.

[16] The reason why we chose a context-specific and not a neutral framing was that the experiment was relatively complex. In complex experiments a completely neutral language bears the danger that subjects create their own (potentially misleading) interpretation of the decision environment. Thus, the context specific framing gives us control over what our participants have in mind.

questions. The lending game did not start until all subjects had correctly answered all control questions.

In total 126 students participated in our experiment. In the WE treatment there were 7 matching groups of 6 players each, in the SE treatment 8 matching groups and in the 1-Shot treatment there were 6 matching groups. As displayed by Table 1 this implies that we observe 63 lender-borrower relationships in the WE treatment, 72 relationships in the SE treatment, and 54 relationships in the 1-shot treatment

Each participant could only participate in one session, so that each subject experienced only one of the treatments. All participants were students at Tilburg University. The experiment was programmed and conducted with the experimental software z-Tree (Fischbacher, 2007).

All sessions of the WE and SE treatments lasted approximately 90 minutes each. Sessions of the 1-shot treatment lasted approximately 50 minutes. Subjects received a show-up fee of 5 Euros and 1 additional Euro for every 25 points earned during the experiment. On average subjects earned 18.5 Euro for their participation.

3. Predictions

Under the assumption of common knowledge of rationality and selfishness of all market participants, the predictions for all three treatments are straightforward. Since repayments are not enforceable, a borrower's best response is to never repay a loan in a one period game. Lenders, anticipating this behavior, will never offer credit in the 1-Shot treatment. As it is common knowledge that the WE treatment and the SE treatment last for a finite number of periods, a backward induction argument ensures that this equilibrium is played in each period of these treatments.

A broad body of experimental evidence suggests, however, that not all people will simply maximize monetary payoffs in our experiment. Social preferences based on reciprocity (Dufwenberg and Kirchsteiger, 2004) or distributional concerns (Fehr and Schmidt, 1999) can induce borrowers in our experiment to repay loans even in one-shot interactions. Evidence from similar one-period investment games in the lab (Berg et al., 1995) and in the field (Karlan, 2005) suggests that a substantial share of second movers, i.e. borrowers in our context, do exhibit such social preferences and repay.

In the following we establish predictions for our treatments under the assumption that some (non-identifiable) borrowers are conditionally reciprocal: they are willing to meet their repayment obligations in a one-shot situation, as long as the repayment requested by the lender does not exceed a threshold value. We assume that this threshold $\overline{R}_t = \bar{r} S_t$ can be characterized by the maximum (gross) interest rate $\bar{r}$ that a social borrower is willing to pay. We assume that the remaining borrowers are selfish in the sense that they never repay loans in a one-shot situation. The share of social borrowers p is assumed to be $\frac{1}{\bar{r}^T} \leq p \leq \frac{1}{\bar{r}}$ such that it is not profitable for risk-neutral lenders to lend in a one-shot game, but such that an equilibrium in which all borrowers repay loans in period 1 of a $T>2$ period game is feasible.

The outcome of our pre-experimental games, documented in Appendix A, confirms that there is a substantial share of social borrowers in all three treatments. In particular, behavior in a one-shot strategy-method trust game suggests that less than 20% of the subjects in the roles of borrowers can be characterized as pure money-maximizers, who always default in a 1-shot situation By comparison, almost 25% of the subjects behave as social borrowers who are willing to repay a loan as long as the desired repayment implies equal surplus sharing (in our experiment $\bar{r} = 2$). This finding suggests the above condition on the share of social borrowers is satisfied in our sample.

In the following we outline the main predictions for each treatment resulting from the analysis of the repeated game in the WE and SE treatments. All proofs are presented in Appendix B. Since borrower types are a priori indistinguishable, the WE and SE treatments can be characterized as finitely repeated games of incomplete information. Theory suggests that such games have multiple equilibria (Kreps et al., 1982). We distinguish between two types of equilibria and, within each type, concentrate on the profit-maximizing equilibria for the lender, as he makes loan offers (as in Thomas and Worrall, 1994). In *reputation equilibria*, selfish borrowers imitate the behavior of social borrowers during the first periods but default towards the end of the game. In *screening equilibria*, selfish borrowers default in the first period, and from period 2 onwards the lender only extends credit to (now identified) social borrowers. It is important to note that in both treatments the one-shot equilibrium of no lending at all is also feasible.

In the **SE treatment** the profit-maximizing reputation equilibrium for the lender features loans of maximum size 10 in periods 1 to 6 and a loan of $10\frac{\bar{r}}{v}$ in period 7. Loan offers in periods t={2,…,7} are contingent on the borrower repaying all past loans. The incentive constraint of a selfish borrower in period t is as follows:

$$\sum_{k=t}^{T-1}(v-\bar{r})S_k + vS_T \geq vS_t \qquad (IC_{SE})$$

Since loans are of size 10 for periods 1 to 6, IC_{SE} is satisfied with inequality in these periods. The smaller loan size in period 7 implies that the constraint is satisfied with equality in period 6. Thus, in this period the selfish borrower is indifferent between repaying and defaulting, and defaults with a strictly positive probability. This allows the lender to learn about the borrower's type in period 6 and lend profitably in period 7.

A screening equilibrium is not feasible in the SE treatment. By definition in such an equilibrium selfish borrowers would default with certainty in the first period of the game. In

the following periods, the lender would offer maximum loans of 10 to the borrowers who did not default, i.e. social borrowers. However, given that the lender offers maximum loans in subsequent periods, a selfish borrower has no incentive to default in the first period. In other words, given that the gross interest rate in period 1 will not exceed $\bar{r}$, it is impossible for the lender to offer a contract that does not meet IC_{SE} in the initial period. We summarize these results in Proposition 1.

Proposition 1: *In the SE treatment the profit-maximizing reputation equilibrium features the maximum credit volume in periods 1 to 6 and no defaults in periods 1 to 5. A screening equilibrium is not feasible in this treatment.*

In the **WE treatment**, the potential to keep the lender's funds and reinvest them in future periods increases the borrower's incentive to default. This can be seen from the selfish borrower's incentive constraint in this treatment:

$$\sum_{k=t}^{T-1}(v-\bar{r})S_k + vS_T \geq vS_t + \sum_{k=t}^{T-1}(v-1)S_t \qquad (IC_{WE})$$

Reputation equilibria are also feasible in the WE treatment. However, these equilibria must be characterized by "starting small" loan profiles: To meet the borrower's incentive constraint IC_{WE}, the lender must start with non-maximum loans and increase the loan size offered to the borrower if he repays. The intuition for this result is simple: if the lender offers the maximum loan of 10 in period 1, a selfish borrower could default and reinvest these funds in all future periods without paying interest. The selfish borrower only stands to gain from repaying initial loans if future loans are higher. This is key in IC_{WE}: the left-hand side requires S_k to be increasing over time in order to compensate for the interest payments, which the borrower avoids by defaulting. In Appendix B we show that given the parameters of our experiment (v=3) and assuming that social borrowers are willing to pay a gross interest rate of

$\bar{r} = 2$, the profit maximizing loan schedule for the lender which meets IC_{WE} will be characterized by a loan S_1 of 4 in period 1, and a steady increase in loan size over the subsequent periods with S_7=10.

In contrast to the SE treatment, a screening equilibrium does exist in the WE treatment. If the lender offers a large enough loan in the first period, a selfish borrower prefers to default straight away. For example, a selfish borrower will never repay a loan of 10, with desired repayment of $10\bar{r}$, while a social borrower will repay such a loan. The lowest loan size such that the borrower is indifferent between repaying and defaulting, and thus the profit maximizing screening contract for the lender, can be found using IC_{WE}. By plugging in the gains from defaulting in period 2 on a loan size of 10 and comparing them to those from defaulting in period 1 on a loan size of *S'*, we find that $S' = 10 \cdot \frac{6v - 5}{6(v-1) + \bar{r}}$. In Appendix B we show that given the parameters of our experiment (v=3) and assuming that fair borrowers are willing to repay surplus-sharing loans ($\bar{r} = 2$) the first period loan in the profit-maximizing screening equilibrium would be $S' = 9$. A screening equilibrium with a first period loan of 10 also exists, though it is not profit-maximizing. These results are brought together in Proposition 2:

Proposition 2: *In the WE treatment the profit-maximizing reputation equilibrium features "starting small". Initial loans in a reputation equilibrium should be less than 5 and should increase gradually over time. No defaults are observed in periods 1 through 5. In this treatment a screening equilibria is also feasible in which lenders offer a loan of 9 or 10 in period 1 and 10 in all subsequent periods. In a screening equilibrium selfish borrowers default with certainty in the first period.*

Whether the reputation equilibrium or the screening equilibrium yields higher profits for the lender in the WE treatment depends on the parameters of the game: the gross return on investment (v in our experiment), the share of social borrowers (p), and the threshold repayment of social borrowers ($\bar{r}$). In Appendix B, we show that if v=3 , $\bar{r}$=2 and $\frac{1}{\bar{r}^T} \leq p \leq \frac{1}{\bar{r}}$ the lender earns a higher profit in the reputation equilibrium than in a screening equilibrium.[17]

How sensitive are our predictions to the assumption of a finite horizon? In an infinite horizon weak exclusion would have the same qualitative effects on credit volume and repayment: it would lead to a lower credit volume and higher defaults. Under strong exclusion the reputation equilibrium with maximum loan sizes is still profit-maximizing while screening is not feasible, as in the finite horizon case. Additionally, "starting small" equilibria may also be profit-maximizing (as in Ray, 2002), if the share of social borrowers is relatively small. Under weak exclusion a reputation equilibrium featuring "starting small" is still profit-maximizing, and screening is feasible as well. Note that, if exclusion is weak and there are no social borrowers, lending cannot occur in equilibrium, as in Bulow and Rogoff (1989), or as in the finite horizon case.

Our predictions above also assume that lenders are risk neutral. Allowing for moderate risk aversion does not affect the comparison between WE and SE treatments qualitatively. Under risk-aversion the reputation equilibrium in the WE treatment will still feature lower initial loan sizes than in the SE treatment, as this is the only way the incentive constraint of borrowers can be met. Furthermore, the screening equilibrium in the WE treatment is still feasible with risk-averse lenders, but would feature lower first-period loan offers.[18]

[17] The assumption that $\bar{r}$=2 implies that social borrowers demand at least half the surplus from a loan contract. As we show in section 4, this assumption is supported by observed behavior in our experiment. We find that the 2 is the most common interest rate demanded in both our treatments.

[18] For extreme degrees of risk aversion, where the lender prefers not to lend if there is a positive probability of default, there are no equilibria with lending at any point in time.

A comparison of our predictions for the WE and SE treatments leads to the following three hypotheses regarding treatment differences in credit relationships and the underlying behavior of lenders and borrowers:

H1 (Duration and Time Structure of Credit Relationships): Credit relationships which characterized by positive loan offers which are accepted and repaid have a lower average duration in WE treatment than in the SE treatment. The long-term credit relationships which do emerge in the WE treatment are more likely to "start small" than long-term relationships in the SE treatment.

H2 (Lender behavior): Lenders in the WE treatment are more likely to offer lower initial loans than lenders in the SE treatment as they fear that borrowers in the WE treatment are more likely to default on high initial loans. In both treatments lenders condition loan offers in periods 2-7 on past repayment behavior of their borrower. Conditional on offering a loan, lenders in the WE treatment offer a stronger increase in loan sizes over the course of a credit relationship than in the SE treatment.

H3 (Borrower behavior): Borrowers in the WE treatment are less likely to repay large loans than borrowers in the SE treatment, especially in initial periods. In both treatments the propensity for borrowers to repay decreases with the repayment demanded by the lender.

Our predictions also imply differences in investment and thus efficiency across our treatments. We expect that in the WE and SE treatments investment is higher than in the baseline 1-shot treatment. Aggregate investment should be lower in the WE than in the SE treatment if reputation equilibria rather than just screening equilibria do emerge in the WE treatment. Reputation equilibria will be characterized by higher lending volumes and thus higher investment in the SE than in the WE treatment. Note that a screening equilibrium in the

WE treatment may be characterized by almost full efficiency, as defaulting selfish borrowers can reinvest the lender's funds.

4. Results

We start the presentation of our results by comparing the duration and time structure of credit relationships in the WE and SE treatments. We then turn to examine lender behavior and borrower behavior in each treatment. We conclude with by comparing efficiency and payoffs in the WE and SE treatments to that in our benchmark 1-shot treatment.

2.1. The emergence and time structure of long-term credit relationships

In each of the 7 periods of a credit relationship the lender must decide whether to offer credit, while the borrower must decide whether to accept the offer and then whether to repay the loan. We define an active credit relationship as one which up to any given decision point has always been characterized by (i) strictly positive credit amounts offered, (ii) the loan offer has always been accepted, and (iii) the loan has always been repaid.

Figure 1 reveals that the survival rate of active credit relationships is markedly lower in the WE treatment compared to the SE Treatment. In the WE treatment only 48% of the 63 relationships are still active at the end of the first period, compared to 74% of the 72 relationships in the SE treatment. This difference in first-period survival is statistically significant (Mann-Whitney test, p-value<0.01) and is driven by a lower number of loans offered (86% vs. 99%), a lower acceptance ratio (80% versus 92%), and a lower repayment rate (70% versus 82%) in the WE treatment. The substantial treatment difference in the survival of active credit relationships continues in period 2. Only 30% of all relationships in

the WE treatment are active by the end of period 2 compared to 60% in the SE treatment.[19] Between periods 3-5 the number of active relationships remains quite stable in the SE treatment (close to 60%) while it drops to only 10% in the WE treatment. In periods 6 and 7 the majority of relationships in the SE treatment fall subject to the end-game effect: Borrowers start to default on loans and lenders deny access to further credit.[20]

Figure 1 here

Figure 2 confirms our hypothesis that the time structure of loans in credit relationships differs between the WE treatment and SE treatment. The figure displays the average loan size by period for relationships with different ultimate lengths. We hereby define the ultimate length of a relationship as the number of periods for which the relationship is active, i.e. loans are offered, accepted and repaid. A relationship in which a loan is offered and accepted in period 1, but not repaid is defined as having an ultimate length of 0 periods. By contrast, a relation which involved positive loan offers in all periods, and in which the borrower always accepted and repaid the loan has an ultimate length of 7 periods. [21]

In the SE treatment (Figure 2B) we find that long-term relationships, i.e. relationships with an ultimate duration of at least 4 periods start off with higher initial loan sizes than short-term relationships (relationships with an ultimate duration of 2 or 3 periods).[22] By

[19] Besides the relationships which are active in both period 1 and 2, we observe 5 relationships without a loan offer in period 1, but successfully started in period 2. Further, there are 17 relationships, six in the SE treatment and eleven in the WE treatment, credit is offered in the first period, but the offer is rejected by the borrower. Lenders attempt to "restart" 16 of these relationships (10 in the WE and 6 in the SE treatment) in period 2 by offering credit. Twelve of these loans are accepted by borrowers in period 2 (7 in the WE and 5 in the SE treatment) and six of these loans are repaid (2 in the WE and 4 in the SE treatment).

[20] This effect is stable across rounds as shown in Appendix D, Figure D1.

[21] For each ultimate length Figure 2 reports the number of relationships in the legend (N). In total, there were 72 lending relationships in the SE treatment and 63 in the WE treatment. Seven relationships in the SE treatment and twenty in the WE treatment did not start, i.e. there was no loan offer or no loan offer was accepted, in period 1. Hence, N adds up to 65 and 43 in the SE and WE treatments, respectively. See Table D1 in Appendix D for a corresponding analysis per round.

[22] See Brown et al. (2004) for a similar evidence in a finitely repeated gift-exchange game with endogenous partner choice.

comparison, in the WE treatment (Figure 2A) the long-term relationships that emerge are of two types: they either start off with small loan sizes, lower than 4, or start off very large, with loan sizes of 9 or more. The small initial loan size in some of the long-term relationships in the WE treatment is in line with the reputation equilibria. The long-term relationships in the WE treatment which start with large loan sizes develop in line with a screening equilibrium in which the lender is paired with a social borrower until period 5 or 6.[23]

Insert Figure 2 here

Overall, the time structure of credit relationships in the WE and SE treatments confirm our Hypothesis 1:

Result 1: *In the WE treatment the average duration of active credit relationships is shorter than in the SE treatment. Those long-term credit relationships that do emerge in the WE treatment are of two types: they are either characterized by lower initial loan volumes than long-term relationships in the SE treatment, or by large loan volumes, similar to the SE treatment.*

2.1. Lender behavior

Hypothesis 2 suggests that lenders in the WE treatment will be more likely to offer low initial loans than in the SE treatment, as this is the only way to motivate selfish borrowers to repay in the WE treatment. Figure 3 displays the distribution of loan sizes and interest rates

[23] The relationships which lasted 6 periods occurred in the third round of the experiment. In both, the lender stopped lending in the last period, though the borrower had always repaid previous loans. The relationship which lasts 5 periods with maximum loan sizes occurred in the first round of the experiment. In this relationship the borrower defaulted in period 6. One possible explanation ist hat the borrower may have doubted whether the lender would renew the contract in period 7.

offered by lenders to borrowers in the first period of relationships in the WE and SE treatments. The figure reveals that large loans are less frequent under weak exclusion. In the SE treatment more than 35% of lenders choose a loan larger than 8, and almost 70% offer loan sizes of 5 and above. By contrast, in the WE treatment only 19% of lenders offer a loan larger than 8 in period 1 and less than 45% of loans offered are of size 5 and above.[24] In the WE treatment small loans are most frequent. More than 40% of the lenders offer loans of sizes between 1 and 4. Figure 1B shows that the distribution of gross interest rates (Requested Repayment / Loan Size) is similar in the WE and SE treatments: In both treatments the surplus sharing interest rate of 2 is most common. This supports our assumption of $\bar{r}=2$ in Section 2.3.[25]

Figure 3 here

Table 2 reports the results of a multivariate analysis relating first-period loan offers to the treatment (WE or SE) and characteristics of the lender. The estimated coefficient of the dummy variable *WE treatment* in column 3 suggests that first-period loans in the WE treatment were on average 2.2 points lower than in the SE treatment. The column (1-2) estimates show a trend in loan sizes across rounds in the WE and SE treatments. In the WE treatment first-period loans in round 3 are smaller than in round 1 and 2. By contrast in the SE treatment first-period loans are higher in round 2 and round 3 than in round 1. In column (4) the interaction effects *WE Treatment * Round 2* and *WE Treatment * Round 3* confirm this opposite development of first-period loans across rounds in the two treatments.

[24] Our data shows that there are no first period loan offers of 9 in either treatment. Thus all offers above 8 are actually offers including the maximum loan size of 10.
[25] The characteristics of first-period loan offers are stable across rounds, as shown in Appendix D, Figure D2 and Table D1.

In both treatments we find that the variation in initial loan offers across lenders is related to individual risk attitudes. In Table 2 we control for three measures of lender characteristics using data from the pre-experimental games discussed in section 2.3. We find that lenders with higher indicators of risk aversion offer smaller period 1 loans in the WE and the SE treatment. This finding confirms field evidence by Schechter (2007) suggesting that first-mover behavior in trust-games is significantly related to individual risk attitudes.[26]

Table 2 here

Figure 3 and Table 2 suggest that (at least after the first round) lenders were well aware of the weaker incentives of borrowers to repay large loans in the WE treatment. This finding is supported by an analysis of lenders' beliefs about the first-period repayment behavior of borrowers. While lenders waited for borrowers' decisions on the acceptance and repayment of loans, we elicited their beliefs about repayment. These were not incentivized to avoid increasing the complexity of the experiment for participants. Lenders simply answered the question 'How probable do you think it is that the borrower will make the desired repayment?' with a scale from 1, 'very unlikely', to 6, 'very likely'.

Among the lenders who offered a loan size of 10 in the SE treatment, the average share of lenders who stated that repayment was likely or very likely was 53%. Among the lenders who offered a loan size of 5-8 55% stated that repayment was likely or very likely. By contrast, among lenders who offered first-period loan sizes of 1-4 only 23% thought borrowers were likely or very likely to repay.

In the WE treatment we observe a very different pattern of lenders' beliefs. Among those lenders who offered loans of 5-8 (10) in the first period only 28% (25%) stated that repayment

[26] If each lender characteristic is entered separately (instead of jointly as in Table 3), results remain the same. This suggests that risk attitudes directly, not through their impact on trust, affect first-period loan sizes.

was likely or very likely. By contrast, among those lenders who offered a first-period loan of 1-4 50% thought that repayment was likely or very likely.[27] Thus, in line with our second hypothesis, lenders in the SE treatment expect a strategy of "starting small" to be more successful in inducing repayment by borrowers. The beliefs of lenders who offer high first-period loans are in line with the screening equilibrium, whereby large loans are more likely to lead to default.[28]

Table 3 here

In Table 3 we analyze the development of loan sizes over time focusing only on surviving relationships. We hereby compare loan sizes in a given relationship for each pair of consecutive periods. From Period 1 to 2, transitions are significantly different in the WE treatment compared to the SE treatment (Fisher exact test, p-value=0.074). In particular, in the WE treatment there is a larger share of relationships with small period 1 loans (loans of sizes 1-4) that experience an increase in loan size in Period 2. By contrast in the SE treatment there is a higher share of relationships with large period 1 loans (loan size of 9-10) that remain the same in Period 2. That said, even in the SE treatment we observe a substantial share of relationships which exhibit an increase in loan sizes over time. This result does not correspond to the profit-maximizing equilibrium for a (risk-neutral) lender in the SE treatment discussed in Section 3.2, i.e. a flat profile of loans of size 10. This finding is, however, in line with previous experimental research (Anderhub et al., 2002; Cochard et al., 2004; King-Casas et al., 2005 and Bornhorst et al., 2010). Transitions also differ significantly for Periods 2 to 3

[27] Results remain qualitatively the same if we focus on Rounds 2 and 3. In the SE treatment, the percentage of lenders offering loans of sizes 1-4, 5-8 and 9-10, who believed repayment was likely was 0%, 53% and 52% respectively. For the WE treatment, the percentages were 52%, 33% and 20%, respectively.

[28] Note that eliciting beliefs about repayment is the closest way to identify screening, from the lender's perspective, in the experiment. Using the strategy method could not help since it requires that the contingent plans made by lenders are implementable. If a lender offers a loan of 10 in period 1, conditional on the borrower defaulting, her offer must be 0 in period 2. Thus, a lender's naïveté cannot be observed.

and 3 to 4 between treatments (Fisher's exact test, p-value=0.075 and 0.086). No significant difference is observed in later periods, though these results should be interpreted with caution due to the lower number of relationships in the WE treatment.

Table 4 here

Our predictions suggest that in both treatments the renewal of loan offers by lenders from one period to another should be strongly contingent on the repayment of past loans by their borrowers. Table 4 analyzes the contract renewal behavior of lenders in the WE and SE treatments.[29] As borrowers in the WE treatment may have accumulated capital in previous periods (by defaulting) we need to normalize the loan size offered by lenders by the maximum potential loan to the borrower (10 – capital in the WE treatment; 10 in the SE treatment). We label the normalized loan size the *Loan share*. In columns (1- 4) of Table 4 we examine the *Loan share*, offered by lenders in both treatments. In columns (5-12) we split the loan offer of the lender into two separate decisions: we examine the decision of the lender to offer a positive loan rather than no loan at all (*Contract renewal*). Second we examine the loan share offered, conditional on the contract being renewed (i.e. for positive loan sizes only).

The Table 4, column (1-4) results suggest that loan offers are strongly contingent on past repayment in both treatments. Interestingly, the effect of past repayment is stronger in the SE treatment. In the WE treatment, lenders are significantly less likely to offer a loan if the borrower repays (coefficient of *WE * Past repayment*) and somewhat more likely to offer a loan if the borrower defaulted in the past (*WE treatment* coefficient in column 4). A similar result emerges considering contract renewal (columns 5-8) and loan shares conditional on

[29] The regression results reported in Table 4 include individual lender characteristics as well as round fixed effects. Results remain qualitatively the same if we use lender fixed effects. Due to our interest in the interaction effects of treatment dummies and other variables we use linear probability models rather than probit or logit models. (see Ai and Norton, 2003 for a discussion of the difficulty of interpreting the marginal effects of interaction terms in non-linear models).

contract renewal (columns 9-12). The renewal probability does not increase significantly in periods 4-5, compared to periods 2-3, and then drops significantly in periods 6-7.

The Table 4 results suggest that lenders are significantly more likely to "get cold feet" during relationships in the WE treatment: they are more likely to stop lending to borrowers who repaid in the past. This finding is in line with Figure 1 which reveals that, even in cases where the borrower repaid past loans, lenders sometimes stop lending. This occurs in all periods in the WE treatment. By contrast, it never occurs in periods 2-4 in the SE treatment, and only starts happening towards the end of relationships (periods 5-7).[30]

The Table 4 results confirm our observation from Figure 3 and Table 3 that "starting small" is more common in the WE treatment. Conditional on contract renewal, we find that loan increases over time are stronger in the WE treatment: The estimated coefficients of Period 4-5 and Period 6-7 are larger in column 9 (WE treatment) than in column 10 (SE treatment). Moreover, in column (12) the interaction terms *WE treatment*Period 4-5* and *WE treatment*Period 6-7* are both positive and sizeable, though the first lacks statistical significance.

Result 2: *Lenders in the WE treatment offer smaller loans in the initial period of relationships compared to the SE treatment, as they expect higher default rates on large loans. In both treatments, conditional on contract renewal, relationships display in increase in loan size over time. More relationships in in the WE treatment experience an increase in loan size over time than in the SE treatment.*

2.1. Borrower behavior

[30] Our data shows further that, after a default, lenders attempt to restart relationships in less than half of the cases, 48.3% of the cases in the WE treatment and in 41.5% of the cases in the SE treatment. Lenders offer borrowers loans that are small, the loan share is 0.25 in the WE treatment and 0.19 in the SE treatment. In 91.9% and 92.7% of the cases, respectively, these loan offers are accepted. They are repaid at low rates, in 34.9% of the cases in the WE treatment and in 32.1% of the cases in the SE treatment.

Conditional on receiving a loan offer, a borrower must make two decisions: He has to decide whether to accept or reject the offer, and then conditional on acceptance, he decides whether to repay the loan or default. Figure 4 displays the frequency with which borrowers reject and default by treatment, conditional on the offered loan size (Figure 4A) and the desired repayment (Figure 4B).

Figure 4A shows that larger loans are less likely to be rejected than small loans in both treatments. Moreover, Figure 4B shows that loan offers which propose a gross interest rate (desired repayment / loan size) larger than 2 are much more likely to be rejected. In line with our assumption on the presence of social preferences among borrowers, this result confirms that borrowers dislike loans which offer them less than an equal split of surplus. The multivariate analysis presented in columns 1 to 3 of Table 4 confirm that in both treatments borrowers are more likely to reject loan offers with higher interest rates.

Figure 4 here

Table 5 here

In line with our hypotheses we find that borrowers in the WE treatment are more likely to default on large loans than borrowers in the SE treatment. Figure 4A shows that while the probability of default is decreasing with loan size in the SE treatment, the opposite is the case in the WE treatment. The repayment rate on loans of 5-8 (9-10) is 12.2 (13.9) percentage points lower in the WE than in the SE treatment. The multivariate analysis presented in columns 5 to 8 of Table 5 confirms that the probability of default increases with loan size in the WE treatment but not in the SE treatment. The positive coefficient of the interaction term *WE * Loan size* in column 8 confirms that this treatment difference is statistically significant.

In line with our findings that relational contracts are less frequent in the WE treatment than in the SE treatment we find a strong end-game effect on loan repayment only in the latter treatment. The probability of default increases by 52 percentage points in the final two periods in the SE treatment. This effect is consistent with the unraveling of reputational incentives for selfish borrowers.

Result 3: *Borrowers in the WE treatment are more likely to default on large loans than borrowers in the SE treatment. Due to the unraveling of reputational incentives defaults increase significantly in the final periods of the SE treatment. This is not the case in the WE treatment.*

2.1. Efficiency

Efficiency in our experiment is determined by the volume of investment in each period. In the SE treatment the volume of investment is identical to the volume of credit extended by lenders in each period. In the WE treatment the investment volume is determined by the accumulated volume of loans to a borrower up until that period, including loans upon which the borrower defaulted. Thus if more borrowers default in early periods of the WE treatment, this may not imply lower efficiency compared to the SE treatment.

Our results show that - due to lower initial loan sizes and the early breakdown of credit relationships - investment is lower in the WE treatment than the SE treatment. However, significant differences in investment levels only materialize in the third round of our experiment. Averaged over all three rounds investment per borrower and period is 5.54 in the SE treatment compared to 5.45 in the WE treatment. These average investment levels are significantly higher than in our baseline one-shot treatment (3.61) confirming that in both treatments the potential for repeated interaction increases credit market performance. Mann-

Whitney tests using group averages as the unit of observation confirm that the difference between the 1-shot and the SE treatment (p-value=0.07) as well as the difference between the 1-shot and the WE treatment (p-value=0.02) is significant, while the difference between the WE and SE treatments is not (p-value = 0.91).

By Round 3 average investment is 5.78 in the SE treatment, 4.41 in the WE treatment, and 2.78 in the 1-shot treatment. The difference between the SE and WE treatments is significant (Mann-Whitney test, p-value=0.03). The fall in investment level across rounds in the WE treatment suggests that it takes lenders time to learn that the weaker repayment incentives strongly undermine the feasibility of relational contracts.

Table 5 here

The lower level of surplus in the WE treatment compared to the SE treatment is borne by lenders. Averaged over all rounds lenders profits' are lower in the WE treatment (10.83) than in the SE treatment (13.26). A Mann-Whitney test (p-value=0.01) confirms that this difference is statistically significant. Averaged over all rounds borrowers' profits are actually higher in the WE treatment (20.06) than in the SE treatment (17.82). However, as lenders reduce their lending in the second and third round of the WE treatment borrowers profits also fall over time. By Round 3 borrowers profits' in the WE treatment are almost identical to those in the SE treatment.

Result 4: *Investment and thus total surplus are higher in the WE treatment and SE treatment than in the benchmark 1-shot treatment. Investment is lower in the WE treatment than in the SE treatment only in the final round. Differences in total surplus across treatments are borne by lenders.*

5. Conclusion

In this paper we examine how the ability of principals to exclude misbehaving agents from their current income source impacts on the duration and time structure of relational contracts. Our results suggest that weak exclusion reduces the number of long-term credit relationships in which moral hazard is mitigated through reputation incentives. When relational contracts do emerge under weak exclusion, they frequently "start small" to motivate selfish borrowers to repay.

Our findings provide strong support to the conjecture that observed patterns of progressive lending in microfinance and staggered investment in FDI relationships may be driven by weak creditor and investor protection. In particular, the small initial investment sizes, observed in such relationships (Armendariz and Morduch, 2006; Rauch and Watson, 2003) may be driven by the fear that borrowers or host-country partners may default and continue to use the investor's funds in the future.

More generally, our findings provide a new perspective on the conditions under which relational contracts may successfully develop. In most existing studies, principals, i.e. lenders or employers, are assumed to have the ability to exclude agents, i.e. borrowers or workers, from their current income source. However, in many situations, such as unsecured debt environments or service markets, agents may have the possibility running away with borrowed funds or the firms' clients after misbehaving. In such cases, we show that the nature and effectiveness of relational contracts is likely to change.

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Table I. Treatments and Number of Observations

Treatment	Conditions	Observations
Weak Exclusion (WE Treatment)	7 period game, after default borrower reinvests the loan principal for all remaining periods	7 matching groups = 63 lender-borrower relations
Strong Exclusion (SE Treatment)	7 period game, after default the borrower cannot reinvest the loan principal	8 matching groups = 72 lender-borrower relations
One-Shot (1-Shot Treatment)	1 period game	6 matching groups = 54 lender-borrower relations

Table 2. Determinants of first-period loan offers

The table reports OLS estimates for the dependent variables *Loan size* (columns 1-4) and *Interest* (columns 5-8), using observations from the first period of each relationship only. *Loan size* is the loan offered by lenders, taking values from 0 to 10. *Interest* is the gross interest rate (Repayment / Loan Size) requested by lenders, and takes values 0 to 3. *WE Treatment* is a dummy variable which is 1 for all observations from the WE treatment and zero for those from the SE treatment. All regressions include Round fixed effects, whereby Round 1 is the ommitted category. The variables *Risk aversion* , *Strategic reasoning* and *Trust* are lender-specific measures elicited from pre-experiment games. Standard errors are reported in brackets and are corrected for clustering at the matching group level. *, **, *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable		*Loan size*				*Interest*		
Treatment	WE	SE	WE and SE	WE and SE	WE	SE	WE and SE	WE and SE
WE Treatment			-2.185***	-0.510			0.147	0.158
			[0.540]	[0.746]			[0.105]	[0.140]
WE Treatment * Round 2				-2.030***				0.059
				[0.594]				[0.134]
WE Treatment * Round 3				-2.994***				-0.100
				[0.685]				[0.174]
Round 2	-0.905	1.125***	0.178	1.125***	0.098	0.032	0.052	0.027
	[0.556]	[0.284]	[0.396]	[0.274]	[0.117]	[0.064]	[0.064]	[0.065]
Round 3	-1.952***	1.042	-0.356	1.042*	-0.068	0.052	0.007	0.048
	[0.425]	[0.575]	[0.536]	[0.554]	[0.176]	[0.067]	[0.078]	[0.068]
Risk aversion	-0.440*	-0.632**	-0.575***	-0.575***	-0.021	0.030*	0.015	0.014
	[0.187]	[0.208]	[0.110]	[0.111]	[0.034]	[0.013]	[0.021]	[0.021]
Strategic Reasoning	-0.015	-0.039	-0.026	-0.026	-0.003	0.003	-0.001	-0.001
	[0.057]	[0.038]	[0.042]	[0.042]	[0.005]	[0.004]	[0.003]	[0.003]
Trust	0.33	0.057	0.154	0.154	-0.029	0.028*	0.013	0.012
	[0.285]	[0.140]	[0.127]	[0.128]	[0.025]	[0.012]	[0.013]	[0.013]
Constant	7.165	12.082***	11.005***	11.005***	2.630***	1.422***	1.891***	1.891***
	[6.001]	[2.852]	[3.381]	[3.381]	[0.384]	[0.300]	[0.297]	[0.297]
Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Lender effects	no	no	no	no	no	no	no	no
Observations	63	72	135	135	54	71	125	125
Number of Lenders	21	24	45	45	21	24	45	45
R^2	0.26	0.13	0.21	0.24	0.07	0.17	0.058	0.07

Table 3. Changes in loan offers: periods 2-7

The transition matrices in this table show the change in loan size from period t-1 to period t in surviving relationships (in which the borrower repaid in t-1) by treatment. Within each transition matrix, loans in period t-1 are classified into 3 groups following Figure 3, i.e. loan size 1-4, 5-8 or 9-10. Loan changes from period t-1 to period t are classified into three groups: smaller, equal and larger. Smaller loans include loans of 0, i.e. relationships

	Period 2 loan					
	WE Treatment (N=30)			SE Treatment (N=53)		
Period 1 loan	Smaller	Equal	Larger	Smaller	Equal	Larger
1-4	3%	13%	47%	0%	9%	23%
5-8	0%	10%	10%	0%	8%	25%
9-10	3%	13%	0%	4%	32%	0%

	Period 3 loan					
	WE Treatment (N=18)			SE Treatment (N=45)		
Period 2 loan	Smaller	Equal	Larger	Smaller	Equal	Larger
1-4	11%	22%	17%	0%	13%	7%
5-8	0%	11%	11%	0%	7%	24%
9-10	0%	28%	0%	0%	49%	0%

	Period 4 loan					
	WE Treatment (N=10)			SE Treatment (N=44)		
Period 3 loan	Smaller	Equal	Larger	Smaller	Equal	Larger
1-4	0%	10%	40%	0%	7%	9%
5-8	0%	0%	0%	0%	9%	9%
9-10	10%	40%	0%	2%	64%	0%

	Period 5 loan					
	WE Treatment (N=8)			SE Treatment (N=41)		
Period 4 loan	Smaller	Equal	Larger	Smaller	Equal	Larger
1-4	0%	13%	13%	0%	5%	2%
5-8	0%	0%	38%	2%	5%	10%
9-10	0%	38%	0%	2%	73%	0%

	Period 6 loan					
	WE Treatment (N=5)			SE Treatment (N=38)		
Period 5 loan	Smaller	Equal	Larger	Smaller	Equal	Larger
1-4	0%	0%	20%	0%	5%	0%
5-8	0%	0%	20%	5%	5%	5%
9-10	0%	60%	0%	21%	55%	3%

	Period 7 loan					
	WE Treatment (N=4)			SE Treatment (N=17)		
Period 6 loan	Smaller	Equal	Larger	Smaller	Equal	Larger
1-4	0%	0%	0%	0%	6%	0%
5-8	25%	0%	0%	0%	0%	6%
9-10	50%	25%	0%	29%	59%	0%

Table 4. Lender behavior in periods 2-7

The table reports panel estimates for *Loan share* (columns 1-4), defined as loan size divided by the maximum possible loan offer (10 - capital of the borrower), *Contract renewal* (columns 5-8) and *Loan share* conditional on contract renewal (columns 9-12) in all relationships in periods 2 to 7. Loan share ranges from 0 to 1. *Contract renewal* is a dummy variable which is 1 if the lender offers a loan, i.e. loan size>0, 0 otherwise. Past repayment is a dummy variable which is 1 if the borrower repaid the loan in the previous period. *Period* 4-5 and 6-7 are dummy variables denoting the corresponding period of the relationship (Period 2-3 is the ommitted category). *WE* is a dummy variable which is 1 for all observations from the WE treatment and zero for those from the SE treatment. Standard errors are clustered at the matching group level and reported in brackets. All regressions include lender characteristics (risk aversion, strategic reasoning and trust), round fixed effects and the interaction of round fixed effects with the treatment dummy. *, **, *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	*Loan share, including no offer*				*Contract renewal (offer)*				*Loan share, conditional on offer*			
Treatment	WE	SE	WE and SE	WE and SE	WE	SE	WE and SE	WE and SE	WE	SE	WE and SE	WE and SE
Past repayment	0.185***	0.571***	0.405***	0.569***	0.331***	0.661***	0.527***	0.668***	-0.081	0.244***	0.046	0.247***
	[0.063]	[0.051]	[0.069]	[0.049]	[0.095]	[0.072]	[0.077]	[0.077]	[0.070]	[0.059]	[0.074]	[0.056]
Period 4-5	0.089***	0.038	0.067***	0.038	0.013	-0.027	-0.003	-0.028	0.094***	0.053***	0.075***	0.053***
	[0.031]	[0.029]	[0.020]	[0.028]	[0.029]	[0.036]	[0.025]	[0.036]	[0.021]	[0.016]	[0.016]	[0.016]
Period 6-7	0.010	-0.108**	-0.067	-0.108**	-0.143**	-0.209***	-0.183***	-0.210***	0.134***	0.060**	0.091***	0.060**
	[0.063]	[0.044]	[0.041]	[0.043]	[0.056]	[0.039]	[0.034]	[0.038]	[0.037]	[0.027]	[0.024]	[0.026]
WE Treatment			-0.119**	0.162**			-0.013	0.235*			-0.135***	0.145**
			[0.049]	[0.066]			[0.070]	[0.122]			[0.052]	[0.068]
WE * Past repayment				-0.385***				-0.332***				-0.330***
				[0.077]				[0.115]				[0.086]
WE * Period 4-5				0.050				0.044				0.042
				[0.041]				[0.045]				[0.026]
WE * Period 6-7				0.117				0.074				0.074*
				[0.074]				[0.066]				[0.044]
Constant	0.583	0.436***	0.648***	0.521**	0.746**	0.429***	0.559***	0.463**	0.838**	0.834***	1.061***	0.883***
	[0.447]	[0.167]	[0.195]	[0.226]	[0.326]	[0.123]	[0.168]	[0.181]	[0.424]	[0.206]	[0.209]	[0.229]
Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Lender indiv. charateristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	186	342	528	528	186	342	528	528	151	282	433	433
Number of Lenders	21	24	45	45	21	24	45	45	19	24	43	43
R^2 - overall	0.185	0.422	0.324	0.363	0.146	0.514	0.339	0.376	0.0575	0.0960	0.116	0.128

Table 5. Borrower behavior

This table reports panel estimates for *Offer rejection* (columns 1 to 4) and *Default* (columns 5 to 8) in surviving relationships from Period 1 to 7. *Offer rejection* is a dummy variable that takes value 1 if the borrower rejects the lender's offer, 0 otherwise. *Default* is a dummy variable that takes value 1 if the borrower does not repay an accepted loan offer. *Interest* is the gross interest rate (Repayment / Loan Size) desired by the lender. Period 2-3, 4-5 and 6-7 are dummy variables denoting the corresponding period of the relationship (Period 1 is the ommitted category). *WE* is a dummy variable which is 1 for all observations from the WE treatment and zero for those from the SE treatment. Standard errors are clustered at the matching group level and reported in brackets. All regressions include borrower characteristics (risk aversion, strategic reasoning and trustworthiness), round fixed effects and the interaction of round fixed effects with the treatment dummy. *, **, *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	*Offer rejection*				*Default*			
Treatment	WE	SE	WE and SE	WE and SE	WE	SE	WE and SE	WE and SE
Loan size	-0.002	0.001	0.003	0.002	0.024*	-0.010*	0.004	-0.006
	[0.015]	[0.004]	[0.007]	[0.004]	[0.014]	[0.006]	[0.008]	[0.009]
Interest	0.276***	0.118***	0.217***	0.130***	0.356*	0.198**	0.334***	0.256***
	[0.080]	[0.042]	[0.060]	[0.050]	[0.215]	[0.081]	[0.117]	[0.085]
Period 2-3	-0.179***	-0.081**	-0.116***	-0.083**	0.049	-0.096**	-0.026	-0.062**
	[0.034]	[0.035]	[0.027]	[0.034]	[0.076]	[0.039]	[0.036]	[0.028]
Period 4-5	-0.160***	-0.082**	-0.110***	-0.085**	0.039	-0.081	-0.027	-0.039
	[0.050]	[0.037]	[0.028]	[0.036]	[0.084]	[0.049]	[0.030]	[0.033]
Period 6-7	-0.164***	-0.078**	-0.107***	-0.079**	-0.008	0.407***	0.415***	0.477***
	[0.054]	[0.037]	[0.031]	[0.035]	[0.168]	[0.110]	[0.100]	[0.103]
WE Treatment			0.036	-0.177			0.166*	-0.248
			[0.031]	[0.207]			[0.087]	[0.495]
WE * Loan size				-0.004				0.029**
				[0.016]				[0.015]
WE * Interest				0.147*				0.080
				[0.089]				[0.235]
WE * Period 2-3				-0.078				0.111
				[0.052]				[0.075]
WE * Period 4-5				-0.061				0.075
				[0.060]				[0.077]
WE * Period 6-7				-0.087				-0.500***
				[0.064]				[0.191]
Constant	-0.571***	-0.172*	-0.437***	-0.300***	-0.324	0.150	-0.058	0.170
	[0.170]	[0.105]	[0.130]	[0.110]	[0.470]	[0.182]	[0.276]	[0.189]
Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Borrower characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Round fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	120	295	415	415	109	289	398	398
Number of Lenders	21	24	45	45	21	24	45	45
Overall R^2	0.295	0.104	0.207	0.235	0.155	0.241	0.169	0.214

Table 6. Investment and Profits

The table reports means for investment, lender profits and borrower profits by treatment. *Investment* is defined as the amount invested from the borrower, stemming from the accepted loan size plus the capital of the borrower. *Lender profit* and *Borrower profit* are the per-period payoffs of the lender / borrower. *Mann-Whitney tests* denotes the p-values of treatment comparisons based on matching group level data. Results are shown for all rounds first, and then separately for rounds 1 to 3. Each round represents a 7-period lender-borrower interaction.

	Investment			
	All rounds	Round 1	Round 2	Round 3
WE	5.45	6.67	5.27	4.41
SE	5.54	5.60	5.24	5.78
1-shot	3.61	4.44	4.11	2.28
Mann-Whitney test				
WE vs. SE	0.91	0.42	0.56	0.03
SE vs. 1 shot	0.07	0.44	0.27	0.00
WE vs. 1-shot	0.02	0.00	0.22	0.00

	Lender profits			
	All rounds	Round 1	Round 2	Round 3
WE	10.83	11.42	9.99	11.09
SE	13.26	12.48	13.15	14.14
1-shot	7.02	6.00	7.33	7.72
Mann-Whitney test				
WE vs. SE	0.01	0.25	0.00	0.01
SE vs. 1-shot	0.00	0.00	0.00	0.00
WE vs. 1-shot	0.00	0.00	0.03	0.00

	Borrower profits			
	All rounds	Round 1	Round 2	Round 3
WE	20.06	21.91	20.54	17.73
SE	17.82	18.71	17.32	17.42
1-shot	20.20	22.89	20.89	16.83
Mann-Whitney test				
WE vs. SE	0.13	0.10	0.13	0.42
SE vs. 1-shot	0.12	0.01	0.12	0.90
WE vs. 1-shot	0.89	0.43	0.83	0.57

Figure 1. Survival of active credit relationships

Figure 1 compares the duration of credit relationships in the WE and SE treatments. For each decision point in each period it shows the share of relationships which are fully active at that point in time. We define an active relationship as one in which are characterized by positive loan amounts, loan acceptance and loan repayment at all prior decision points. The total number of relations are 63 in the WE treatment and 72 in the SE treatment.

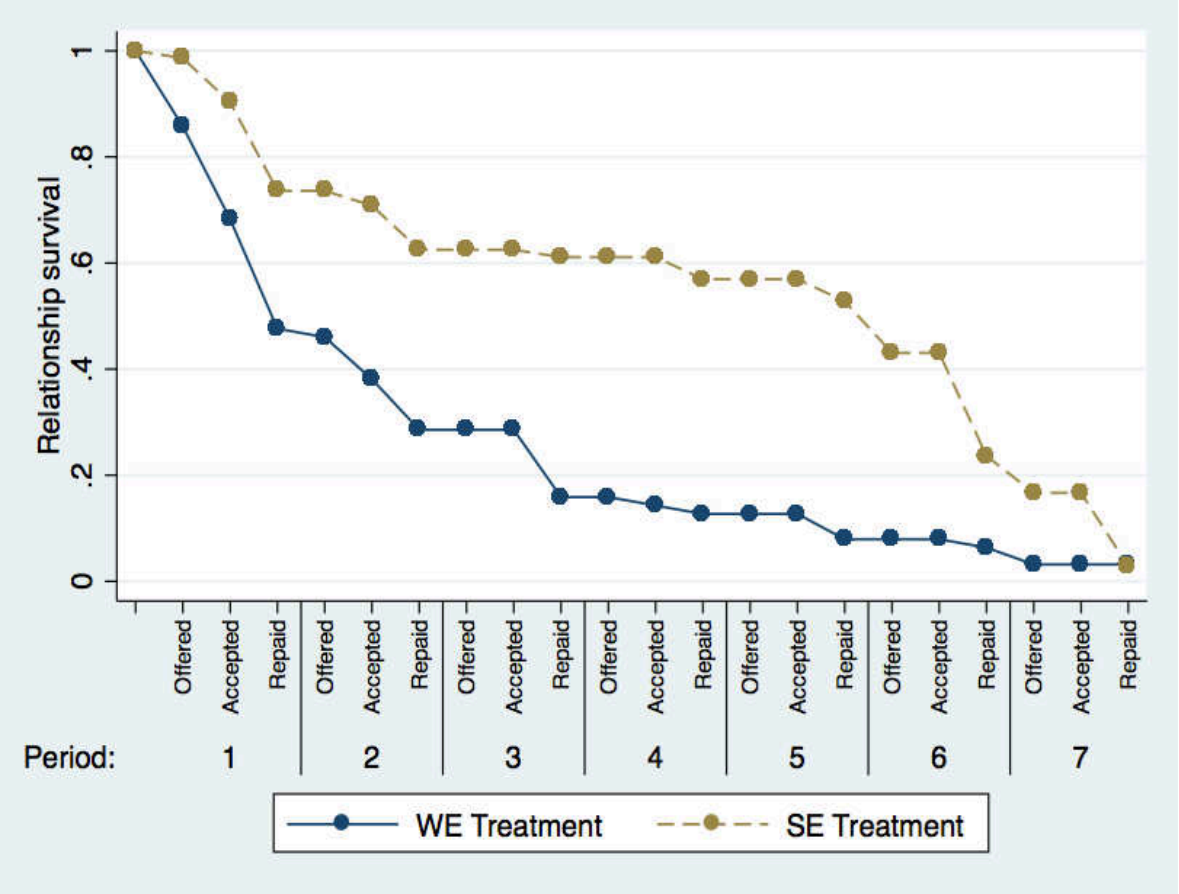


Figure 2: Credit relationships: Duration and lending profile

This figure dispalys average loan size by period in the WE treatment (Figure 2A) and the SE treatment (Figure 2B) conditional on the ultimate length of a credit relationship. The ultimate relationship length is defined as the number of periods in which the relationship was fully active (i.e. a loan was offered, accepted and repaid). Relationships of ultimate length 0 are defined as those for which a loan was offered and accepted, but not repaid in period 1.

Figure 2A: WE Treatment

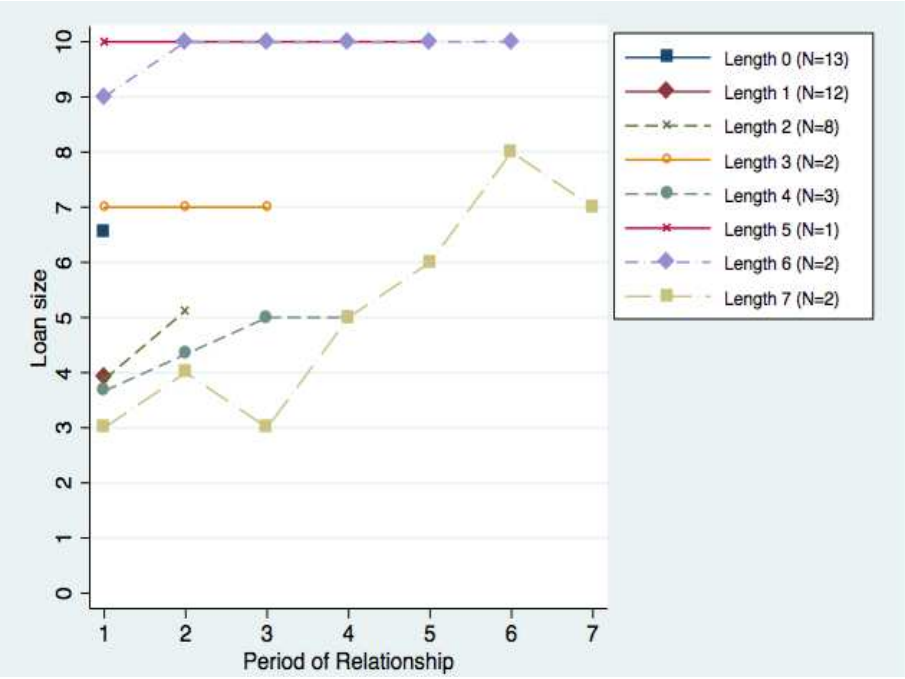


Figure 2B: SE Treatment

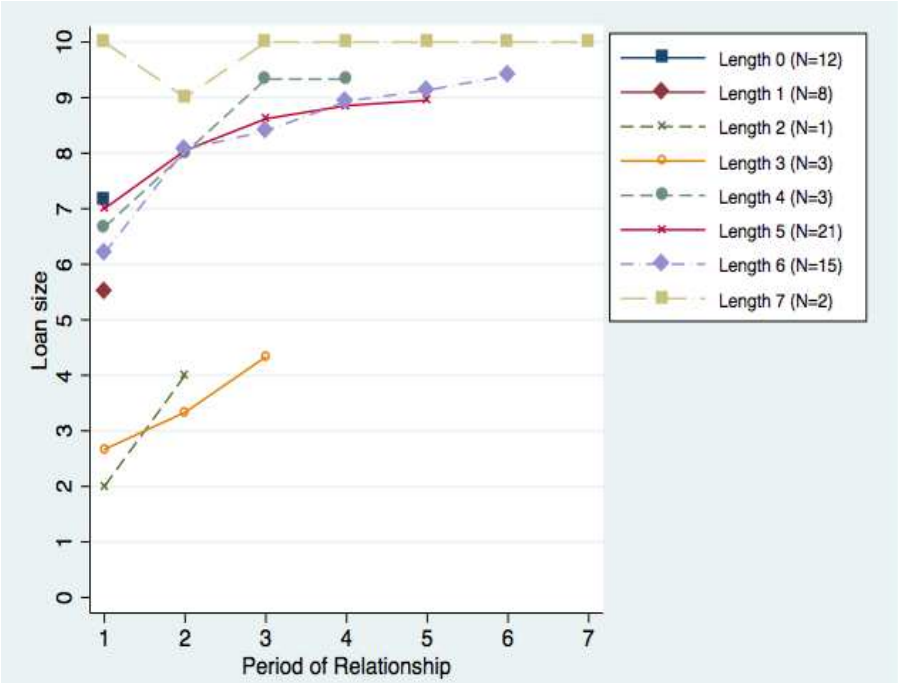


Figure 3. First period loan offers

This figure compares the period 1 loan offers in the WE and SE treatments. Figure 3A displays the distribution of offers by *Loan size* while Figure 3B displays the distribution of loan offers by the gross *Interest rate* (Repayment / Loan Size).

Figure 3A. Loan size

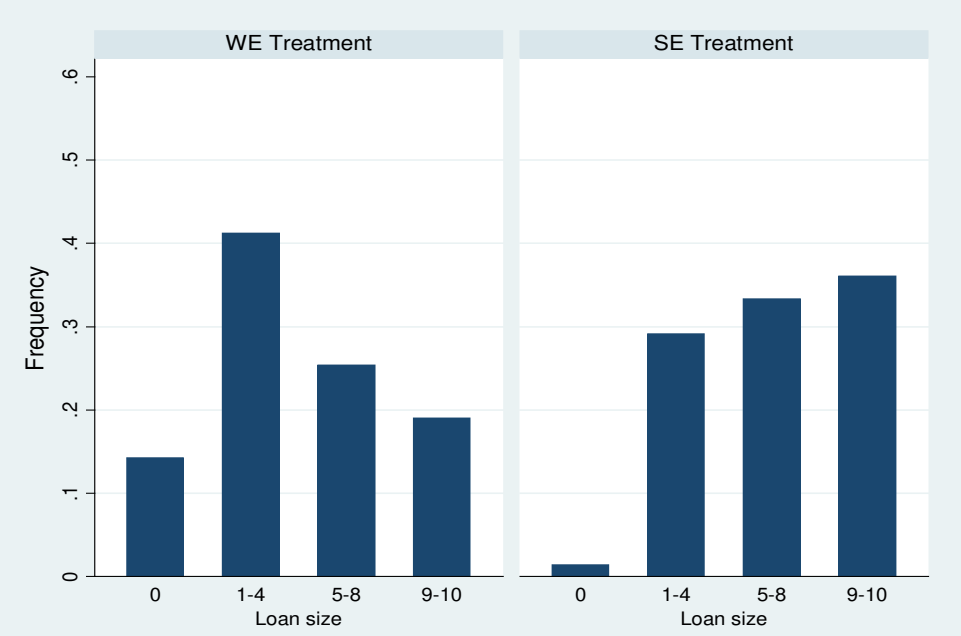


Figure 3B. Gross interest rate (Repayment / Loan Size)

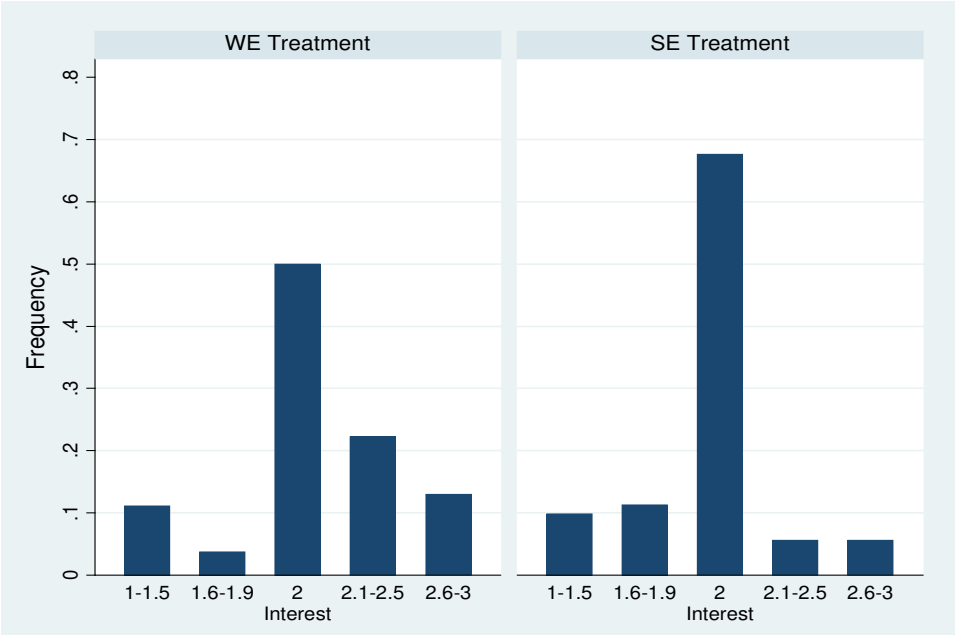


Figure 4. Loan acceptance and repayment

Figure 4A displays the average rejection and default rate over groups of loan sizes in periods 1 to 7, by treatment. Figure 4B displays average rejection and default rates over groups of gross interest tates. Categories r<=2 and r>2 indicate a gross rate of 2 or lower (fair offers) and a rate of more than 2, correspondingly. The average rejection and default frequency is calculated at the matching group level

Figure 4A. Rejection and Default by Loan Size

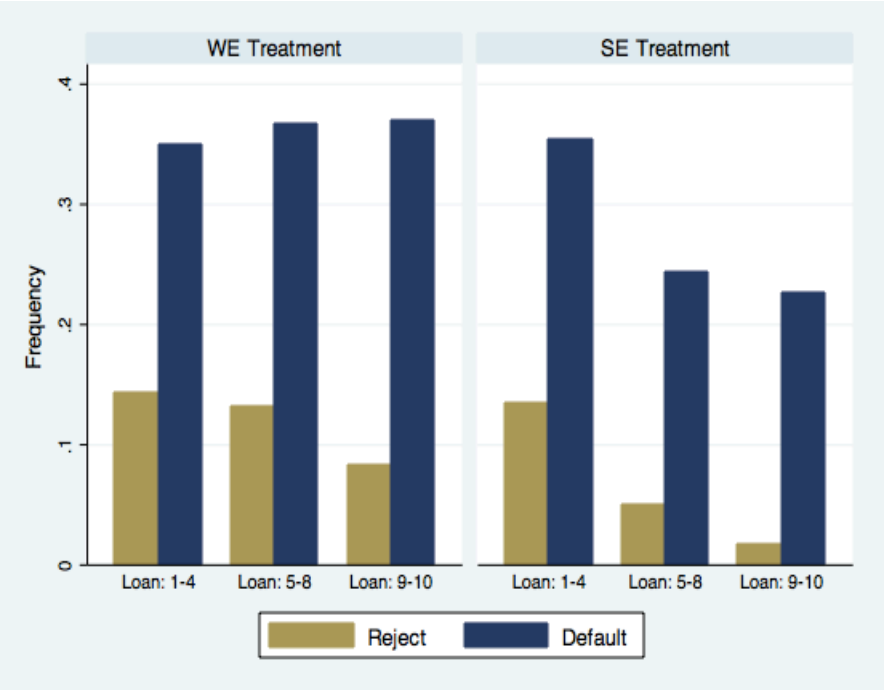
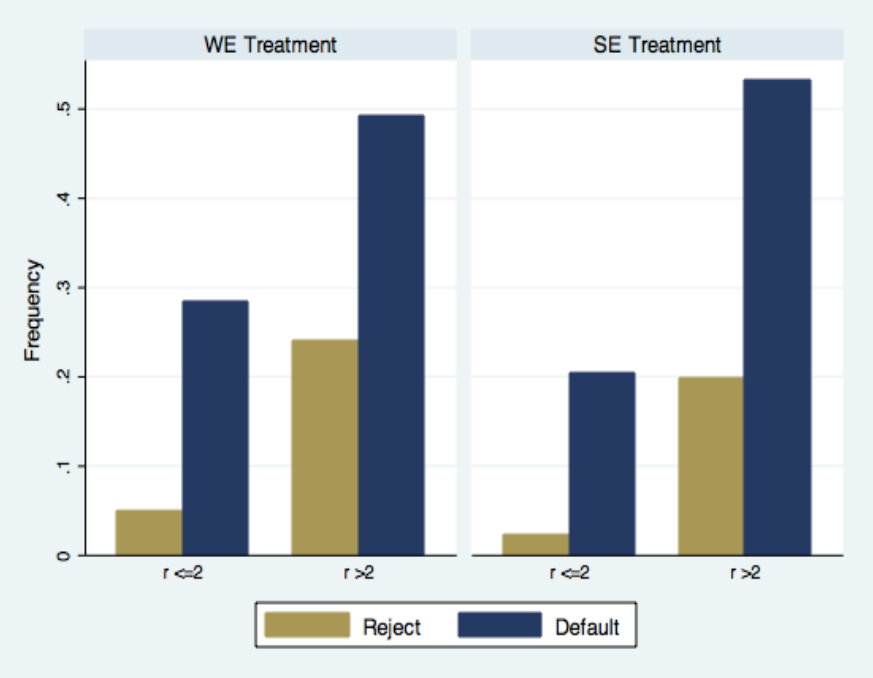


Figure 4B. Rejection and Default by Gross Interest Rate



Appendix A. Behavior in Pre-experiment Games

Table A1 summarizes the behavior of our subjects in the three pre-experiment games.

Table A1. Behavior in pre-experiment games in each treatment

Treatment	WE (n=42)		SE (n=48)		1-Shot (n=36)		T-test Pr(|T| > |t|)		
	Mean	Std.	Mean	Std.	Mean	Std.	WE vs. SE	WE vs. 1-Shot	SE vs. 1-Shot
Risk aversion	5.9	2	6.1	1.5	5.9	1.8	0.54	0.99	0.54
Strategic Reasoning	71.7	16.1	71.8	12.1	64.2	13.2	0.98	0.03	0.01
Trust	5.8	3.2	5.1	3.6	5.4	3.4	0.32	0.63	0.64
Trustworthiness	19.1	13.5	18.4	12.9	19.3	13.8	0.80	0.97	0.77

The first game was a risk preference elicitation task (following Dohmen et al. 2010). In this task, each player made eleven decisions, each of which had two options, A and B. Option A was a lottery with two outcomes, 0 and 100 points. The probability that the second outcome would be drawn was one half in each decision. Option B was a certain amount, which ranged from 0 points (in decision number 1) to 100 points (in decision number 11) and incremented by 10 points as the decision number increased. The indicator *Risk aversion* in Table A1 reports the number of times a subject chose option B in this game. Table A1 shows that there is no significant difference in risk aversion across treatments.

The second game was a one-shot guessing game (Nagel 1995). Each participant was randomly matched with 5 other participants. Each participant had to choose a number between 0 and 100. The participant whose choice was closest to 2/3 of the average choice would be the winner of a prize of 150 points. The indicator *Strategic Reasoning* in Table A1 is the choice made by subjects in this guessing game. Table A1 shows there is no significant difference in strategic reasoning between the WE and SE treatments. Strategic reasoning is however lower in the 1-Shot treatment.

The third game was a one-shot lending game, played in the strategy method. First, subjects were asked to make decisions in the role of borrower. They were shown a table in which each column displayed a loan size in steps of 2 (2, 4, 6, 8 and 10), while each row displayed a requested repayment in steps of 2 (2, 4, ..., 30). They were asked whether they would make the desired repayment, in each cell of the table for which the desired repayment was smaller or equal to three times the loan size. The subject then moved onto a different screen in which he was asked to make his decisions as a lender, i.e. to make a loan offer and request a repayment, both in steps of 2. The indicator *Trust* in Table A1 is the loan offer a subject chose to make as a lender in this game. The indicator *Trustworthiness* in Table B is the number of times a subject chose to repay as a borrower in this game. Table A1 shows there is no significant difference in average trust and trustworthiness across treatments.

Table A2 examines the heterogeneity among individuals in terms of their trustworthiness, across treatments. This table speaks to our assumption of the presence of social borrowers. A money-maximizing borrower would not repay any loan in the strategy-method trust game. We find that between 12% and 19% of borrowers do not repay any loan. An additional 22% to 33% repay less than the loan size. In contrast, close to a quarter of the borrowers choose to always repay, when requested to repay at least the equal split or more. Hence, almost one out of four borrowers is a social borrower, and their share does not vary significantly across treatments (Chi-square test, p-value=0.976).

Table A2. Repayments in the strategy-method trust game

	Share of borrowers		
	WE	SE	1-Shot
Types	(n=42)	(n=48)	(n=36)
Never repay	12%	19%	19%
Repay less than the loan size	26%	33%	22%
Repay at least loan size, but less than "fair" split	0%	4%	8%
Repay at least "fair" split	24%	23%	25%
Other	38%	21%	25%

Appendix B. Predictions for the WE and SE treatments

B.1. The Repeated Lending Game

A lender and a borrower interact for $T = 7$ periods. In every period, the schedule of events is the following:

1. The lender has an endowment of 10 in every period t. The borrower has a capital of C_t, where $C_1 = 0$.
2. The lender makes an offer (S_t, R_t) to the borrower. Whereby $S_t \in [0, 10 - C_t]$ and $R_t \in [1, v]S_t$, where $v > 1$.
3. The borrower chooses to accept $(A_t = 1)$ or reject $(A_t = 0)$ the offer.
4. If the offer is accepted, the borrower earns an investment income of $I_1 = v \cdot (S_t + C_t)$ and chooses whether to repay $(D_t = 0)$ or default $(D_t = 1)$

We examine behavior in this game under two different conditions. First, in what we call the lending game with strong exclusion, the capital of the borrower is $C_t = 0$ in all periods. Second, in the lending game with weak exclusion, where we have that the borrower's capital for $t > 1$ is:

$$C_t = \sum_{k=1}^{t-1} S_k D_k$$

The monetary payoff for the lender Π_t is 10 if he decides not to give a loan or if his loan offer is not accepted. If he gives out a loan, his offer specifies a loan size S_t and a repayment of $R_t = i_t S_t$, where $i_t \in [1, v]$. If the borrower accepts the offer $(A_t = 1)$, he receives S_t and chooses whether to repay or not. Thus the lender's payoff Π_t in period t is:

$$\Pi_t = 10 - A_t S_t (1 - i_t (1 - D_t))$$

In turn, the borrower's income stems from two sources. He has a fixed income from other self-financed projects or income from other activities of 10. Additionally, he earns an investment income, which depends on whether he accepts a loan offer and the loan size offered S_t, as well as his own capital. If the borrower decides to repay, $R_t = i_t S_t$ is transferred to the lender. If he defaults, he accumulates capital for the next period, C_{t+1}, if in the lending game with weak exclusion. The borrower's payoff U_t in period t is:

$$U_t = 10 + v \cdot (A_t S_t + C_t) - A_t R_t (1 - D_t) - C_{t+1}$$

There are two borrower types, conditionally reciprocal (H for 'high') and selfish (L for 'low'), not observable to the lender. An L type repays a loan if it maximizes his monetary payoffs. An L type borrower will thus never repay a loan in period T. Assuming that lenders offer contracts (S_t, i_t) only to a borrower who repays in all prior periods, the incentive constraint of an L type borrower in the game with strong exclusion for periods $t = \{1, ..., T-1\}$ is:

$[\mathbf{IC}_{L,SE}]$ $\sum_{k=t}^{T-1} (v - i_k) S_k + v S_T \geq v S_t$

In the game with weak exclusion the incentive constraint for the L type borrower is

$[\mathbf{IC}_{L,WE}]$ $\sum_{k=t}^{T-1}(v-i_k)\,S_k + vS_T \geq \sum_{k=t}^{T-1}(v-1)\,S_t + vS_t$

Note that in both incentive constraints, the monetary payoff of the borrower is positive. His participation constraint is therefore satisfied and has an incentive to accept any loan offer.

The H type borrower repays any loan he has accepted. However, the H type also cares about relative payoffs, which makes him yield negative utility if the gross interest rate is above a threshold $\bar{r} \in (1, v)$.The participation constraint of the H type can thus be written as

$[\mathbf{PC}_H]$ $i_t \leq \bar{r}$

The lender's prior about the borrower being of type H is $\bar{p} \in (0,1)$, i.e. $\bar{p}$ is the ex-ante probability that the borrower is of type H. For any period $t > 1$ the lender updates his belief p_t on the borrower's type using Bayes' Rule. If selfish borrowers repay in period $t-1$ with a probability $\gamma_{t-1} \in [0,1]$, then the lender's updated belief is given by $p_t = \frac{p_{t-1}}{p_{t-1}+\gamma_{t-1}(1-p_{t-1})}$.

Assuming that the participation constraint of H borrowers is met in all periods ($i_t \leq \bar{r}$) and that L type borrowers repay with a repayment probability $\gamma_1, ...\gamma_7$, whereby $\gamma_7 = 0$, the participation constraint of the lender can be defined as

$[\mathbf{PC\ Lender}_t]$ $\sum_{k=t}^{T} S_k\left(\left(p_k + \gamma_k(1-p_k)\right)i_k - 1\right) \geq 0$, whereby $i_k \leq \bar{r}$

Since $\gamma_7 = 0$, for lenders to lend in the final period we must have $p_T\bar{r} - 1 \geq 0$.

In what follows we will describe the equilibria of the repeated lending game, both with weak and strong exclusion. The equilibrium concept used throughout is that of Perfect Bayesian Equilibrium (PBE). We will consider two types of equilibria: **reputation** and **screening** equilibria. Reputation equilibria are defined as those equilibria in which the L borrower repays loans at least in period 1. He thus builds a reputation, by imitating the H borrower for at least one period. Screening equilibria are defined as those in which the L type borrower defaults with certainty in period 1. Therefore, for the rest of the game L borrowers have been screened out and H types are identified. Whenever these equilibria exist, there exist a plethora of them. As is conventional in the literature (e.g. Thomas and Worral, 1994), we concentrate on the equilibrium which is profit-maximizing for the lender, as he is the player making offers and the borrower only has the option of accepting them or not.

We make the following assumptions regarding the ex-ante probability $\bar{p}$ that the borrower is of type H. Assumption 1 implies that the proportion of H type borrowers does not make it profitable to extend a loan in a one-shot situation:

Assumption 1: $\bar{p} < \frac{1}{\bar{r}}$

Assumption 2 implies that the proportion of H type borrowers is high enough to make a reputation equilibrium feasible in the repeated game with T periods feasible:

Assumption 2: $\bar{p} \geq \frac{1}{\bar{r}^T}$

B.2. Lending under strong exclusion

Given our assumptions about $\bar{p}$, the profit-maximizing reputation equilibrium for the lender has maximum loan sizes in all non-final periods, and a smaller loan in the final period. Borrowers pool in periods 1 through 5, during which L borrowers always repay. In period 6 L borrowers default with positive probability and in period 7 they default always.

Proposition 1: *In the lending game with strong exclusion the profit-maximizing reputation equilibrium for the lender is characterized by offers* $(S_t, i_t) = (10, \bar{r})$ if $t \leq 6$ and $(S_7, i_7) = (10\frac{\bar{r}}{v}, \bar{r})$. *The H type borrower accepts and repays in all periods. The L type borrower accepts in all periods, repays with* $\gamma_t = 1$ *in periods* $t \leq 5$, *with* $\gamma_6 = \frac{\bar{p}}{(1-\bar{p})}(\bar{r} - 1)$ *and* $\gamma_7 = 0$.

Proof: We first consider whether the IC of the L type borrower is satisfied in periods 1 to 6. Then, we check whether the PC of the H type borrower is satisfied. Finally, whether the lender's PC is satisfied and whether the equilibrium is profit-maximizing.

- L type borrower repayment: Condition [$\text{IC}_{L,SE}$] holds with inequality in all periods $t < 6$. In period 6 it holds with equality, so we know that the L type borrower is indifferent between repaying and not. Thus, $\gamma_1 = ... = \gamma_5 = 1$ and $\gamma_6 = \frac{\bar{p}}{(1-\bar{p})}(\bar{r} - 1)$ is a best response behavior.
- H type borrower accepts and repays as $i_t = \bar{r}$ for all t.
- Lender contracts: Condition [PC Lender_T] is met with equality if he offers $(S_7, i_7) = (10\frac{\bar{r}}{v}, \bar{r})$, as $p_T = \frac{\bar{p}}{\bar{p}+\gamma_6(1-\bar{p})} = \frac{1}{\bar{r}}$. The lender's profits from lending in period 6 are $S_{T-1}\left((\bar{p} + \gamma_6(1-\bar{p}))\, i_{T-1} - 1\right)$ which are positive for $(S_6, i_6) = (10, \bar{r})$, as $\bar{p} > \frac{1}{\bar{r}^2}$ (Assumption 2). Since $\gamma_t = 1$ in all periods $t \leq 5$ the lender's participation constraint is met.
- This equilibrium is profit-maximizing for the lender for three reasons: (i) $i_t = \bar{r}$, therefore the H type borrower repays, and the lender extracts the maximum surplus; (ii) since $\frac{\partial \pi_t}{\partial S_t} > 0$, conditional on repayment, offering maximum loan sizes (of 10) until period 6 is profit-maximizing; (iii) Since $\gamma_t = 1$ until period 5, he obtains maximum profits until this period and screening starts in the last period possible, 6.

In the game with strong exclusion, a **separating equilibrium**, in which L borrowers default with certainty in period 1, does not exist. In such an equilibrium the lender will offer maximum credit at the interest rate $\bar{r}$ for all periods 2 through 7 to borrowers who repay in period 1. Given this prospective loan schedule L borrowers would not default in period 1.

Proposition 2: *In the lending game with strong exclusion no fully separating equilibrium* $(\gamma_1 = 0)$ *exists.*

Proof: In a fully separating equilibrium the lender will set the maximum possible interest rate and loan size $(S_t, i_t) = (10, \bar{r})$ in all periods $t > 1$. The incentive constraint of L borrowers is then $\sum_{t=2}^{6}(v - \bar{r})\, 10 + v10 \geq i_1 S_1$. Given that the interest rate in period

1 cannot exceed $\bar{r}$ it is impossible for the lender to offer a contract which does not meet $[\text{IC}_{L,SE}]$.

Finally, note that the equilibrium described in Proposition A1 is 'second-best', as the loan sizes are maximal until period 6, but must fall in period 7 to meet the L borrower's IC.

B.3. Lending under weak exclusion

Given the above parameters a **reputation equilibrium** exists in the lending game with weak exclusion. In contrast to the strong exclusion treatment, loans are of a smaller size in period 1 and increase over time, with maximum credit only in the final period. Repayment behavior is identical to the reputation equilibrium under strong exclusion: borrowers pool in periods 1 through 5, with L borrowers repaying always. In period 6 L borrowers default partly and in period 7 they default always.

Proposition 3: *In the game with weak exclusion the profit-maximizing reputation equilibrium for the lender is characterized by offers* $(S_7, i_7) = (10, \bar{r})$ *and for all periods* $t < 7$: $i_t = \bar{r}, S_t = \frac{(v-I)}{((7-t)(v-1)+\bar{r})} \sum_{k=t+1}^{6} S_k + \frac{v}{((7-t)(v-1)+\bar{r})} 10$. *The H type borrower accepts and repays in all periods. The L type borrower accepts in all periods, repays with certainty in periods 1-5, with probability* $\gamma_6 = \frac{\bar{p}}{(1-\bar{p})}(v-1)$ *and* $\gamma_7 = 0$.

Proof:

- L type borrower repayment: The incentive constraint $[\text{IC}_{L,WE}]$ holds with equality in all periods $t \leq 6$. As a result $\gamma_6 = \frac{\bar{p}}{(1-\bar{p})}(\bar{r}-1)$ and $\gamma_t = 1$ if $t < 6$ is a best response behavior.
- H type borrower accepts and repays as $i_t = \bar{r}$ for all t.
- Lender contracts: Proposition A1 shows that the participation constraint of the lender is met in all periods. The same holds under weak exclusion, as the repayment behavior of the L type borrowers is identical.
- By the same reasons as in Proposition A1, the interest rate and the repayment behavior are profit-maximizing for the lender. To incetivize the L type borrower to repay until period 6 loan sizes have to be increasing, as follows from $[\text{IC}_{L,WE}]$. Therefore, to reach maximum profits the lender starts by choosing the maximum loan size of 10 in the last period, 7. In the previous periods, the loan size is chosen such that the borrower's IC is satisfied with equality.

Under weak exclusion a **separating equilibrium** exists in which L borrowers default with certainty in period 1.

Proposition 4: *In the lending game with weak exclusion a fully separating equilibrium* $(\gamma_1 = 0)$ *exists. The profit-maximizing screening equilibrium for the lender has offers* $(S_1, i_1) = \left(10\frac{6v-5}{6(v-1)+I}, \bar{r}\right)$; $(S_2, i_2) ... (S_7, i_7) = (10, \bar{r})$.

Proof: In a screening equilibrium, which maximizes the lender's profits, the lender will set the maximum interest rate $(i_t = \bar{r})$ and loan size $(S_t = 10)$ in each period $t > 1$. In

period 1 the lender offers the maximum interest rate and lowest loan size such that the borrower does not prefer to default in period 2. This implies that $6(v-1)S_1 + vS_1 > (v-i_1)S_1 + 5(v-1)10 + v10$. This implies that $i_1 = \bar{r}$ and $S_1 = 10\frac{6v-5}{6(v-1)+\bar{r}}$.

Note that the screening equilibrium is more efficient than the reputation equilibrium. This is due to the fact that loan sizes are larger in period 1 under the screening equilibrium and L type borrowers default and reinvest these large loans until period 7. Therefore, investment levels are higher than under the reputation equilibrium. However, full efficiency is not reached, because this would require an initial loan size of 10, which is not profit-maximizing for the lender, who can screen by giving out a loan of $S_1 = 10\frac{6v-5}{6(v-1)+\bar{r}} < 10$.

Whether the lender earns a higher profit under the reputation equilibrium or the separating equilibrium depends on the schedule of loan sizes in the reputation equilibrium, as well as the share of H type borrowers. In the next subsection, we use the parameters in place in our experiment, to generate the predicted loan sizes and compare profits.

B.4. Application to the experiment

In our experiment we have that $v = 3$. We assume that H type borrowers are conditionally reciprocal and will repay only if the receive at least half of the gains from trade in any period, i.e. $\bar{r} = 2$. This gross interest rate also coincides with that observed in the experiment. Assuming $\bar{r} = 2$, our assumptions 1 and 2 on the share of H borrowers hold if $\frac{1}{2} > \bar{p} > \left(\frac{1}{2}\right)^7$.

This implies from assumption 2 that a reputation equilibrium would be possible even in a 2 period repeated game. These parameters also imply the following schedule of loan sizes.

Period	Strong Exclusion	Weak Exclusion
1	10	4.19
2	10	4.51
3	10	4.92
4	10	5.47
5	10	6.25
6	10	7.5
7	6.67	10

Table B.1: Predicted loan sizes over time

The profits from the reputation equilibrium are $(4.19 + 4.51 + 4.92 + 5.47 + 6.25)(\bar{r} - 1) + 7.5(\bar{p} + (1-\bar{p})\gamma_6)\bar{r} - 7.5 = 25.34 + 7.5\left(\bar{p}\bar{r}^2 - 1\right) = 25.34 + 7.5 * 4\bar{p} - 7.5 = 17.84 + 30\bar{p}$. In contrast, the profits from the screening equilibrium are $9.29\left(\bar{r}\bar{p} - 1\right) + 60\bar{p}(\bar{r} - 1) = 9.29\left(2\bar{p} - 1\right) + 60\bar{p} = 78.58\bar{p} - 9.29$. The lender earns higher profits in the screening equilibrium if $78.58\bar{p} - 9.29 > 17.84 + 30\bar{p}$. This is not the case for any $\bar{p} < 27.13/48.58 = 0.56$. If $\bar{p} < 1/\bar{r} = 1/2$, as in assumption 1, the lender is better off under the reputation equilibrium.

Appendix C. Instructions

The instructions displayed below are for all treatments. Parts of the text which are specific to a treatment are presented in brackets and the corresponding treatment is mentioned. We use the following code for treatments: **WE**: Weak Exclusion Treatment and **SE:** Strong Exclusion Treatment.

Instructions for Lenders

For simplicity, throughout these instructions we refer to the lender in the masculine form, i.e "he", and the borrower in the feminine form, i.e. "she".

Overview of the experiment

a) For this experiment you have been grouped together with 5 other participants. In this group there are 3 lenders and 3 borrowers. **You will be a lender for the entire duration of the experiment.**

b) The experiment consists of 3 rounds: **in each round you will be matched with a different borrower**. You will not be matched with the same borrower twice. You will not be informed about the identity of the other participants at any point.

c) Each round consists of 7 periods. **You will interact with the same borrower for 7 periods** only.

d) In each period you have an endowment which you can use to offer credit to the borrower. If you offer credit you can ask for a repayment from the borrower. If you make a credit offer, the borrower decides whether to accept this offer. If the borrower accepts your credit offer, she decides whether to make the repayment desired by you.

e) The points you earn in each period depend on the amount of credit you offer in each period, your desired repayment, whether the borrower accepts the offer, and whether the borrower makes your desired repayment.

f) All points that you earn during the course of the experiment will be exchanged into euro at the end of the experiment. The exchange rate will be:

25 points = 1 euro

g) This is the final experiment. Your earnings from this experiment will be paid out together with your earnings from the previous 3 experiments after this experiment is completed.

Experimental Procedures

There are 3 lenders and 3 borrowers in this experiment. You are a lender for the entire duration of the experiment. The experiment lasts for 3 rounds, and in each round you will be matched with a different borrower. Each round consists of 7 periods, so that you interact with the same borrower for 7 periods. In the following we describe in detail how you and the borrower make decisions in each period. Attached to these instructions are screen shots of each screen on which either you or the borrower will be required to enter a decision.

1. Investment

In each period of this experiment the borrower has an investment opportunity. The amount the borrower invests is determined [**WE**: by her capital and] by the credit amount the borrower receives from you. The borrower's investment amount cannot exceed 10 points in any period.

[**WE**:
In period 1 the borrower's capital is 0. Her capital in periods 2-7 depends on her and your decisions in periods 1-6. How the borrower's capital in period 2-7 is determined is explained in detail in section 4.
]

Section 2 describes in detail how the borrower's credit amount in each period is determined.

In each period the investment income of the borrower is three times her investment amount.

Investment amount = [WE**: Capital +] Credit amount ≤ 10**

Investment income = 3 x Investment amount

2. Credit offers

In each period you have an endowment of **10 points.** With this endowment you can make a credit offer to the borrower. For this purpose, the "credit offer" screen (screen shot attached to these instructions) will be shown to you at beginning of each period.

At the top of the screen you can see which round of the experiment you are in, what your identification number is, and the identification number of the borrower you are matched with for this round. All lenders and borrowers keep their identification number for the whole duration of the experiment. This allows you to check that within each round of 7 periods you are always matched with the same borrower, and that in each new round you are matched with a new borrower. At the top of the screen you also see which period you are in, and the remaining time left to make your credit offer (in seconds). In each period you have 30 seconds to make your credit offer.

To make a credit offer you first choose the **credit amount**. As the borrower has a maximum investment amount of 10 [**WE**: which also includes her capital], the maximum credit amount you can offer in any period is 10 [**WE**: – the borrower's capital].

You then choose your desired repayment. The **desired repayment** may not exceed three times the credit amount.

0 ≤ Credit amount ≤ 10 [**WE**: **– Capital**]

0 ≤ Desired repayment ≤ 3 x Credit amount

You do not have to make a credit offer to the borrower in any period. If you do not want to make a credit offer you can enter a credit amount of 0 and a desired repayment of 0.

[**WE**:
If the borrower's capital equals the maximum investment amount of 10, then you cannot make a credit offer in this period. In this case the credit offer screen will inform you that no credit offer can be made.]

After you have determined your credit offer by entering a credit amount and desired repayment you must click on the "enter" button to finalize this offer. As long as you have not clicked on "enter" you may revise your offer.

On the left hand side of the "Credit offer" screen you can see the **history** of your interaction for all completed periods in this round. The history displays the following items for each period: [**WE**: the borrower's capital,] your credit amount offered, your desired repayment and whether the desired repayment was made (yes/no).

3. Accepting the credit offer and making the desired repayment.

If you make a credit offer, the borrower will see the details of this offer on the **"Credit acceptance" screen** (screen shot attached). The borrower can then **decide whether to accept the credit offer or not**.

If the borrower accepts a credit offer she then chooses her Actual repayment. The borrower's actual repayment can either be your desired repayment or 0. The borrower decides whether to make the desired repayment by choosing "yes" or "no" on the "**Repayment decision" screen** (screen shot attached).

Actual repayment =	**Desired repayment** *or* **0**

[**WE**:

4. The borrower's capital

In period 1 the borrower's capital is 0.

The borrower's capital for periods 2, 3, 4, 5 ,6 , or 7 depends on her credit amount and her actual repayment in the previous periods.

- If the borrower did not accept a credit offer in the previous period, her capital is equal to that in the previous period.

- If the borrower accepted a credit in the previous period and made the desired repayment to the lender, her capital is equal to that in the previous period.
- If the borrower accepted a credit in the previous period and did not make the desired repayment to the lender, her capital is equal to that in the previous period *plus* the credit amount in the previous period.

Capital for periods 2, 3, 4, 5, 6 or 7	= Capital in previous period	if no credit offer is accepted in the previous period.
	= Capital in previous period	if a credit offer is accepted and the desired repayment is made in the previous period
	= Capital in previous period + Credit Amount in previous period	if a credit offer is accepted and the desired repayment is not made in the previous period

]

5. Income calculation

If you did not make a credit offer or your offer was not accepted by the borrower your income equals your endowment of 10 points in this period. If you did make a credit offer and it was accepted by the borrower your income depends on the amount of credit you offered and the actual repayment of your borrower.

Your Income = 10 – Credit amount + Actual repayment

In each period the borrower has a certain income of 10 points. As mentioned in section 1 the borrower earns an additional investment income which is three-times the size of her investment amount. The borrower's income in each period equals her 10 points plus her investment income minus her actual repayment [**WE**: and minus the borrower's capital for the next period. As period 7 is the final period the borrower's income in this period equals her 10 points plus her investment income minus her actual repayment.]

Income of the Borrower =

10 + Investment income – Actual repayment [WE: **– Capital for next period]**

You will be informed about your income [**WE**:,][**SE**: and] the income of the borrower [**WE**: and the borrower's capital] on the "**Income" screen** (screen shot attached).

After you have studied the income screen, you can record this information on your documentation sheet. You can then proceed to the next period or next round.

Exercises

The experiment will not commence, until all participants are completely familiar with all procedures. In order to secure that this is the case, we kindly ask you to solve the exercises that will be displayed on your computer screen. Wrong answers have no consequences for you. If you have any questions, please contact us.

Exercise 1:

[**WE**: In period 1,] what is the maximum credit amount you can offer?

Maximum credit amount [**WE**: in period 1 =]

Exercise 2:

In period 1 you do not make a credit offer. How high is your income and that of the borrower in period 1 [**WE**: and the borrower's capital for period 2]?

Your income in period 1 =

[**WE**: Borrower's capital for period 2=]

Income of the borrower in period 1=

Exercise 3:

In period 1 you make a credit offer with a credit amount of 8 and a desired repayment of 10. The borrower does not accept the offer. How high is your income and that of the borrower in period 1 [**WE**: and the borrower's capital for period 2]?

Your income in period 1 =

[**WE**: Borrower's capital for period 2=]

Income of the borrower in period 1=

Exercise 4:

In period 1 you make a credit offer with a credit amount of 8 and a desired repayment of 10. The borrower accepts the offer and makes the desired repayment of 10. How high is your income and that of the borrower in period 1 [**WE**: and the borrower's capital for period 2]?

Your income in period 1 =

[**WE**: Borrower's capital for period 2=]

Income of the borrower in period 1=

Exercise 5:

In period 1 you make a credit offer with a credit amount of 8 and a desired repayment of 10. The borrower accepts the offer and does not make the desired repayment of 10. How high is your income and that of the borrower in period 1 [**WE**: and the borrower's capital for period 2?]

Your income in period 1 =

[**WE**: Borrower's capital for period 2=]

Income of the borrower in period 1=

[**WE**: **Exercise 6:**

In period 2 the borrower has a capital of 0. What is the maximum credit amount you can offer to the borrower?

Maximum credit amount period 2=]

[**WE**: **Exercise 7:**

In period 2 the borrower has a capital of 8. What is the maximum credit amount you can offer to the borrower?

Maximum credit amount period 2=]

Documentation Sheet – Lenders

Round 1: you are matched with Borrower Nr. :					
Period	[**WE**: Borrower's capital]	Credit Amount	Desired Repayment	Actual Repayment	Your Income
1	0				
2					
3					
4					
5					
6					
7					

Round 2: you are matched with Borrower Nr. :					
Period	[**WE**: Borrower's capital]	Credit Amount	Desired Repayment	Actual Repayment	Your Income
1	0				
2					
3					
4					
5					
6					
7					

Round 3: you are matched with Borrower Nr. :					
Period	[**WE**: Borrower's capital]	Credit Amount	Desired Repayment	Actual Repayment	Your Income
1	0				
2					
3					
4					
5					
6					
7					

Instructions for Borrowers

For simplicity, throughout these instructions we refer to the lender in the masculine form, i.e "he", and the borrower in the feminine form, i.e. "she".

Overview of the experiment

h) For this experiment you have been grouped together with 5 other participants. In this group there are 3 lenders and 3 borrowers. **You will be a borrower for the entire duration of the experiment.**

i) The experiment consists of 3 rounds: **in each round you will be matched with a different lender**. You will not be matched with the same lender twice. You will not be informed about the identity of the other participants at any point.

j) Each round consists of 7 periods. **You will interact with the same lender for 7 periods** only.

k) In each period the lender has an endowment which he can use to offer credit to you. If the lender offers credit he can ask for a repayment from you. If the lender offers credit, you decide whether to accept this credit offer. If you accept the credit offer, you decide whether to make the repayment desired by the lender.

l) The points you earn in each period depend the amount of credit offered by the lender, his desired repayment, whether you accept the lender's credit offer, and whether you make the desired repayment to him.

m) All points that you earn during the course of the experiment will be exchanged into euro at the end of the experiment. The exchange rate will be:

25 points = 1 euro

n) This is the final experiment. Your earnings from this experiment will be paid out together with your earnings from the previous 3 experiments after this experiment is completed.

Experimental Procedures

There are 3 lenders and 3 borrowers in this experiment. You are a borrower for the entire duration of the experiment. The experiment lasts for 3 rounds, and in each round you will be matched with a different lender. Each round consists of 7 periods, so that you interact with the same lender for 7 periods. In the following we describe in detail how you and the lender make decisions in each period. Attached to these instructions are screen shots of each screen on which either you or the lender will be required to enter a decision.

1.Investment

In each period of this experiment you have an investment opportunity. The amount you invest is determined [**WE**: by your capital and] by the credit amount you receive from the lender. Your investment amount cannot exceed 10 points in any period.

[**WE**:
In period 1 your capital is 0. Your capital in periods 2-7 depends on your and the lender's decisions in periods 1-6. How your capital in period 2-7 is determined is explained below in section 4.]

Section 2 describes in detail how your credit amount in each period is determined.

In each period your investment income is three times your investment amount.

Investment amount = [WE**: Capital +] Credit amount ≤ 10**

Investment income = 3 x Investment amount

2. Credit offers

In each period the lender has an endowment of **10 points.** With this endowment the lender can make a credit offer to you. For this purpose, the "credit offer" screen (screen shot attached to these instructions) will be shown to the lender at beginning of each period.

To make a credit offer the lender first chooses the **credit amount**. As you have a maximum investment amount of 10 [**WE**: which also includes your capital], the maximum credit amount the lender can offer in any period is 10 [**WE**: – capital].

The lender then chooses his desired repayment. The **desired repayment** may not exceed three times the credit amount.

0 ≤ Credit amount ≤ 10[**WE**: **– Capital**]

0 ≤ Desired repayment ≤ 3 x Credit amount

The lender does not have to make a credit offer to you in any period. If the lender does not want to make a credit offer he can enter a credit amount of 0 and a desired repayment of 0.

[**WE**:
If your capital equals your maximum investment amount of 10, then the lender cannot make a credit offer to you.]

3. Accepting credit offers and choosing the actual repayment

If the lender makes a credit offer to you, you will see the details of this offer on the **"Credit acceptance" screen** (screen shot attached).

At the top of the screen you can see which round of the experiment you are in, what your identification number is, and the identification number of the lender you are matched with for this round. All lenders and borrowers keep their identification number for the whole duration of the

experiment. This allows you to check that within each round of 7 periods you are always matched with the same lender, and that in each new round you are matched with a new lender. At the top of the screen you also see which period you are in, and the remaining time left to make your decision (in seconds). In each period you have 30 seconds to accept a credit offer.

On the right hand side of the screen you see the credit offer made by the lender. You can decide to **accept a credit offer or not** by clicking on the yes or no button on the right hand side of this screen. After you have made your decision you must click on the "enter" button to finalize this decision. As long as you have not clicked on "enter" you may revise your decision.

If you decide to accept the credit offer you then choose your Actual repayment. Your **Actual repayment** is either equal to the desired repayment of the lender or 0. You decide whether to make the desired repayment by choosing "yes" or "no" on the "**Repayment decision" screen** (screen shot attached).

Actual repayment =	**Desired repayment** *or* **0**

On the left hand side of the "Credit acceptance" screen and "Repayment decision" screen you can see the **history** of your interaction for all completed periods in this round. The history displays the following items for each period: [**WE**: your capital,] the credit amount offered, the desired repayment and whether the desired repayment was made (yes/no).

[**WE**:

4. Your capital

In period 1 your capital is 0.

Your capital for periods 2, 3 , 4, 5, 6 or 7 depends on your credit amount and your actual repayment in the previous periods.

- If you did not accept a credit offer in the previous period, your capital is equal to that in the previous period.

- If you accepted a credit in the previous period and made the desired repayment to the lender, your capital is equal to that in the previous period.
- If you accepted a credit in the previous period and did not make the desired repayment to the lender, your capital is equal to that in the previous period *plus* the credit amount in the previous period.

Capital for periods 2, 3, 4, 5, 6 or 7	= Capital in previous period	if you did not accepted a credit offer in the previous period.
	= Capital in previous period	if you accepted a credit offer and made the desired repayment in the previous period
	= Capital in previous period + Credit Amount in previous period	if you accepted a credit offer and did not make the desired repayment in the previous period

]

5. Income calculation

If the lender did not make a credit offer or you did not accept the lender's offer, the lender's income equals his endowment of 10. If the lender did make a credit offer and it was accepted by you, the lender's income depends on the amount of credit offered and your actual repayment.

Income of Lender = 10 – Credit amount + Actual repayment

In each period you earn a certain income of 10 points. As mentioned in section 1 you earn an additional investment income which is three-times the size of your investment amount. Your income in each period equals your 10 points plus your investment income minus your actual repayment [**WE**: and minus your capital for the next period. As period 7 is the final period your income in this period equals your 10 points plus your investment income minus your actual repayment.]

Your Income =

10 + Investment income – Actual repayment [WE: **–Capital for next period]**

You will be informed about your income [**WE**:, your capital] and the income of the lender on the "**Income" screen** (screen shot attached).

After you have studied the income screen, you can record this information on your documentation sheet. You can then proceed to the next period or next round.

Exercises

The experiment will not commence, until all participants are completely familiar with all procedures. In order to secure that this is the case, we kindly ask you to solve the exercises that will be displayed on your computer screen. Wrong answers have no consequences for you. If you have any questions, please contact us.

Exercise 1:

[**WE**: In period 1,] what is the maximum credit amount the lender can offer to you?

Maximum credit amount [**WE**: in period 1 =]

Exercise 2:

In period 1 the lender does not make a credit offer. How high is your income and that of the lender in period 1[**WE**: and your capital for period 2]?

[**WE**: Your capital for period 2=]

Your income in period 1 =

Income of the lender in period 1=

Exercise 3:

In period 1 the lender makes a credit offer with a credit amount of 8 and a desired repayment of 10. You do not accept the offer. How high is your income and that of the lender in period 1 [**WE**: and your capital for period 2]?

[**WE**: Your capital for period 2=]

Your income in period 1=

Income of the lender in period 1=

Exercise 4:

In period 1 the lender makes a credit offer with a credit amount of 8 and a desired repayment of 10. You accept the offer and make the desired repayment of 10. How high is your income and that of the lender in period 1 [**WE**: and your capital for period 2]?

[**WE**: Your capital for period 2=]

Your income in period 1 =

Income of the lender in period 1=

Exercise 5:

In period 1 the lender makes a credit offer with a credit amount of 8 and a desired repayment of 10. You accept the offer and do not make the desired repayment of 10. How high is your income and that of the lender in period 1 [**WE**: and your capital for period 2]?

[**WE:** Your capital for period 2=]

Your income in period 1 =

Income of the lender in period 1=

[**WE**: **Exercise 6:**

In period 2 you have a capital of 0. What is the maximum credit amount the lender can offer to you?

Maximum credit amount period 2=]

[**WE**: **Exercise 7:**

In period 2 you have a capital of 8. What is the maximum credit amount the lender can offer to you?

Maximum credit amount period 2=]

Documentation Sheet - Borrowers

Round 1: you are matched with Lender Nr.:					
Period	[**WE**: Capital]	Credit Amount	Desired Repayment	Actual Repayment	Your Income
1	0				
2					
3					
4					
5					
6					
7					

Round 2: you are matched with Lender Nr.:					
Period	[**WE**: Capital]	Credit Amount	Desired Repayment	Actual Repayment	Your Income
1	0				
2					
3					
4					
5					
6					
7					

Round 3: you are matched with Lender Nr.:					
Period	[**WE**: Capital]	Credit Amount	Desired Repayment	Actual Repayment	Your Income
1	0				
2					
3					
4					
5					
6					
7					

Appendix D: Figure D1. Relationship survival, by round

Figure D1a. Relationship survival in round 1

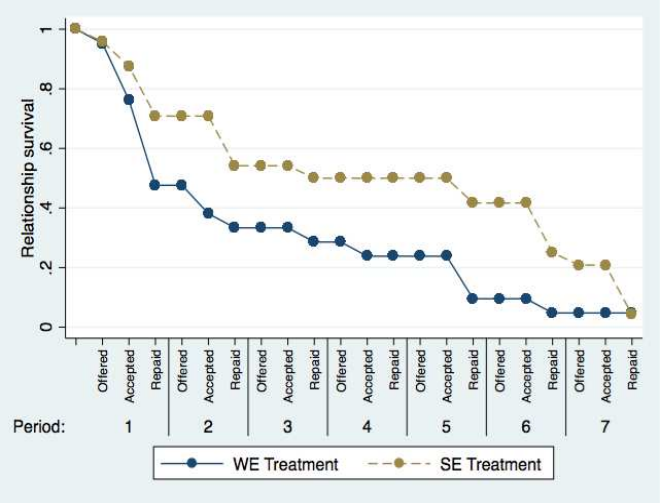


Figure D1b. Relationship survival in round 2

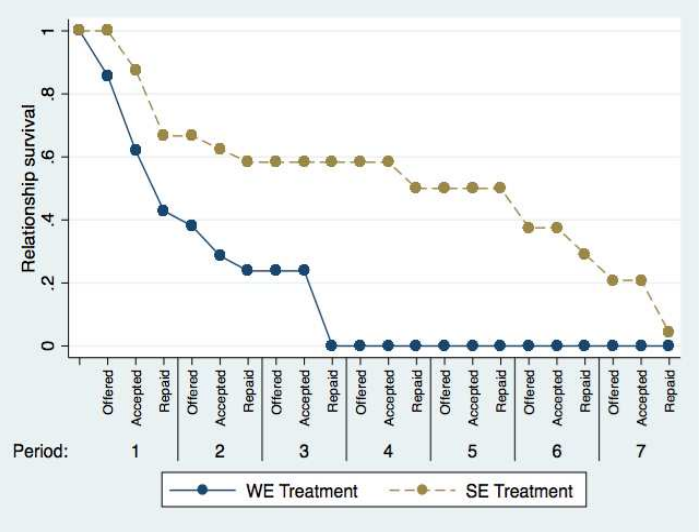
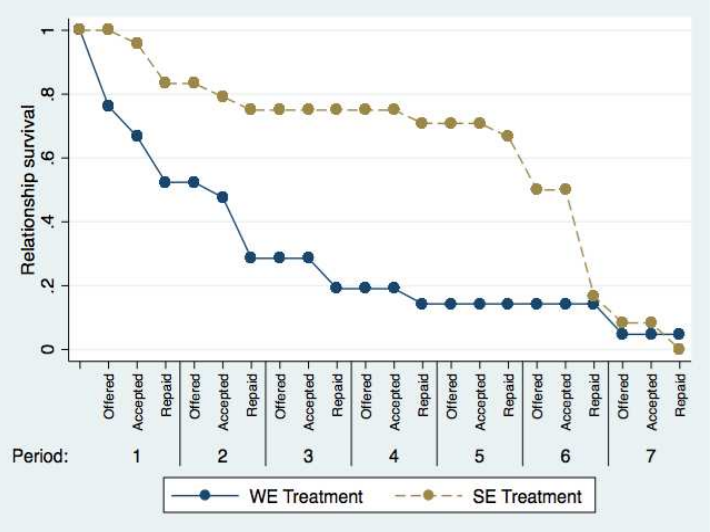


Figure D1c. Relationship survival in round 3



Appendix D: Figure D2. First period loan offers, by round

Figure D2a. Loan sizes in Period 1, by round

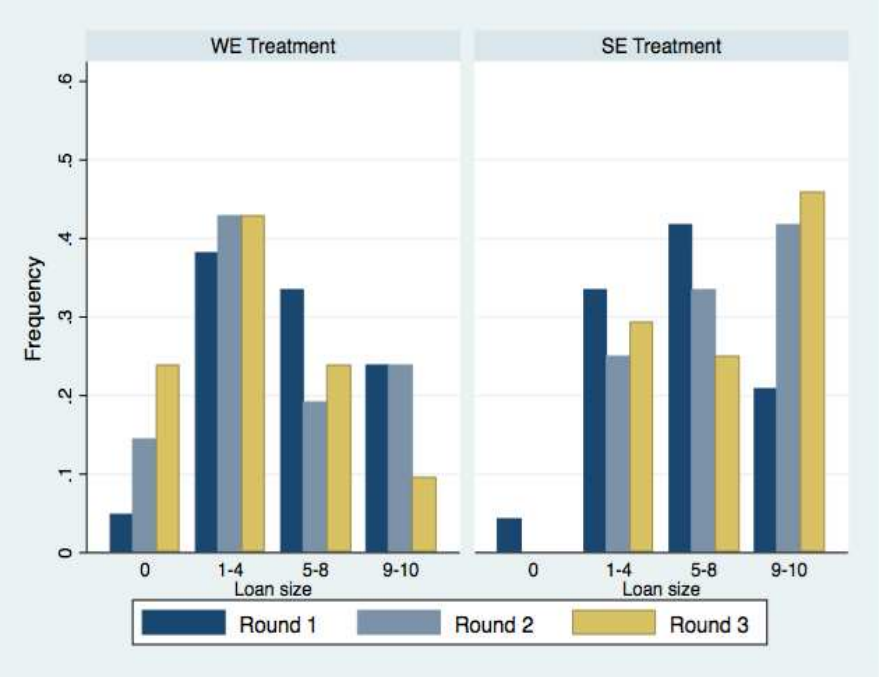
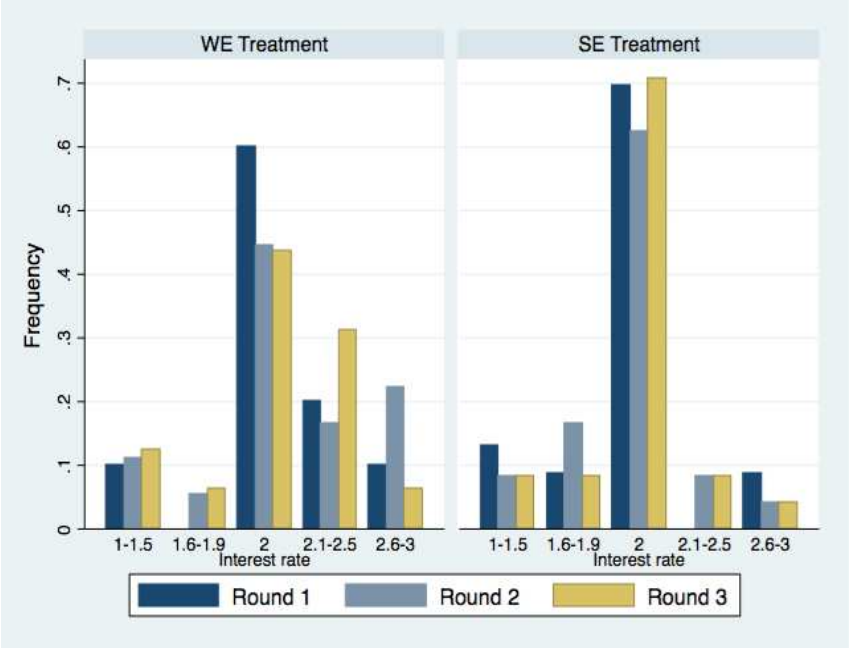


Figure D2b. Interest rates in Period 1, by round



Appendix D: Table D1. Summary statistics by round

	WE treatment			SE treatment		
	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
% of relationships surviving by the end of period 1	47.6%	42.9%	52.4%	70.8%	66.7%	83.3%
% of relationships surviving by the end of period 3	28.6%	0.0%	19.0%	50.0%	58.3%	75.0%
Average loan size in relationships of:						
1 Period ultimate length	4.76	2.65	4.00	4.43	6.48	5.85
N	*12*	*12*	*6*	*6*	*9*	*5*
2 & 3 periods ultimate length	7.00	3.64	4.30	4.60	7.00	2.00
N	*3*	*6*	*5*	*3*	*1*	*1*
4 & 5 periods ultmate length	5.78	-	4.00	8.17	7.23	6.50
N	*3*	*0*	*2*	*2*	*5*	*6*
6 & 7 periods ultimate length	8.00	-	6.69	8.51	8.72	8.77
N	*2*	*0*	*3*	*10*	*9*	*12*
Average period 1 loan offer						
Loan size	5.38	4.48	3.43	5.63	6.75	6.67
Gross interest rate	2.13	2.22	2.07	1.97	1.99	2.01