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DEBT ENFORCEMENT AND RELATIONAL CONTRACTING

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Abstract

We examine how third-party debt enforcement affects the emergence and performance of relational contracts in credit markets. We implement an experiment with finitely repeated credit relationships in which borrowers can default. In the weak enforcement treatment defaulting borrowers can keep their funds invested. In the strong enforcement treatment defaulting borrowers have to liquidate their investment. Under weak enforcement fewer relationships emerge in which loans are extended and repaid. When such relationships do emerge they exhibit a lower credit volume than under strong enforcement. These findings suggest that relational contracting in credit markets requires a minimum standard of third-party debt enforcement.

Keywords: Relational contracts, Debt enforcement, Creditor rights, Banking.

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

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1. Introduction

Creditor rights and debt enforcement are important determinants of 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.

The empirical relation between law and finance is puzzling in view of the theoretical and empirical literature on relational contracting. Relational contracts, i.e. implicit self-enforcing agreements, can overcome moral hazard in the lender-borrower relationship as shown theoretically in Stiglitz and Weiss (1983) or Boot and Thakor (1994) and empirically by McMillan and Woodruff (1999) and Brown and Zehnder (2007). Given that relational contracts can substitute third-party enforcement, why do we still observe a strong relationship between creditor protection and financial development?

This paper attempts to reconcile the apparent contradictory evidence from the law and finance and relational contracting literatures. We provide experimental evidence showing that in credit and investment contexts the emergence and effectiveness of relational contracts is dependent on the quality of third-party debt enforcement. The intuition behind our finding is that weak debt enforcement may allow borrowers to keep and reinvest funds after default and thereby seriously weaken their dynamic incentives to repay. Examples of weak enforcement include lengthy judicial procedures to enforce contracts, slow and costly bankruptcy procedures or allowing an automatic stay on assets.[1] Evidence from the 2010 Doing Business indicators of the World Bank[2] shows that the time required by a lender to recover a secured debt through a bankruptcy procedure ranges from 1.7 years on average in OECD countries to 3.4 years in Sub-Saharan Africa and 4.5 years in South Asia. The recovery rate (cents on the

[1] In addition, borrowers may "tunnel" loaned funds to other investments (Johnson et al., 2000).
[2] The data is available under www.doingbusiness.org

dollar) for the lender may also be very low, varying hereby from 68.6 in OECD countries to 17 in Sub-Saharan Africa and 20 in South Asia.[3]

We implement a credit market experiment in which a lender and a borrower interact for 7 periods. In each period the principal decides how much to lend to the borrower and what interest payment 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 Enforcement treatment - a borrower who defaults can use the borrowed funds to invest in future periods. We compare this main treatment to a control treatment – the Strong Enforcement treatment - in which, upon default, the borrower cannot use the borrowed funds for future investment. In both treatments strategic default is thus possible. What affects credit market performance is the *strength of debt enforcement after default*.

We expect weak debt enforcement to have two main effects on lender-borrower relationships in our experiment: First, we expect to see fewer relational contracts in which borrowers are motivated to repay loans and more credit relationships in which borrowers default, and thus are screened out, in initial periods. Second, when relational contracts emerge under weak debt enforcement, we expect them to display lower credit volumes in initial periods. Only by "starting small" and increasing loan sizes over time can a lender motivate a borrower to repay when debt enforcement is weak.

Our experimental results confirm these predictions: Aggregate lending is lower when enforcement is weak compared to when it is strong, leading to lower investment and efficiency. In particular, loans offered in the initial period of a relationship are substantially

[3] Looking at a broader set of regulations and institutions which protect creditors, the Legal Rights Index elicited by Doing Business (on a scale of 0-10) varies from 6.8 in OECD countries to 4.6 in Sub-Saharan Africa and 5.3 in South Asia. Even if one accounts for the variation in the Legal Rights Index, debt enforcement continues to be strongly related to credit market performance (Djankov et al., 2008).

lower under weak enforcement. When borrowers can use the lender's funds after default, they default more often in early periods of a relationship, especially when they receive a large loan.

Our paper contributes to the empirical literature on law and finance by identifying a causal impact of debt enforcement on implicit contracting and credit market performance. 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 a minimum standard of third-party debt enforcement is necessary for relational credit contracts to be effective. Our experimental results also complement the findings of Qian and Strahan (2007) showing that the quality of creditor protection affects loan characteristics. Using data on corporate lending to firms in 49 countries they show that loan maturities are shorter in countries with weaker creditor protection. They argue that weak protection induces banks to shorten loan maturities in order to incentivize borrowers. Our results show that weak creditor protection also affects the schedule of loan sizes provided by the bank over time in a credit relationship.

We also contribute to the literature on relational contracting in labor (e.g. Bull, 1987, MacLeod and Malcolmson, 1998) and credit relationships (e.g. Boot and Thakor, 1994, Boot, 2000). Experimental evidence both in labor and credit environments has shown that relationships can be sustained and lead to more efficient outcomes than one-shot interactions (see e.g. Brown et al., 2004; Fehr and Zehnder, 2009).[4] The existing experimental literature has explored two conditions under which relational contracts may not be a perfect substitute for third-party creditor protection: lender competition and non-deterministic investment returns. Competition between lenders could potentially weaken borrowers' incentives to repay and thus explain why enforcement is still important. However, Brown and Zehnder (2007)

[4] See Fehr et al. (2009) for an overview of the experimental evidence on relational contracting.

show that, even in the presence of competition, relational contracts emerge and lead to large volumes of credit. Similarly, stochastic investment returns may limit the scope for relational contracts as lenders cannot perfectly identify and punish strategic defaults. However, Fehr and Zehnder (2009) find that even with stochastic investment returns relational contracts emerge and sustain high credit volumes. To our knowledge, existing experimental investigations of relational contracting ignore the fact that weak enforcement may allow agents to reinvest the lender's funds.[5]

Finally, we contribute to the theoretical and empirical literature studying the increase in stakes over time in credit and investment relationships. Weak enforcement provides a rationale for the observation of the gradual building up of credit relationships in microfinance (Morduch, 1999, Armendariz and Morduch, 2006), in small-business lending (Ioannidou and Ongena, 2010), and in FDI relationships (Rauch and Watson, 2003). Previous theoretical contributions suggest 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)[6]. "Starting small" can also be rationalized by profit maximization of the the principal who increase stakes towards the end of the relationship, such that he can extract a greater surplus in the beginning (e.g. Thomas and Worrall, 1994, and 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).

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.

[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] "Starting small" has also been studied in prisoner's dilemmas (see Watson, 1999 and 2002, Andreoni and Samuelson, 2006).

2. Experimental design

2.1. Weak enforcement treatment

In a single round of our main treatment - the **Weak Enforcement 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. 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 thus be identified as relationships in which the borrower repays in non-final periods and then defaults in the final period. We discuss the implications of the time horizon in terms of predictions after outlining these below. We choose 7 periods rather than 2 or 3, to be able to clearly separate the initial '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.[7] We hold the investment opportunity of the borrower constant over time in order to examine credit rationing over the course of a relationship.[8]

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

[7] For an experimental analysis of credit relationships with stochastic investment returns see Fehr and Zehnder (2009).

[8] If, for example, we observe that a lenders 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.

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 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.[9]

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.[10] The capital of a borrower in

[9] 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, as in Brown and Zehnder (2007).

[10] 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 consumption / saving decisions. Second, reinvestment of loaned funds is the optimal strategy of a borrower who has defaulted: in a reputation equilibrium, any borrower who defaults on a loan will not receive future loans and so it is in his best interest to reinvest the funds he has available.

periods t={2,…,7} thus equals the sum of the loaned funds which he did not repay: $C_t = \sum_{k=1}^{t-1} D_k S_k$.

Both the lender and the borrower receive a symmetric "reservation" income of 10 points per period. 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 $C_{t+1} = C_t + D_t S_t$. 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.

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

We assume that 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.

2.2. Strong Enforcement Treatment

We contrast our main treatment with a control treatment - the **Strong Enforcement treatment (SE treatment) -** in which the borrower must liquidate the lender's funds after default. 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 the defaulting borrower cannot keep the lender's funds and reinvest them. Thus, C_t =0 in each period.

Note that in both the WE treatment and the SE treatment borrowers can default on their loans. The difference between the two treatments lies in what a borrower can do with the funds when he defaults. In the SE treatment the borrower must liquidate all of these funds and cannot reinvest any part of them. This treatment represents a legal environment in which loan default is possible, but 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 in the same period, 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 WE treatment thus represents a legal

environment in which creditor protection and debt enforcement are weaker than in the SE treatment.

Our lending game 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). We explore the outcome of a repeated investment game which accounts for an inherent characteristic of many credit and investment environments: In our WE treatment defaulting investees are not fully reliant on repeated interaction with the investor to generate future income. Table 1 provides an overview of our experimental treatments.

Table 1 here

2.3. 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 three different borrowers (lenders) in her/his matching group. As a consequence, we observe 9 lender-borrower relationships for each matching group.

In both treatments, the lender and the borrower have an overview of the history of play 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 erased.

Behavior in our lending game might be affected by individual characteristics. First, as shown by Schaechter (2007), individual risk preferences affect decisions in trust-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 (see Camerer, 2003 for a detailed discussion).[11] Before the lending game started, the participants took part in three short pre-experiment games aimed at measuring their levels of risk aversion, strategic reasoning, trust and trustworthiness. Appendix A describes these pre-experiment games in detail and provides summary statistics for their outcomes in the WE and SE treatments. We show there that there are no significant differences in behavior in these games between the two treatments. The instructions for these games are available from the authors upon request. 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 were informed about this at the beginning of the experiment. They also knew that the decisions in each pre-experimental game had no effect on the lending game.

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 market language.[12] After reading the instructions participants had to pass a test with control questions. The lending game did not start until all subjects had correctly answered all control questions.

[11] 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.

[12] 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. In our view, this not only reduces noise but also increases the external validity of the experiment. See also Brown and Zehnder (2007) for a discussion of this issue.

In total 90 students participated in our experiment. In the WE treatment there were 7 matching groups of 6 players each and in the SE treatment 8 matching groups. As displayed by Table 1 this implies that we observe 63 lender-borrower relationships in the WE treatment and 72 relationships in the SE 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 were implemented in November 2009 and lasted approximately 120 minutes each. 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 10 euro (15 USD approx. in November 2009) per 60 minutes of participation.

3. Predictions

Under the assumption of common knowledge of rationality and selfishness of all market participants, the predictions for both 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 a one-shot interaction. As 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 trust games or investment games (Berg et al., 1995) suggests that a substantial share of second movers, i.e. borrowers in our context, do exhibit such social preferences.

We examine our treatments under the assumption that some (non-distinguishable) 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 $\bar{r}$, where $\bar{r} < v$, 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. In accordance with previous experimental evidence, which is also confirmed in our experiment, we assume that the share of social borrowers is positive but not large. More specifically, 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 $T>1$ period game is feasible. In the following we outline the main results for each treatment resulting from the analysis of the repeated game in the WE and SE treatments (all proofs are presented in Appendix B). We use these results to establish hypotheses for our main treatment effects.

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 lends to (now identified) social borrowers.

In the **SE treatment** the profit-maximizing reputation equilibrium for the lender has the lender extend 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. Thus, in the SE treatment the profit-maximizing reputation equilibrium for the lender has maximum lending in periods 1 through 6 and full repayment in periods 1 through 5.

No screening equilibrium exists in the SE treatment. By definition in such an equilibrium selfish borrowers would default with certainty in the first period of the game. After their default, 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 interest rate in period 1 cannot 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: *With strong enforcement, 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 under strong enforcement.*

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 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 (additional term on the right-hand side of IC_{WE}). In Appendix B we show that given the parameters of our experiment (v=3) and assuming that fair borrowers are willing to pay an 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 pay an interest rate of $\bar{r} = 2$ the first period loan in a 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: *Under weak enforcement, 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. There also exist screening equilibria 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 or a screening equilibrium yields higher profits for the lender in the WE treatment depends on the parameters of the game: the gross return on investment (recall v=3 in our experiment), the share of social borrowers, and the threshold interest rate of social borrowers $\bar{r}$. In Appendix B, we show that if $\bar{r}$ =2 the lender earns a higher profit in the reputation equilibrium than in a screening equilibrium.[13]

How sensitive are our predictions to the assumption of a finite horizon? In an infinite horizon weak enforcement would have the same qualitative effects on credit volume and repayment: it would lead to a lower credit volume and higher defaults. Under strong enforcement 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"

[13] 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.

equilibria may also be profit-maximizing (as in Ray, 2002), if the share of social borrowers is relatively small. Under weak enforcement a reputation equilibrium featuring "starting small" is still profit-maximizing, and screening is feasible as well. Note that, if enforcement 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.

Comparing our predictions for the WE and SE treatments, we expect lower levels of credit volume in the WE than in the SE treatment. There are two reasons for this. First, reputation equilibria in the WE treatment should be characterized by "starting small", and thus by lower initial loan sizes than in the SE treatment. Second, in the WE treatment a screening equilibrium which implies no lending to selfish borrowers in periods 2 through 7 is feasible, in contrast to the SE treatment.

We expect the default rate in the WE treatment to be higher in initial periods but lower in subsequent periods, than in the SE treatment, if some relationships in the WE treatment are characterized by screening.

Aggregate investment (and thus efficiency) 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 full efficiency, as defaulting selfish borrowers can reinvest the lender's funds. Thus even if lenders don't extend credit to selfish borrowers in periods 2 through 7 the investment volume can be at the maximum level if the first period loan under screening is 10.

4. Results

4.1. Aggregate treatment effects

Table 2 presents mean statistics by treatment for lenders' offers, borrowers' acceptance and default behavior, as well as the resulting level of investment and payoffs. Our matching process implies that each lender (borrower) played the lending game with three different borrowers (lenders) in three subsequent rounds. Table 2 reports means based on the aggregate outcome over all three rounds as well as for rounds 1, 2 and 3 separately. The significance of treatment effects between the WE and SE is established using two-sided Mann-Whitney (MW) tests, which use the means per matching group as independent observations.

Table 2 here

Credit volume, defined as the average loan size per period, is lower in the WE treatment compared to the SE treatment. If we consider all three rounds the average credit volume per period is 3.17 in the WE treatment, compared to 5.67 in the SE treatment ($p=.01$). In round 1 the credit volume in the WE treatment (4.53) is already substantially lower than in the SE treatment (5.73), although the difference is not significant ($p=.42$). In rounds 2 and 3 the credit volume falls in the WE treatment, leading to a significant difference between the WE and the SE treatments ($p=.01$ in round 2, $p<.01$ in round 3).

The *Interest rate* offered by lenders, defined as the desired repayment divided by the loan size, is close to 2 in both treatments, which implies that most lenders offered an equal split of the surplus. The Interest rate is slightly higher in the WE treatment (2.13) than in the SE treatment (1.99) suggesting that lenders did try to compensate partly for the increased credit risk in this treatment with higher risk-premia on loans ($p=.05$).

Turning to borrower behavior, Table 2 shows that the large majority of loan offers are accepted in both treatments. We find a higher *Default* rate in the WE treatment than in the SE. Considering all three rounds, the default rate is 36% in the WE treatment and 21% in the SE treatment (p=.05). The treatment difference in default rates is lowest in round 1 (8 percentage points) and highest in round 2 (29 percentage points).

We find similar level of *Investment* in the WE (5.45) and the SE treatment (5.54) considering all three rounds. However, by round 3 investment falls substantially in the WE treatment and is significantly lower than in the SE treatment (p=.03).

Lender profits differ significantly between the WE and SE treatments. In the WE treatment lenders just break even and earn significantly less than in the SE treatment (10.83 vs. 13.26, p<.01). Conversely, *Borrower profits* are higher in the WE than in the SE treatment although this difference is not statistically significant (20.06 vs. 17.82, p=.13).

Result 1: *Weak debt enforcement leads to a lower credit volume, higher interest rates and higher default rates in the WE treatment compared to the SE treatment. Investment is similar in both treatments in rounds 1 and 2 but lower in the WE treatment than the SE treatment by round 3.*

Result 1 confirms our main hypothesis at an aggregate level: If relational contracts are less frequent and characterized by lower credit volume in the WE treatment, we expect lower credit volume, lower investment and higher default rates in this treatment compared to the SE treatment. We now investigate how the underlying individual lender and borrower behavior in the WE treatment to the SE treatment matches our predictions.

4.2. Loan offers and repayment behavior

A. First-period loan offers

Figure 1A displays the distribution of loan offers in the first period of relationships in the WE and SE treatments. This figure reveals that large loans are less frequent in the WE compared to the SE treatment. 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.[14] 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 interest rates is similar in the WE and SE treatments: In both treatments the surplus sharing interest rate of 2 is most common.

Figure 1 here

Table 3 reports the results of a multivariate analysis OLS regressions relating first-period loan offers to the treatment (WE or SE) and characteristics of the lender. The results displayed in the table confirm that period 1 loans are significantly smaller in the WE than SE treatment. In particular the estimated coefficient of the dummy variable WE treatment in column 3 suggests that first-period loans are 2 points lower in the WE than the SE treatment. By contrast, the table 3 results suggest that there is no difference in first-period interest rates between the two treatments.

The variation in period 1 loan offers across lenders seems to be strongly related to individual risk attitudes. In Table 3 we control for three measures of lender characteristics using data from the pre-experimental games discussed in section 2.3. We find that lenders

[14] 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.

with higher indicators of risk aversion offer smaller period 1 loans. This finding confirms field evidence by Schaechter (2007) suggesting that first-mover behavior in trust-games is significantly related to individual risk attitudes. We find no relation between loan offers in period 1 and our measures of strategic reasoning or trust.[15]

Table 3 here

The distribution of first-period loan offers in the SE and WE treatments suggest that from the outset 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 low', to 6, 'very high'.

Among the lenders which offered a loan size of 10 in the SE treatment, the share of lenders which stated that repayment was likely or highly likely was 48%. Among the lenders which offered a loan size of 5-8 in period 1 60% stated that repayment was likely or highly likely. By contrast, among lenders which offered first-period loan sizes of 1-4 only 20% thought borrowers were likely or highly likely to repay.

In the WE treatment we observe a different pattern of lenders' beliefs concerning repayment. Among those lenders which offered loans of 5-8 (10) in the first period only 23% (22%), stated that repayment was likely or highly likely. By contrast, among those lenders

[15] 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.

which offered a first-period loan of 1-4 48% thought that repayment was likely or highly likely. Thus in line with our predictions lenders in the SE treatment expect a strategy of "starting small" to be more successful in inducing repayment while large first-period loans are expected to induce first-period default. Additionally, lenders' beliefs are in line with the screening equilibrium, whereby large loans offered in the first period are likely to deal to a high default probability allowing lenders to screen out selfish borrowers.[16]

Result 2: *In the WE treatment lenders offer smaller loans in the initial period of relationships compared to the SE treatment, while interest rates are similar in both treatments.*

B. Loan defaults

Figure 2 displays the probability of default by borrowers in the WE and SE treatment. Figure 2A displays defaults in period 1 depending on the loan size offered to borrowers. The figure shows that in the WE treatment, the probability of default in period 1 is substantially lower for loans of sizes 1-4 (9%), than for loans of 5-8 (54%) and loans of 10 (44%). By contrast, in the SE treatment the probability of default is equally low for small and large loans. This finding supports our prediction that the possibility to keep and reinvest the lender's funds gives borrowers stronger incentives to default on large loans at the beginning of a relationship. Figure 2B displays probability of default by period in the WE and SE treatments. Defaults in the SE treatment occur in less than 20% of the cases in the period 1 and periods 2 to 5, while they increase substantially in periods 6 and 7. As in Brown and Zehnder (2007) this pattern suggests the presence of strong reputation incentives. Selfish

[16] 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.

borrowers imitate social ones during the first periods and start defaulting as the game comes close to an end. By contrast, in the WE treatment we find that the defaults probability is more or less equal across all periods.

Figure 2 here

Table 4 presents the results of a multivariate analysis of individual borrower default probabilities in the WE and SE treatments. The results in the table are presented separately for period 1 (columns 1-4) and periods 2 to 7 (columns 5-8). They reveal that defaults are more likely in the WE treatment in period 1, if loan sizes are large. This confirms the relationship between loan sizes and default observed in Figure 4A.

Interestingly, larger loan sizes decrease the probability of default in the SE treatment for periods 2 to 7, while higher interest rates increase this probability. The positive coefficient for the variable Period and the negative coefficient for the interaction term WE * period estimated in column (6) estimated for the interaction variable *Period* confirm that there is a stronger time trend on loan default in the SE than in the WE treatment.

In unreported regressions we replace borrower random effects in columns (1) and (2) of Table 4 with the measures of risk aversion, strategic reasoning and trustworthiness from our pre-experimental games. Interestingly we find that default behavior in the WE and SE treatments are unrelated to risk aversion and trustworthiness. We find that default rates are positively related to strategic reasoning in the SE but not in the WE treatment.

Table 4 here

Result 3: *In the WE treatment the default rate in initial periods is higher than in the SE treatment, but the increase in the default rate towards the end of the game is also more moderate.*

C. Loan contract renewals

Lenders react strongly to defaults in our experiment. Figure 3 and Table 5 examine the decision of lenders to renew loan offers to borrowers over the course of relationships. Figure 3 shows that lenders are significantly more likely to offer a new loan if there was no default by the borrower in previous periods, in both treatments. Interestingly, in the WE treatment, renewed loan offers are less conditional on past repayment behavior than in the SE treatment. The probability of renewal increases on average by 41 percentage points (column 1) in treatment WE and 64 percentage points (column 2) in treatment SE, if the borrower did not default in the past compared to the case he did.

The difference in conditionality of contract renewal is confirmed by the significant negative coefficient of the interaction term *WE * No default*, in column 5 of Table 5. This difference in conditionality across treatments is not predominantly driven by the reaction of lenders to defaulting or non-defaulting borrowers. If a borrower does not default, contract renewal is slightly less likely in the WE treatment (column 3), while if he defaults, contract renewal is slightly more likely in this treatment (column 4).

Figure 3 here

Table 5 here

Figure 4 and Table 6 examine the **time structure of the loan size in relationships.** Hereby we focus on the successful relational contracts, i.e. those without previous default. Figure 4A displays the mean loan size over the course of a relationship for those relationships with no prior default. In the SE treatment, the mean loan size to non-defaulting borrowers increases strongly over time; from 6.3 in period 1 to 8.8 in period 5. This result does not correspond to the profit-maximizing equilibrium for a (risk-neutral) lender in the SE treatment discussed in section 3, 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). These studies show that in repeated trust games first-movers do increase the stakes over time, and that this can be explained by learning (Anderhub et al, 2002). In our experiment learning seems to play an important role: loan sizes start at 5.6 in the first round, while they increase to 6.7 by the last round. The loan schedule over time also becomes flatter in the SE treatment by round 3.

By contrast, the loan size remains almost constant over time in the WE treatment. Here the mean loan size to non-defaulting borrowers increases from 4.4 in period 1 to 5.4 in period 2. After this, however, the mean loan size hovers between 4.9 and 5.5 until period 6 before falling to 2 in the final period. In contrast to the SE treatment, in this treatment learning across rounds does not seem to play a significant role.

The constant loan sizes over time in the WE treatment are surprising. After all, in this treatment the lender can only motivate (selfish) borrowers to repay by increasing loan sizes over time. Analyzing loan offers in more detail we find that the flat pattern of mean loan size in the WE treatment over time is driven by several lenders who stop lending, although the borrower did not default. In Figure 4B we therefore examine the mean loan size in "active" relationships only, i.e. relationships in which lenders always offered a strictly positive loan between periods 1 and 5. Considering these relationships only, we find a significant increase

in the mean loan size for both the SE and the WE treatment. In particular in the WE treatment the loan size increases from 4.4 in period 1 to 8.4 in period 6.

Figure 4 here

Table 6 provides a multivariate analysis of loans and interest in relationships without previous default. We relate the loan size and interest rate offered by lenders to the period of the relationship and the round of the experiment. To account for non-linear time trends of loan offers we include the period of the relationship as well as its squared value in the model. We account for heterogeneity in loan offers across lenders with lender random effects. The table 6 results confirm the pattern of loan sizes presented in Figure 4B. We find a significant positive coefficient of *Period* and a negative coefficient of its squared value for both treatments (columns 1-3). These results suggest that, controlling for the (significant) heterogeneity in behavior across lenders, loan sizes in no-default relationships increase over time, but at a declining growth rate, in both treatments.[17] By contrast, the *Interest rate* does not display a time trend in either treatment (columns 4-6).

In unreported regressions we replace the lender random effects with our measures of risk aversion, strategic reasoning, and trust from our pre-experimental games. Confirming our results from Table 3 we find that in both treatments risk averse lenders offer lower loans to borrowers, even when they have never defaulted in the past. We also find that the lenders' level of trust is strongly correlated with loan offers to non-defaulting borrowers in the WE treatment, but not in the SE treatment. Lenders' level of strategic reasoning is not correlated with loan offers to non-defaulting borrowers in either treatment.

[17] These findings confirm the results of McMillan and Woodruff (1999) who find a concave increase in credit volume over time in trade credit relationships in Vietnam.

Table 6 here

Result 4: *In both the WE and SE treatments, lenders increase loan sizes to borrowers who repaid all prior loans, but do not alter interest rates.*

4.3. Frequency and characteristics of successful relations

Our analysis of lender and borrower behavior in section 4.2 show that relations in the WE treatment are characterized by lower initial loan sizes and earlier default than in the SE treatment. These findings are in line with our hypotheses that there should be fewer reputation based relational contracts in the WE treatment than in the SE treatment, and that in the WE treatment relational contracts are more likely to be characterized by "starting small" than in the SE treatment. We conclude the presentation of our findings with a comparison of the frequency and characteristics of successful relational contracts across treatments.

We classify each lender-borrower relationship into one of four types at the end of each period: relationships in which no loan has been extended (No loan), relationships in which a loan has been extended in at least each period so far and no default has occurred (No default-Active), relationships in which there was no default but the lender stopped lending (No default – Not active) and relationships in which the borrower has defaulted at least once (Default).

As predicted the share of "No default – Active" relations, i.e. relational contracts with positive lending and no default is much higher in the SE than in the WE treatment. By period 3 two-thirds of the relations in the SE treatment can be still classified as successful relational contracts, while this holds only for a third of the relations in the WE treatment (MW-test, two-sided, $p<.01$).

Also in line with our predictions in the WE treatment more relationships are characterized by default in earlier stages of the relationship than the SE treatment. Panel A of Table 7 shows that by period 3 57% of relationships have experienced a default in the WE treatment, while only 31% have in the SE treatment (MW-test, two-sided, $p<.01$). As expected in reputation equilibria in periods 6 and 7 more relationships feature defaults in the SE treatment. By the end of the lending game, in period 7, a similar small proportion of relationships experience no default, 21% in the WE treatment and 24% in the SE treatment. This supports the assumption in our predictions above that a similar share of "social" borrowers exists in each treatment.

Table 7 here

Panel B of Table 7 compares the intertemporal lending pattern in "No default – Active relations" across treatments. Guided by our theoretical predictions we distinguish relations which "Start big" from those that "Start small". The former are relations which are initiated with a loan size of 10 and continue at this level. The latter are relations which are initiated with a loan size of less than 10 and display an increasing lending profile over time. In line with our predictions we find that in the WE treatment successful relations are much less likely to characterized as "Start big" than in the SE treatment. By period 4, 42% of the remaining successful relations in the SE treatment are relations that started out with a loan of 10, while the corresponding share is only 14% in the WE treatment (MW test, two-sided, $p=.05$). As the number of successful relations declines in the WE treatment in periods 5 and 6 (see panel A), the share of these relations which started big increases to 28%. This share remains, substantially lower than in the SE treatment (38% in period 6), although this difference is no longer statistically significant.

Result 5: *The frequency of relational contracts in which loans are extended and repaid is lower in the WE treatment than in the SE treatment. When they do emerge in the WE treatment such relational contracts are less likely to "Start big" than in the SE treatment.*

5. Conclusion

In countries with weak creditor protection relational contracting between lenders and borrowers may not provide a perfect substitute enforcement mechanism. In this paper we examine the impact of weak debt enforcement, which allows borrowers to default and reinvest the lender's funds in an experimental credit market.

Our results suggest that weak debt enforcement reduces the number of relational contracts in which moral hazard is mitigated through reputation incentives. When relational contracts do emerge under weak enforcement they are characterized by a smaller credit volume as lenders initiate relationships with smaller loans.

Our findings also provide strong support to the conjecture that observed patterns of investment in microfinance and FDI relationships may be driven by concerns over borrower default. 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.

Our findings also highlight the importance of a common problem in sovereign lending: the fact that a creditor country often lacks the legal power to seize any assets from the borrowing country, in case the latter defaults on its debt obligations (Bulow and Rogoff, 1989). We show that in a lending environment where the borrower can continue to invest the lender's funds after default and the lender cannot sanction the borrower, as is the case in sovereign lending, borrowers will face credit constraints.

References

Albuquerque, Rui and Hugo A. Hopenhayn (2004). "Optimal Lending Contracts and Firm Dynamics", *Review of Economic Studies*, 71, 285-315.

Allen, Franklin, Jun Qian and Meijun Qian (2005). "Law, finance and economic growth in China", *Journal of Financial Economics*, 77, 57-116.

Anderhub, Vital, Dirk Engelmann and Werner Güth (2002). "An experimental study of the repeated trust game with incomplete information", *Journal of Economic Behavior and Organization*, 48 (2), 197-216.

Andreoni, James and Larry Samuelson (2006). "Building Rational Cooperation", *Journal of Economic Theory*, 127, 117-154.

Armendariz, Beatriz and Jonathan Morduch (2006). *The Economics of Microfinance*, MIT Press.

Berg, Joyce, John Dickhaut and Kevin McCabe (1995). "Trust, Reciprocity and Social History", *Games and Economic Behavior*, 10, 122-142.

Boot, Arnoud W.A. (2000). "Relationship Banking: What Do We Know?" *Journal of Financial Intermediation*, 9, 3-25.

Boot, Arnoud W.A, and Anjan V. Thakor (1994). "Moral Hazard and Secured Lending in an Infinitely Repeated Credit Market Game", *International Economic Review*, 35 (4), 899-920.

Bornhorst, Fabian, Andrea Ichino, Oliver Kirchkamp, Karl H. Schlag and Eyal Winter (2010). "Similarities and Differences when Building Trust: the Role of Cultures", *Experimental Economics*, 13 (3), 260-283.

Brown, Martin, Armin Falk and Ernst Fehr (2004). "Relational Contracts and the Nature of Market Interaction", *Econometrica*, 72, 747-780.

Brown, Martin and Christian Zehnder (2007): "Credit Reporting, Relationship Banking, and Loan Repayment", *Journal of Money, Credit, and Banking*, 39, 1883-1918.

Bull, Clive (1987): "The Existence of Self-Enforcing Implicit Contracts", *Quarterly Journal of Economics*, 102, 147-159.

Bulow, Jeremy and Kenneth Rogoff (1989). "Sovereign Debt: Is to Forgive to Forget?" *American Economic Review*, 79 (1), 43-49.

Camerer, Colin F. (2003). *Behavioral Game Theory: Experiments in Strategic Interaction*, Princeton, Princeton University Press.

Cochard, François, Nguyen, Phu Van and Marc Willinger (2004). "Trusting behavior in a repeated investment game", *Journal of Economic Behavior and Organization*, 55, 31-44.

Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer (2003). "Courts." *Quarterly Journal of Economics*, 118, 453–517.

Djankov, Simeon, Caralee McLiesh and Andrei Shleifer (2007). "Private Credit in 129 countries", *Journal of Financial Economics*, 84, 299-329.

Djankov, S., Oliver Hart, Caralee McLiesh and Andrei Shleifer (2008). "Debt Enforcement around the World", *Journal of Political Economy*, 116 (6), 1105-1148.

Dohmen, Thomas, Armin Falk, David Huffman, and Uwe Sunde (2010). "Are risk aversion and impatience related to cognitive ability?", *American Economic Review*, 100 (3), 1238-1260.

Dufwenberg, Martin and Georg Kirchsteiger (2004). "A Theory of Sequential Reciprocity", *Games and Economic Behavior*, 47, 268-298.

Falk, Armin, David Huffman and W. Bentley MacLeod (2008). "Institutions and Contract Enforcement", IZA Discussion Paper 3435.

Fehr, Ernst, Martin Brown and Christian Zehnder (2009). "On Reputation: A Microfoundation of Contract Enforcement and Price Rigidity", *Economic Journal*, 119, 333-353.

Fehr, Ernst and Klaus Schmidt (1999). "A Theory of Fairness, Competition and Co-operation", *Quarterly Journal of Economics*, 114, 817-868.

Fehr, Ernst and Christian Zehnder (2009). "Reputation and Credit Market Formation: How Relational Incentives and Legal Contract Enforcement Interact", IZA Discussion Paper 4351.

Fischbacher, Urs (2007): "z-Tree: Zurich Toolbox for Readymade Economic Experiments", *Experimental Economics*, 10, 171-178.

Ghosh, Parikshit and Debraj Ray (1996). "Cooperation in Community Interaction without Information Flows", *Review of Economic Studies*, 63 (3), 491-519.

Ghosh, Parikshit and Debraj Ray (2001). "Information and Enforcement in Informal Credit Markets", working paper.

Ioannidou, Vasso P., and Steven Ongena (2010). "Time for a Change: Loan Conditions and Bank Behavior When Firms Switch", *Journal of Finance*, 65, 1847-1878.

Johnson, Simon, Rafael LaPorta, Florencio Lopez-de-Silanes and Andrei Shleifer (2000). "Tunneling", *American Economic Review (Papers and Proceedings)*, 90, 22-27.

King-Casas, Brooks, Damon Tomlin, Cedric Anen, Colin F. Camerer, Steven R. Quartz and P. Read Montague (2005). "Getting to Know You: Reputation and Trust in a Two-Person Economic Exchange", *Science*, 308, 78-83.

Kirschenmann, Karolin (2010). "The dynamics in requested and granted loan terms when bank and borrower interact repeatedly", Mimeo, University of Mannheim.

Kreps, David, Paul Milgrom, John Roberts and Robert Wilson (1982). "Rational Cooperation in the Finitely Repeated Prisoners' Dilemma", *Journal of Economic Theory*, 27, 245-252.

LaPorta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer and Robert W. Vishny (1997). "Legal Determinants of External Finance", *Journal of Finance*, 52, 1131–1150.

LaPorta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer and Robert W. Vishny (1998). "Law and Finance", *Journal of Political Economy*, 106, 1113–1155.

MacLeod, W. Bentley and James M. Malcolmson (1998). "Motivation and Markets", *American Economic Review*, 88, 388-411.

McMillan, John and Christopher Woodruff (1999). "Interfirm Relationships and Informal Credit in Vietnam", *Quarterly Journal of Economics*, 114 (4), 1285-1320.

Morduch, Jonathan (1999). "The Microfinance Promise", *Journal of Economic Literature*, 37, 1569-1614.

Nagel, Rosemarie (1995). "Unraveling in Guessing Games: An Experimental Study", *American Economic Review*, 85, 1313-1326.

Qian, Jun and Philip E. Strahan (2007). "How Laws and Institutions Shape Financial Contracts: The Case of Bank Loans", *Journal of Finance*, 62 (6), 2803-2834.

Rauch, James and Joel Watson (2003). "Starting small in an unfamiliar environment", *International Journal of Industrial Organization*, 21, 1021-1042.

Ray, Debraj (2002). "The Time Structure of Self-Enforcing Agreements", *Econometrica*, 70 (2) pp. 574-582.

Roe, Brian E. and Steven Y. Wu (2009). "Do the Selfish Mimic Cooperators? Experimental Evidence from Finitely-Repeated Labor Markets", IZA Discussion Papers 4084.

Schaechter, Laura (2007). "Traditional Trust Measurement and the Risk Confound: An Experiment in Rural Paraguay", *Journal of Economic Behavior and Organization*, 62, 67-76.

Sobel, Joel (1985). "A Theory of Credibility", *Review of Economic Studies*, 52 (4), 557-573.

Stiglitz, Joseph E., and Andrew Weiss (1983). "Incentive Effects of Terminations: Applications to the Credit and Labor Markets", *American Economic Review*, 73, 912-927.

Thomas, Jonathan, and Tim Worral (1994). "Foreign Direct Investment and the Risk of Expropriation", *Review of Economic Studies*, 61 (1), 81-108.

Watson, Joel (1999). "Starting Small and Renegotiation", *Journal of Economic Theory*, 85, 52-90.

Watson, Joel (2002). "Starting Small and Commitment", *Games and Economic Behavior*, 38, 176-199.

Table I. Treatments and Subjects

Treatment	Conditions	Matching groups & relations
Weak Enforcement (WE Treatment)	7 period game, borrower can reinvest loan principal after default	7 matching groups = 63 lender-borrower relations
Strong Enforcement (SE Treatment)	7 period game, borrower cannot reinvest loan principal after default	8 matching groups = 72 lender-borrower relations

Table II. Summary Statistics by Treatment

The table reports means for each variable by treatment, at the matching group level. It also reports the Mann-Whitney test p-values comparing outcomes across treatments. *Credit volume* is the size of the loan offered by the lender and has a minimum value of 0 and a maximum value of 10. *Interest* is the gross interest rate calculated as desired repayment / loan size for all loan offers exceeding 0. By design *Interest* lies between 0 and 3. *Acceptance* is a dummy variable which is 1 if loan size > 0 and the offer was accepted and 0 if loan size > 0 and the offer was declined. *Default* is a dummy variable which is 1 if a loan was accepted and the desired repayment was not made, and 0 if a loan was accepted and the desired repayment was made. *Investment volume* is defined as the accepted loan size plus the capital of the borrower. *Lender profit* and *Borrower profit* are the per-period payoffs of the lender / borrower. *MW Test* denotes the Mann-Whitney test (p-values) results, at the matching group level.

	All rounds			Round 1			Round 2			Round 3		
	WE	SE	MW test	WE	SE	MW test	WE	SE	MW test	WE	SE	MW test
Credit volume	3.17	5.67	0.01	4.53	5.73	0.42	2.80	5.40	0.01	2.40	5.87	0.00
Interest	2.13	1.99	0.05	2.15	2.00	0.08	2.13	1.98	0.15	2.09	2.00	0.42
Acceptance	88%	96%	0.04	87%	95%	0.05	87%	95%	0.39	92%	99%	0.09
Default	36%	21%	0.05	37%	29%	0.16	47%	18%	0.01	30%	17%	0.15
Investment volume	5.45	5.54	0.91	6.67	5.60	0.42	5.27	5.24	0.56	4.41	5.78	0.03
Lender profit	10.83	13.26	0.01	11.42	12.48	0.25	9.99	13.15	0.00	11.09	14.14	0.01
Borrower profit	20.06	17.82	0.13	21.91	18.71	0.10	20.54	17.32	0.13	17.73	17.42	0.42

Table III. Determinants of first-period loan offers

The table reports OLS estimates for the dependent variables *Loan size* (columns 1-3) and *Interest* (columns 4-6), using observations from the first period of each relationship only. *WE Treatment* is a dummy variable which is 1 for all observations from the WE treatment and zero for those from the SE treatment. The variables *Risk aversion*, *Strategic reasoning* and *Trust* are lender-specific measures elicited from pre-experiment games. All regressions include Round fixed effects. 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)
Dependent variable	*Loan size*			*Interest*		
Treatment	WE	SE	WE and SE	WE	SE	WE and SE
WE Treatment			-2.185***			0.147
			[0.540]			[0.105]
Risk aversion	-0.440*	-0.632**	-0.575***	-0.021	0.030*	0.015
	[0.187]	[0.208]	[0.110]	[0.034]	[0.013]	[0.021]
Strategic Reasoning	-0.015	-0.039	-0.026	-0.003	0.003	-0.001
	[0.057]	[0.038]	[0.042]	[0.005]	[0.004]	[0.003]
Trust	0.330	0.057	0.154	-0.029	0.028*	0.013
	[0.285]	[0.140]	[0.127]	[0.025]	[0.012]	[0.013]
Round 2	-0.905	1.125***	0.178	0.098	0.032	0.052
	[0.556]	[0.284]	[0.396]	[0.117]	[0.064]	[0.064]
Round 3	-1.952***	1.042	-0.356	-0.068	0.052	0.007
	[0.425]	[0.575]	[0.536]	[0.176]	[0.067]	[0.078]
Constant	7.165	12.082***	11.005***	2.630***	1.422***	1.891***
	[6.001]	[2.852]	[3.381]	[0.384]	[0.300]	[0.297]
Method	OLS	OLS	OLS	OLS	OLS	OLS
Lender effects	no	no	no	no	no	no
Observations	63	72	135	54	71	125
Number of Lenders	21	24	45	21	24	45
R^2	0.26	0.13	0.24	0.07	0.17	0.07

Table IV. Loan defaults

The table reports marginal effects (columns 1-2 and 4-5), OLS estimates (columns 3 and 6) for the dependent variable *Default* which is 1 if the borrower did not make the desired repayment after accepting a loan offer and 0 if the borrower made the desired repayment. *Loan size* and *Interest* are size of the loan and the gross interest rate (desired repayment / loan size) offered by the lender in the accepted loan contract. *Period* and $Period^2$ are variables denoting the period of the relationship and its squared value, respectively. *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. Regressions in columns 4 to 6 include borrower random effects. Standard errors are reported in brackets. *, **, *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Period 1			Periods 2 to 7		
Treatment	WE	SE	WE and SE	WE	SE	WE and SE
Loan size	0.042*	0.013	0.014	-0.002	-0.025***	-0.027***
	[0.023]	[0.016]	[0.017]	[0.017]	[0.010]	[0.009]
Interest	-0.033	0.037	0.039	0.379***	0.429***	0.414***
	[0.193]	[0.194]	[0.194]	[0.119]	[0.118]	[0.085]
Period				0.060*	0.103***	0.099***
				[0.032]	[0.018]	[0.014]
WE Treatment			0.091			0.523*
			[0.563]			[0.270]
WE * Loan size			0.027			0.014
			[0.027]			[0.013]
WE * Interest			-0.049			-0.127
			[0.266]			[0.110]
WE * Period						-0.072***
						[0.024]
Round 2	-0.050	0.028	0.001	0.090	-0.099**	-0.048
	[0.167]	[0.120]	[0.102]	[0.124]	[0.048]	[0.045]
Round 3	-0.135	-0.073	-0.101	-0.063	-0.108**	-0.072*
	[0.153]	[0.111]	[0.099]	[0.107]	[0.048]	[0.043]
Constant			0.051			-0.744***
			[0.422]			[0.204]
Method	Probit	Probit	OLS	Probit	Probit	OLS
Borrower random effects	no	no	no	yes	yes	yes
Observations	43	65	108	173	300	473
Number of Borrowers				21	24	45
R^2 (overall if periods 2-7)			0.076			0.195

Table V. Contract renewal in periods 2-7

The table reports marginal effects (columns 1-4) and OLS estimates (column 5) for contract renewal to borrowers in periods 2 through 7. *Period* and $Period^2$ are variables denoting the period of the relationship and its squared value, respectively. *WE Treatment* is a dummy variable which is 1 for all observations from the WE treatment and zero for those from the SE treatment. *No past default* is a dummy for those borrowers which received at least one loan and never defaulted in prior periods. All regressions include random effects per lender and Round fixed effects. Standard errors are reported in brackets. *, **, *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
Dependent variable			*Contract renewal*		
Treatment	WE	SE	Pooled	Pooled	Pooled
Previous default?	Pooled	Pooled	No	Yes	Pooled
Period	-0.091**	-0.073***	-0.012	-0.072***	-0.055***
	[0.044]	[0.017]	[0.009]	[0.024]	[0.010]
No past default	0.413***	0.638***			0.535***
	[0.152]	[0.071]			[0.037]
WE Treatment			-0.020	0.221	0.110
			[0.022]	[0.190]	[0.105]
WE * Period					-0.001
					[0.015]
WE * No past default					-0.196***
					[0.058]
Round 2	-0.335**	-0.220***	-0.056	-0.205**	-0.142***
	[0.143]	[0.074]	[0.044]	[0.097]	[0.031]
Round 3	-0.390***	-0.217***	-0.039	-0.381***	-0.164***
	[0.147]	[0.078]	[0.031]	[0.092]	[0.030]
Constant					0.721***
					[0.071]
Method	Probit	Probit	Probit	Probit	OLS
Lender random effects	yes	yes	yes	yes	yes
Observations	306	432	426	312	738
Number of Lenders	21	24	44	43	45
R^2 - overall					0.339

Table VI. Loan size and interest rates in relationships without default

This table reports panel estimates for *Loan size* (columns 1-3) and *Interest rates* (columns 4-6) using random effects per lender in relationships without any previous default. *Period* and *Period*^{2} are variables denoting the period of the relationship and its squared value, respectively. *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 random effects per lender and Round fixed effects. Standard errors are reported in brackets. *, **, *** indicate significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable		*Loan size*			*Interest*	
Treatment	WE	SE	WE and SE	WE	SE	WE and SE
Period	2.382***	3.133***	3.140***	0.092	0.038	0.042
	[0.684]	[0.520]	[0.512]	[0.108]	[0.023]	[0.044]
Period^2	-0.295***	-0.413***	-0.414***	-0.012	-0.005*	-0.005
	[0.079]	[0.059]	[0.058]	[0.013]	[0.003]	[0.005]
WE Treatment			-1.454			0.094
			[1.770]			[0.169]
WE * Period			-0.788			0.064
			[0.875]			[0.081]
WE * Period^2			0.122			-0.009
			[0.100]			[0.010]
Round 2	-1.213**	-0.816**	-0.994***	-0.059	0.020	-0.012
	[0.518]	[0.402]	[0.319]	[0.073]	[0.017]	[0.027]
Round 3	-1.015**	-0.713*	-0.854***	-0.073	0.015	-0.017
	[0.504]	[0.375]	[0.301]	[0.071]	[0.016]	[0.025]
Constant	1.957	3.240***	3.338***	2.098***	1.935***	1.951***
	[1.428]	[1.097]	[1.081]	[0.213]	[0.059]	[0.100]
Method	OLS	OLS	OLS	OLS	OLS	OLS
Lender random effects	yes	yes	yes	yes	yes	yes
Observations	151	275	426	127	250	377
Number of Lenders	20	24	44	20	24	44
Overall R^2	0.126	0.133	0.229	0.003	0.000	0.064

Table VII. Classification of relationships

Panel A classifies each relationship into one of four types at the end of each period: Relationships in which no default has occured and a loan has been extended in every period (*No default "Active"*), relationships in which no default has occured but the lender has stopped lending (*No default "Not Active"*), relationships in which at least one loan has been extended and the borrower has defaulted at least once (*Default*), and relationships in which no loan has been extended in any period so far (*No loan*). Panel B classifies No default "Active" relationships according to the dynamics of the loan offers over time: "Start big" are relations in which the initial loan is 9 or 10 and all subsequent loans are larger than 9. "Start small" are relations in which the initial loan is less than 9 and subsequent loans are weakly larger than the initial loan.

Panel A. Relationship types by period

	WE treatment (Total: 63 relationships)				SE Treatment (Total: 72 relationships)			
Period	No Default "Active"	No Default "Not Active"	Default	No loan	No Default "Active"	No Default "Not Active"	Default	No loan
1	65%	0%	21%	14%	82%	0%	17%	1%
2	52%	3%	38%	6%	72%	0%	26%	1%
3	33%	5%	57%	5%	67%	1%	31%	1%
4	30%	5%	60%	5%	61%	1%	36%	1%
5	21%	5%	70%	5%	57%	1%	40%	1%
6	14%	6%	75%	5%	28%	11%	61%	0%
7	6%	14%	75%	5%	4%	19%	76%	0%

Panel B. No-default "Active" relationships by period

	WE treatment			SE Treatment		
Period	Start big	Start small	Other	Start big	Start small	Other
1	17%	83%	0%	33%	67%	0%
2	10%	80%	10%	35%	57%	8%
3	14%	77%	8%	39%	59%	2%
4	14%	72%	14%	42%	58%	0%
5	29%	66%	5%	42%	58%	0%
6	28%	72%	0%	38%	43%	19%
7	17%	83%	0%	100%	0%	0%

Figure 1. First period loan offers

This figure displays the period 1 loan offers by treatment. Figure 1A displays the distribution of offers by Loan size while Figure 1B displays the duistribution of loan offers by Interest rate.

Figure 1A. Loan size

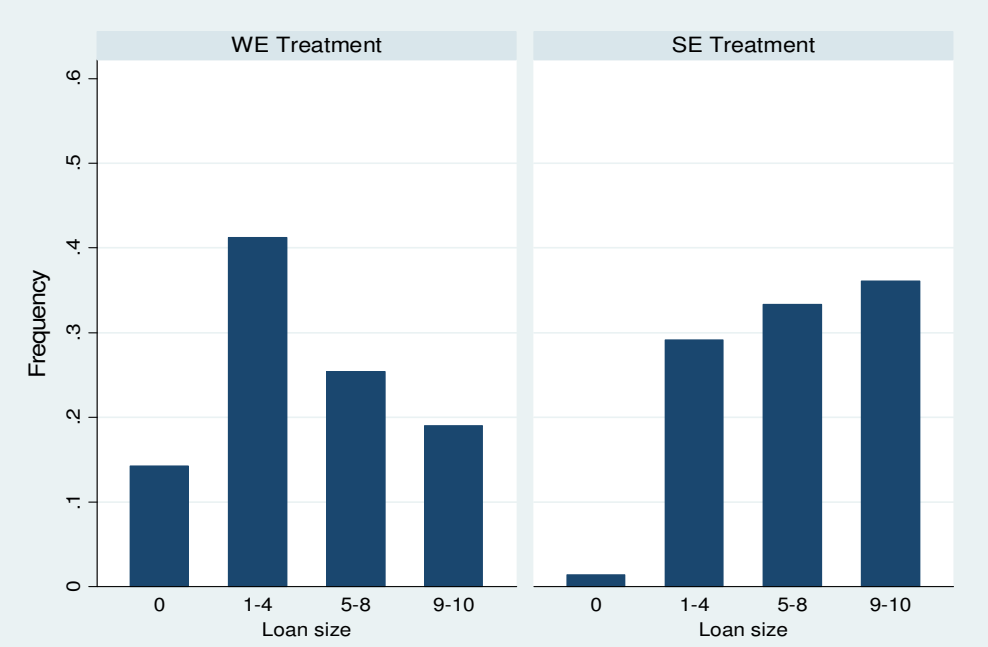


Figure 1B. Interest

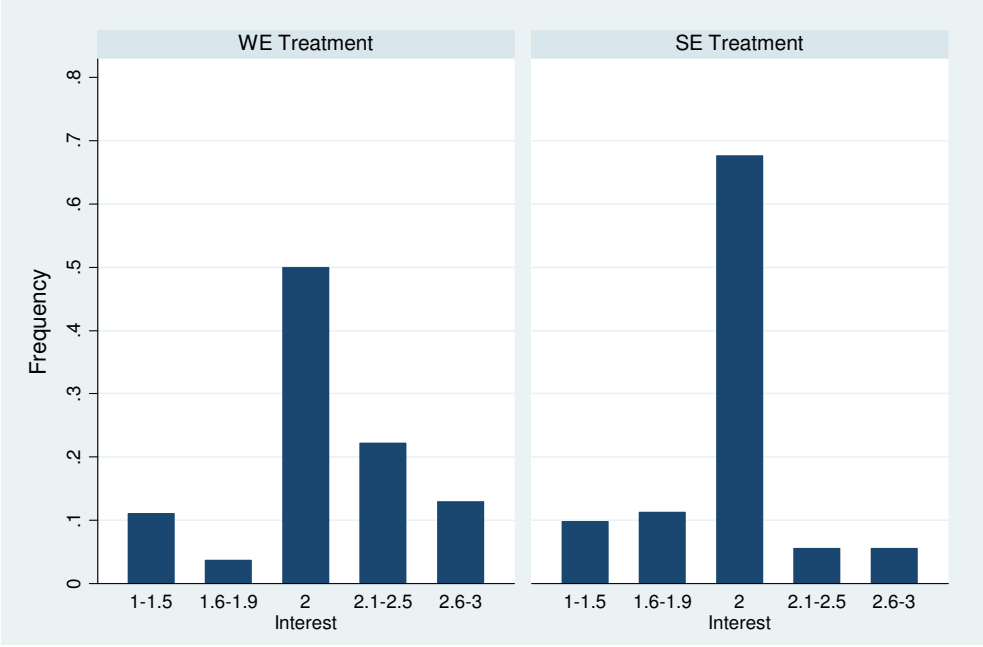


Figure 2. Loan defaults

Figure 2A displays the average default over groups of loan sizes in period 1, by treatment. Figure 2B displays the average default probability of loans over time, by treatment. In Figure 2B the number of loans in each group is displayed at the top of the graph. The average default probability is calculated at the matching group level.

Figure 2A. Default probability by loan size in period 1

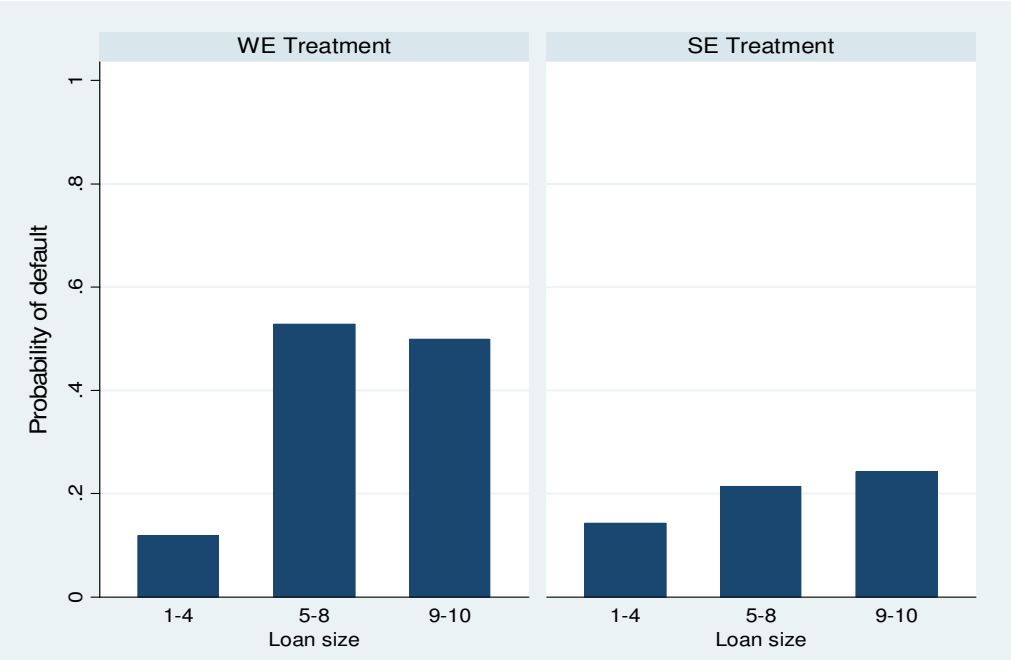


Figure 2B. Default probability by period

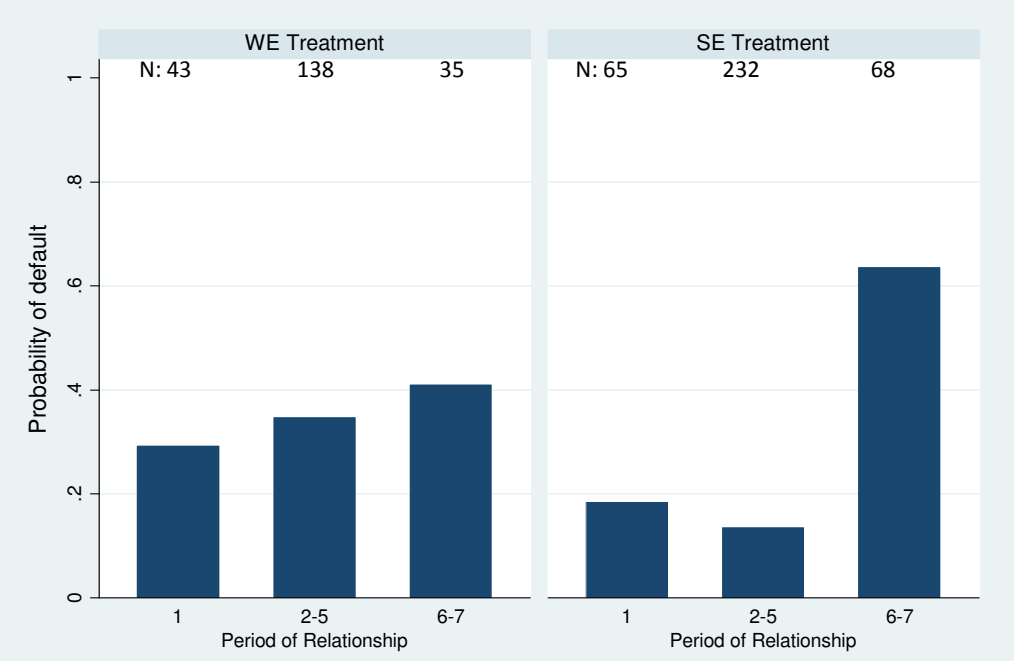


Figure 3. Contract renewal by treatment

Figure 3 displays the probability that lenders renew loan contracts, i.e. offer a positive loan size, for periods 2 to 7. This probability is displayed for two cases: if the borrower defaulted in previous periods (past default) and if the borrower did not default in previous periods (No past default) for each treatment separately

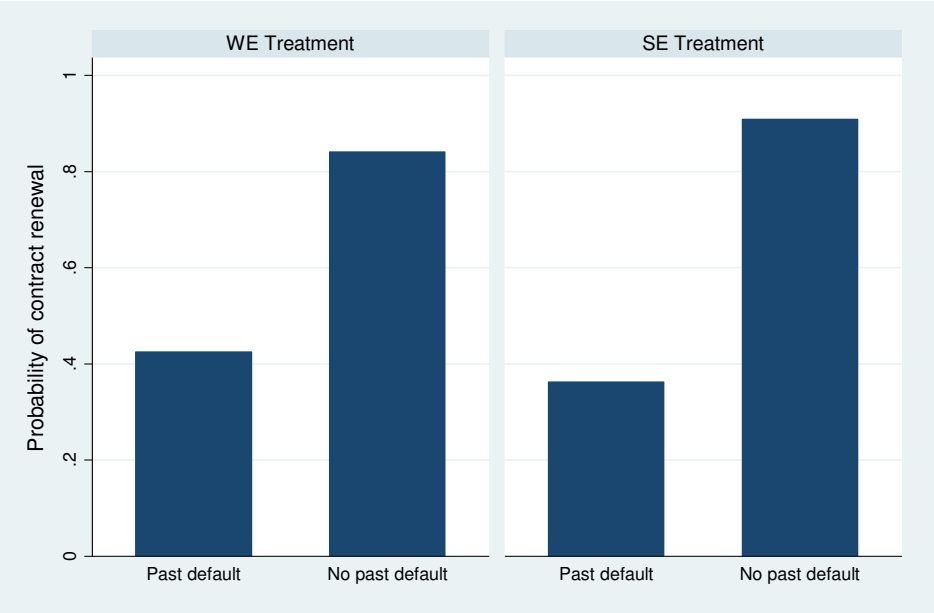


Figure 4. Relationships without default

Figure 4A displays the mean *Loan size* offered by treatment and period in no default relationships (classified as in Figure 3). For period 1 we report the mean loan size and interest rate across all offers. Figure 4B considers only those no default relationships which are "active", i.e. those *relationships* in which the lender always offered a strictly positive loan size.

Figure 4A. Loan size in relationships without default

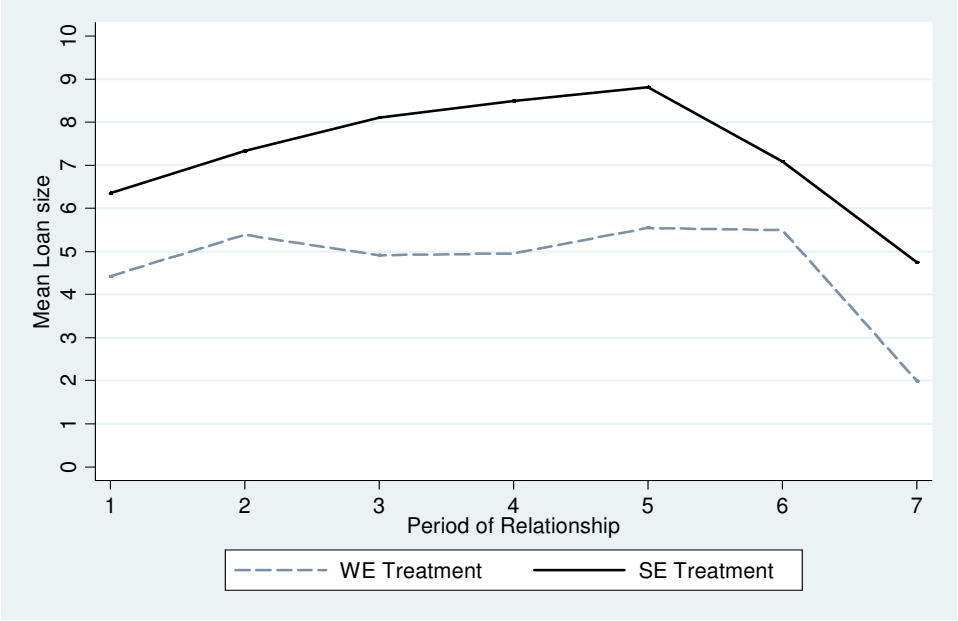
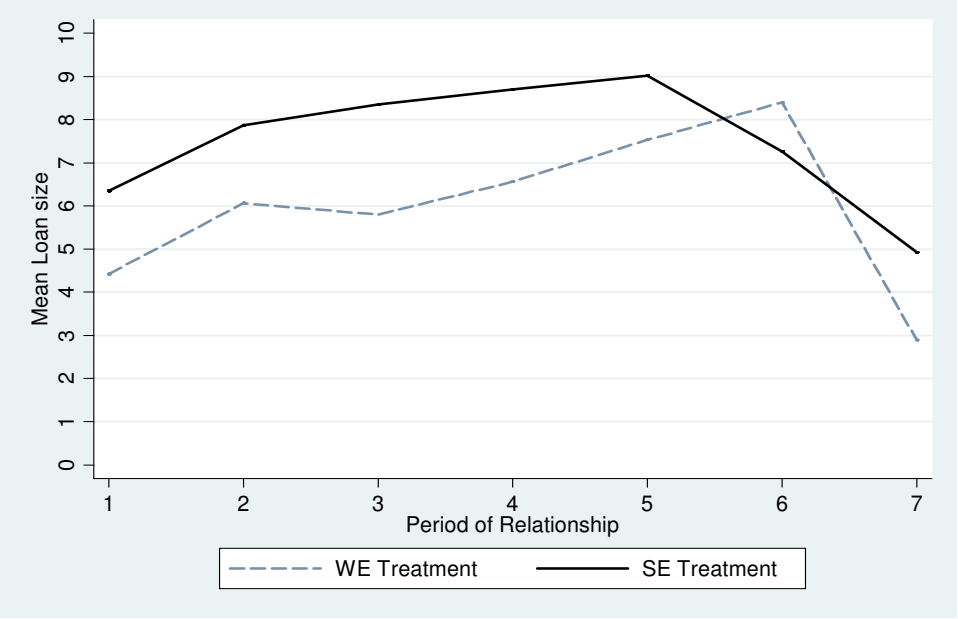


Figure 4B. Loan size in "active" relationships without default



Debt Enforcement and Relational Contracting

Supplementary Appendices

Appendix A. Behavior in Pre-experiment Games

Table A1 summarizes the behavior of our subjects in the three pre-experiment games described in section 2.3. The table shows that there is no significant difference in pre-experiment game behavior between the WE and SE treatments.

Table A1. Behavior in pre-experiment games in the WE and SE treatments.

Treatment	WE					SE					T-test WE vs. SE
	Obs	Mean	Std.	Min	Max	Obs	Mean	Std.	Min	Max	Pr(|T| > |t|)
Risk aversion	42	5.9	2.0	0	11	48	6.1	1.5	3	10	0.54
Strategic Reasoning	42	71.7	16.1	20	97	48	71.8	12.1	40	94	0.98
Trust	42	5.8	3.2	0	10	48	5.1	3.6	0	10	0.32
Trustworthiness	42	19.5	13.6	0	46	48	18.6	13.1	0	44	0.76

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.

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.

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.

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 debt enforcement (or strong enforcement case), the capital of the borrower is $C_t = 0$ in all periods. Second, in the lending game with weak enforcement, 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 enforcement. 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 enforcement 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 enforcement 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

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

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 enforcement. 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 enforcement

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 enforcement the profit-maximizing reputation equilibrium for the lender is characterized by offers* $(S_t, i_t) = (10, \bar{r})$ if $t \leq 6$ and $(S_7, i_7) = \left(10\frac{\bar{r}}{v}, \bar{r}\right)$. *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 [$\text{IC}_{\text{L, SE}}$] 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 $(S_7, i_7) = \left(10\frac{\bar{r}}{v}, \bar{r}\right)$, 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 $S_{T-1}\left(\left(\bar{p} + \gamma_6(1-\bar{p})\right) i_{T-1} - 1\right)$ 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 enforcement, 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 enforcement 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 [$\text{IC}_{\text{L, SE}}$].

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 enforcement

Given the above parameters a **reputation equilibrium** exists in the lending game with weak enforcement. In contrast to the strong enforcement 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 enforcement: 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 enforcement 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 [$\text{IC}_{L,\text{ WE}}$] 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 enforcement, 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 [$\text{IC}_{L,\text{ WE}}$]. 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 enforcement a **separating equilibrium** exists in which L borrowers default with certainty in period 1.

Proposition 4: *In the lending game with weak enforcement 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 Enforcement	Weak Enforcement
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	6.666667	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 Enforcement Treatment and **SE:** Strong Enforcement 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

l

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					

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95/2	*El tamaño de la empresa y la remuneración de los máximos directivos* Pedro Ortín Ángel
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