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Working Paper 23.03

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Moral Constraints, Social Norm Enforcement and Strategic Default in Weak and Strong Economic Conditions*

Martin Brown† Jan Schmitz‡ Christian Zehnder§

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Abstract

We report data from a laboratory experiment studying the behavioral mechanisms which contribute to the increase in strategic defaults during an economic crisis. In our experiment, subjects can default on an outstanding loan, but moral constraints and social norm enforcement may provide incentives to repay. We exogenously vary the state of the economy: In the weak economy more borrowers are forced to default than in the strong. Our data reveal two main effects of an economic contraction: First, weak economic conditions seem to soften moral constraints as solvent debtors strategically default more often. Second, weak economic conditions undermine social norm enforcement. The decrease in norm enforcement, however, is not caused by a break-down of the repayment norm itself, but rather is a consequence of the additional informational uncertainty in weak economic conditions. In a weak economy peers are reluctant to sanction, because the risk of harming innocent debtors is higher.

Keywords: Strategic Default, Moral Constraints, Social Norms
JEL codes: G01, C91, D91, G41

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†Study center Gerzensee, Dorfstrasse 2, CH-3115 Gerzensee, martin.brown@szgerzensee.ch.
‡Radboud University, Heyendaalseweg 141, NL-6525AJ Nijmegen, jan.schmitz@ru.nl.
§University of Lausanne, UNIL-Dorigny, Internef 612, CH-1015 Lausanne, christian.zehnder@unil.ch.

1 Introduction

Consumers and entrepreneurs regularly face decisions to settle their financial obligations or to default on due payments; e.g., loan repayments, supplier invoices, or tax bills. Strategic defaults are instances in which a debtor chooses not to make a due payment, although he or she has the financial means to do so. Strategic defaults not only impose a loss on the creditor, but often also create negative pecuniary externalities for other economic agents. Joint-liability contracts in microfinance, for example, imply that delinquencies within a lending group may limit future access to credit for the whole group of borrowers (Besley and Coate, 1995; Morduch, 1999). Similarly, in the U.S. mortgage crisis high delinquency and foreclosure rates were associated with substantial price declines for owners of nearby properties due to both an increase in local housing supply as well as to the disamenity of being located close to ill-maintained property (Anenberg and Kung, 2014; Hartley, 2014; Seiler et al., 2011). Beyond credit markets, tax evasion can also be considered as a form of strategic default on a financial obligation which imposes costs on the broader society as it undermines the provision of public goods (Luttmer and Singhal, 2014; Slemrod, 2007).

The social externalities of debtors' repayment and individuals' tax payment decisions imply that strategic defaults may trigger moral constraints. Abbink et al. (2006), for example, explore behavior in group-lending contracts and observe that group solidarity induces many borrowers to repay their loans although strategic defaulting would be the individually optimal strategy. Survey data reported by Guiso et al. (2013) shows that 82% of U.S. households consider it morally wrong to strategically default on a residential mortgage.[1] Moreover, Bott et al. (2019) and Hallsworth et al. (2017), for example, show that moral appeals and reminders about externalities increase payment rates for overdue tax. These findings mirror the common insight in the social-preferences literature that many people exhibit feelings of guilt when enriching themselves at the expense of others (Dufwenberg and Gneezy, 2000; Battigalli and Dufwenberg, 2007). Moral concerns may therefore translate into psychological cost which motivate debtors to repay even if a strategic default would be in their narrow economic interest.

Moreover, the presence of moral concerns in the population may also directly affect material incentives. A wide body of evidence documents that many individuals are willing to enforce social norms by sanctioning others who deliberately impose social costs on a community (see, e.g., Fehr and Fischbacher, 2004; De Quervain et al., 2004).

[1] The 2010 Fannie Mae National Housing Survey reports similar results: 9 out of 10 Americans deem it unacceptable to stop making payments on underwater mortgages. http://www.fanniemae.com/resources/file/research/housingsurvey/pdf/Housing-Survey-Fact-Sheet-040610.pdf

Thus, if a large part of the population considers strategic default to be immoral, even debtors without personal moral constraints may refrain from defaulting to avoid the social costs and stigma associated with defying the norm that debts should be paid (Fay et al., 2002; Gross and Souleles, 2002; De Quidt et al., 2016).

The force of individual moral cost and social norm enforcement in deterring strategic defaults may crucially depend on the underlying economic conditions. In fact, survey evidence by Guiso et al. (2013) indicates that during the 2007-2009 crisis a change in attitudes towards strategic defaults may have importantly contributed to the observed increase in strategic mortgage defaults.[2] A shift in the perceived morality of strategic defaults may affect the willingness to repay loans in two ways. First, there is a direct effect in that debtors intrinsic motivation to repay is undermined: debtors may feel less obliged to repay if many others around them do not repay either (weaker moral constraints). Second, there may be an indirect effect affecting debtors' extrinsic motivation to repay: debtors may no longer expect to be ostracized by their peers if they default (weaker enforcement of social norms).

In this paper we use experimental methods to shed light on the behavioral channels underlying the increase in strategic defaults in an economic contraction. Our laboratory environment offers several important advantages as compared to existing studies based on observational and survey data: First, we can perfectly distinguish strategic and forced defaults in our data. In field studies such a distinction is usually not possible, because strategic defaulters tend to disguise themselves as insolvent debtors. Second, the implementation of an explicit third party sanctioning technology in our game allows us to directly measure the extent to which social norms are enforced by independent peers. Such a measure is absent in all previous studies on the topic that we know of. Third and most importantly, our design allows us to exogenously manipulate the economic environment and to directly observe the causal impact of weak and strong economic conditions on strategic defaults and norm enforcement.

We concentrate on studying repayment decisions driven by moral constraints and social norm enforcement triggered by the negative impact of strategic defaults on society. We abstain from including reciprocal lender–borrower relationships and implement

[2]Overall, the delinquency rate on US residential mortgages increased from roughly 2% in the period 2000-2006 to more than 10% in the period 2009-2011. It is undisputed that mortgage defaults were to a large extent triggered by the illiquidity of households (Elul et al., 2010). However, existing evidence also points to a substantial share of strategic mortgage defaults: Households walked away from homes in which they had negative equity due to the significant collapse of house prices (Demyanyk and Van Hemert, 2011; Ghent and Kudlyak, 2011). The data collected by Guiso et al. (2013) suggests that at least one-third of the mortgage defaults during the period 2008-2010 were strategic. Moreover, evidence by Towe and Lawley (2013), Bradley et al. (2015) and Gupta (2019) shows that the contagion of defaults in local mortgage markets goes well beyond what one could expect due to immediate price effects.

a stochastic prisoner's dilemma game which mirrors a debtor's repayment decision because of moral constraints or social norm enforcement in a stylized and simplified way: Two players (borrowers) play a prisoner's dilemma game in which they either cooperate (repay) or defect (default). Repaying a loan is costly for the individual player, while defaulting has negative consequences for the paired partner (reflecting the negative externality of defaults imposed on surrounding borrowers and society). In our experiment the ability of the borrowers to cooperate is stochastic: with a probability γ they have an income so that they can choose to repay or (strategically) default. With a probability $1-\gamma$ they have no income so that they are forced to default. In some of our treatments we add a third-party enforcer to the game. The third player sees the outcome of the prisoner's dilemma game and has the possibility to sanction one or both borrowers (at a personal cost).

To study the behavioral determinants of strategic default across economic conditions, we exogenously manipulate the frequency of forced defaults in the economy across treatments, i.e., we vary the probability $1-\gamma$ with which a borrower cannot make a repayment. We study treatments with and without third-party enforcers. In addition, we also vary the information that enforcers have about borrowers' personal economic situation. Specifically, we vary whether or not enforcers can distinguish strategic from forced defaults. This yields a simple 2x3 design (strong vs. weak economy fully crossed with no enforcers, partially informed enforcers, and fully informed enforcers). Together our six treatments allow us to i) identify the extent to which adverse economic conditions undermine the role of moral constraints in preventing strategic default, ii) to disentangle the effect of weak economic conditions on individual moral constraints from that on social norm enforcement, and iii) to separate the different channels through which an economic downturn may weaken the enforcement of social norms by peers.

Our data confirm that in the absence of third-party enforcers strategic default substantially increase in weak economic conditions. In the weak economy the strategic default rate increases by 23 percent relative to the strong economy. These findings are in line with the hypothesis that moral concerns are less likely to mitigate strategic default once bad economic conditions force others to default. Our results also back up the claim that the state of the economy has a substantial impact on norm enforcement by peers. In the treatments with partially informed enforcers, the third-party sanctions of defaulters decline substantially when the economy moves from the strong to the weak state. This decrease in the intensity of norm enforcement may be the result of two distinct effects. On one hand, partially informed enforcers in the weak economy may be more reluctant to sanction, because the higher frequency of forced defaults makes it harder to distinguish strategic from forced defaults. On the other hand, it is also possible

that the repayment norm itself breaks down if the economic conditions are weak, i.e., that enforcers find strategic defaults more acceptable under weak economic conditions than under strong conditions. Our treatment with fully informed enforcers allows us to disentangle the relative importance of these two channels. Our findings suggest that weak economic conditions do not lead to a break-down of the repayment norms per se, but rather create informational uncertainty that makes it more difficult to enforce the norm.

We contribute primarily to the literature which examines the role of moral concerns and peer sanctions in enforcing debt repayment. Existing studies convincingly document the relevance of individual moral constraints as a motivator to repay. For example, Karlan (2005) documents that a laboratory measure of individual trustworthiness predicts repayment of real-life microfinance loans. Bursztyn et al. (2019) and Karlan et al. (2015) show that interventions at the individual level can further strengthen the role of moral constraints. They apply moral suasion (text-messages with either religious or relationship-enhancing content) in a field experiment and show that this increases debt repayment. Fisman et al. (2017) find that cultural proximity between lenders and borrowers increases the quantity of credit and reduces default. There is also supportive evidence for the importance of peer effects. Examples include Ahlin and Townsend (2007) who provide evidence that social sanctions encourage repayment of loans in rural Thailand; or Breza (2012) who documents that peer effects play an important role in fostering loan repayment even when all contracts feature individual liability.[3] None of the existing work has studied how changes in the economic environment affect the role of moral and social motivators. We expand upon this literature by exploring how different economic conditions impact the efficacy of moral constraints and social norm enforcement in deterring strategic defaults.[4]

Our findings also relate to the literature studying tax evasion. Evading taxes in its essence is a decision to strategically default on tax obligations and evaders impose substantial negative externalities on others (Allingham and Sandmo, 1972; Alm and Torgler, 2011; Dörrenberg and Schmitz, 2017; Dwenger et al., 2016; Fellner et al., 2013;

[3]Some evidence suggests that the relevance of social sanctions also depends on the details of the environment and the availability of other social motivators. Wydick (1999), for example, show that social cohesion rather than social pressure fosters repayment in joint-liability contracts and Giné and Karlan (2014) document that (relative to individual liability contracts) the potential additional peer-effects of joint-liability contracts hardly impact on loan repayment.

[4]We also contribute to the literature which uses laboratory experiments to study the behavioral determinants of credit market outcomes. So far, this literature has predominantly focused on the interplay between the institutional environment and dynamic incentives to repay. Previous studies have examined the presence of credit registries (Brown and Zehnder, 2007), the strengths of legal contract enforcement (Fehr and Zehnder, 2009) or the ability to exclude misbehaving borrowers from the current source of income (Brown and Serra-Garcia, 2016).

Holz et al., 2020; Kirchgaessner, 2010; Tyler, 2006).[5] While most of the existing literature studies tax evasion in static economic environments (see, e.g., Slemrod, 2019, for a review) our experiment sheds light on variation in tax evasion across economic conditions. Our results indicate that downward economic shocks leading to weak economic conditions may have a significant and negative influence on tax morale, i.e., evasion rates may be substantially higher when the economic conditions are weak. In addition, the results of our enforcer treatments emphasize the importance of information transparency in the context of peer sanctions. These findings are related to the emerging literature demonstrating that ostracizing tax evaders through shaming affects tax honesty (Dwenger and Treber, 2018; Perez-Truglia and Troiano, 2018) and reinforce the finding that public disclosure of taxable income has deterring effects on evasion (Bø et al., 2015). Our evidence therefore suggests that transparency with regard to taxpayers' income may substantially mitigate the negative impact of weak economic conditions on tax returns, because informed peers are more prone to enforce repayment norms under adverse economic conditions.

We further contribute to the extant literature studying cooperation in social dilemma situations (see, e.g., Camerer, 2003; Chaudhuri, 2011; Ledyard, 1995, for reviews of the literature). While the previous literature on stochastic prisoner's dilemmas concentrates on learning (Bereby-Meyer and Roth, 2006) and punishment strategies (Kunreuther et al., 2009; Fudenberg et al., 2012; Xiao and Kunreuther, 2016) in repeated two-player relations, our study focuses on third party interventions in a series of one-shot interactions with changing partners. By exogenously varying both the probabilistic nature of the environment and the extent to which social norms can be enforced by peers, we are able to show that third-parties' willingness to engage in norm enforcement strongly depends on their information, but is largely independent of the players' ability to hide their defection behind stochastic events. This finding is important, because it implies that the degree to which the cooperation enhancing property of third-party norm enforcement identified in deterministic setups (Charness et al., 2008) generalizes to stochastic environments crucially depends on the information structure in the situation of interest.

Our findings also contribute to the split literature from behavioral economics on moral wiggle room situations. This literature shows that in some situations individuals may behave more selfishly when the other party is not (fully) informed about the behavior (see, e.g., Dana et al., 2007; Regner, 2018). Yet, there is also literature showing that this is not always the case (see, e.g., Van der Weele et al., 2014). This literature further shows that individuals directly affected by non-coorperative outcomes show a high

[5] According to the European Commission, tax evasion and tax fraud cause an estimated deficit of up to 1 trillion Euro per year (http://ec.europa.eu/taxation_customs/taxation/tax_fraud_evasion/a_huge_problem/index_en.htm).

propensity to punish potential defectors even if there is reasonable uncertainty about the behavior of others (Ambrus and Greiner, 2012; Grechenig et al., 2010). Our findings complement this literature in showing that weak economic conditions entailing moral wiggle room like features (i.e., uncertainty about whether or not behavior was selfish) impact both, moral constraints and social norm enforcement.

The remainder of the paper is organized as follows: In Section 2 we explain and discuss the design of the experiment. Section 3 contains a theoretical analysis of the environment and presents the testable hypotheses. In Section 4 we report our results. Section 5 concludes.

2 Experiment Design and Procedures

Our objective is to identify how moral constraints of strategic default and the enforcement of social norms of repayment are affected by adverse economic conditions. To do this we implement an experimental design which isolates moral constraints and social norm enforcement from other factors. Our experimental game has three key ingredients: (i) An underlying game which captures the negative social externalities of individual defaults, (ii) a game which provides direct measures for the enforcement of social norms to repay and (iii) a game which allows us to vary the underlying economic conditions exogenously. Our experiment builds on a stochastic prisoner's dilemma game with third party punishment. In this section, we first present the details of our design and then discuss the reasons for this design choice.

2.1 Stochastic Prisoner's Dilemma Game

We implement a prisoner's dilemma game in which the ability of each player to cooperate is stochastically determined. Our game is framed in the personal credit context: Both players are borrowers who have an illiquid endowment of 200 points and an outstanding loan of 100 points. Nature determines – independently for each borrower – if the borrower can repay her loan: With probability γ the borrower has an income of 200 points. With probability $1-\gamma$ the borrower has no income.[6] Borrowers only observe their own income, but not the income of the other borrower in the game.

[6]To rule out doubts about randomness, borrowers' incomes were determined by a public roll of a 10–sided dice. Before the dice was rolled, we displayed on each subject's screen the numbers one to ten and the corresponding income (0 points or 200 points) for each number. The assignment of incomes to possible dice outcomes was individually different. The dice was rolled and the resulting number was publicly announced by the experimenter. Subsequently, the realized number and the participant's income appeared on the screen.

Table 1: Prisoner's Dilemma Payoffs

			Borrower 1		
			Inc. 200		Inc. 0
			Repay	Strategic Default	Forced Default
Borrower 2	Inc. 200	Repay	300,300	150,400	150,200
		Strategic Default	400,150	250,250	250,50
	Inc. 0	Forced Default	200,150	50,250	50,50

Notes: The dashed box displays payoffs if both borrowers receive an income of 200 points and can make a repayment decision. If both repay, their payoff results in 300 points. Repayment if the other borrower strategically defaults yields a payoff of 150. Strategic default if the other borrower repays yields the highest income of 400 points. The payoffs under and to the right of the dashed line result if one or both borrowers are forced to default. Repayment if the other borrower is forced to default yields 150 points. Forced default if the other borrower repays yields a profit of 200. If one borrower strategically defaults and the other borrower is forced to default the strategically defaulting borrower secures 250 points and the forced defaulting borrower earns 50 points. If both borrowers are forced to default, each one of them receives 50 points.

Borrowers with an income of zero cannot repay their debt and are therefore forced to default. In this case, the borrower keeps her illiquid endowment of 200 points. Borrowers with an income of 200 points decide whether to repay their loan or to default strategically. If a borrower repays the loan, the payment (100 points) is deducted from her income (200 points), leaving a net income of 100 points. In addition the borrower keeps her illiquid endowment, so that she ends up with a total of 300 points. If the borrower defaults strategically she retains her income of 200 points plus her illiquid endowment of 200 points, so that she realizes a total payoff of 400 points.

The symmetric illiquid endowment of 200 points constitutes a baseline utility which is not affected as long the other borrower repays her loan. However, if the other borrower does not repay her loan (because of forced or strategic default), the borrower's endowment is reduced by 150 points, to 50 points. This reduction captures the negative externality of defaults on other borrowers (and society) in a stylized and simplified way. Our parameter choice implies that strategic defaults are welfare-decreasing. The monetary gain from strategic default (100 points) is 50 points lower than the social cost imposed on the other borrower (150 points).[7]

Table 1 illustrates the game. As the social cost of a default outweighs the private benefit of a strategic default the efficient outcome of the game is achieved if both players choose to repay (conditional on having an income). The unique Nash-equilibrium of the game is, however, to strategically default (conditional on having an income).

[7]Our experimental game consciously abstracts from the consequences of the borrower's repayment decision on the lender's profit. We discuss the reasons for this design decision in section 2.4.

In some of our treatments we add a third player – an enforcer – to the game. Enforcers do not face monetary consequences from borrowers' behavior. Their payoffs are not affected by the decisions of the two borrowers. They simply observe whether a borrower repays or not and can then decide whether or not to impose a costly sanction on the borrower. Enforcers are endowed with 300 points at the beginning of the game.[8] They have access to a costly punishment technology that allows them to reduce the income of one or both borrowers. Deducting points is possible in steps of 10 points. Reducing a borrower's payoff by 10 points is associated with a cost of 1 point for the enforcer.[9] We vary whether enforcers can observe borrowers' incomes (and thereby infer whether defaults were strategic or forced) or not across treatments. The presence of enforcers allows us to explore the role of norm enforcement in the form of punishment by peers and to study how the information situation affects the efficacy of such a mechanism.

2.2 Treatments

To identify the impact of weak and strong economic conditions on strategic defaults and norm enforcement we exogenously vary two dimensions separately. First, we manipulate the state of the economy by changing the probability with which borrowers have a positive income. Second, we vary the extent to which enforcers can draw inferences about borrowers' choices from observed outcomes.

We first describe the three information conditions implemented in the experiment:

No Enforcer Conditions

In our no enforcer conditions, third parties are absent, so that social norm enforcement plays no role. The only force that can prevent borrowers from engaging in strategic default are individual moral constraints. Moral constraints capture the idea that a borrower feels bad if she does not repay a loan although she has the income to do so.

Enforcer with Partial Information Conditions

In our partial information conditions the outcome of the prisoner's dilemma is observed by an enforcer who has not participated in the prisoner's dilemma game. Enforcers only have partial information, i.e, they observe whether a borrower has repaid or not repaid her loan, but they do not know the borrower's income. Accordingly, enforcers cannot distinguish between a forced default and a strategic default.

Enforcer with Full Information Conditions

[8] An endowment of 300 points for enforcers implies that in the event of full repayment and no punishment the two borrowers and the enforcers have the same income. This avoids sanctions driven by inequality-aversion in those situations.

[9] Punishment is rather inexpensive to ensure that sufficiently many subjects make use of the punishment option. We are not interested in the level of punishment per se but rather in the difference in punishment decisions across economic states and information conditions.

Full information conditions are identical to partial information conditions except that enforcers are fully informed about the nature of a default. Enforcers get to know incomes and choices of borrowers and can therefore unambiguously differentiate between forced defaults and strategic defaults.

For each information condition, we implement two separate states of the economy:

Weak Economy Conditions (WE)
In the weak economy conditions the probability of a borrower having an income of 200 points is 50%. With a counter probability of 50% borrowers have no income and are forced to default on their loan.

Strong Economy Conditions (SE)
In the strong economy conditions the probability of a borrower having an income of 200 points is 90%, so that the probability that a borrower is forced to default is only 10%.

Fully crossing our three information conditions with the two possible states of the economy yields six different treatments in a 3x2 design. We implement these six treatments in a between-subject design, i.e., each subject participates in only one of the treatments. Table 2 presents an overview of the treatments.

Table 2: Treatment Overview

	No enforcer	Enforcer with partial information	Enforcer with full information
Weak economy	WE no enforcer	WE partial info	WE full info
Strong economy	SE no enforcer	SE partial info	SE full info

Notes: Weak economy: probability of forced default $(1-\gamma) = 0.5$. Strong economy: probability of forced default $(1-\gamma) = 0.1$. No enforcer stands for treatments without impartial 3rd parties. Enforcer with partial information: Enforcers receive information about default but not about the nature (forced or strategic) of the default. Enforcer with full information: Enforcers observe defaults and incomes of borrowers and can distinguish strategic from forced defaults.

2.3 Procedures and Data

Each of our experimental sessions lasts for 20 identical periods. We allocate subjects to matching groups. In the no enforcer conditions, all participants are in the role of borrowers and there are 8 subjects in each matching group. In these conditions participants within a matching group are randomly re-matched into four separate borrower-pairs at the beginning of each period. In the partial information and full information conditions

participants are either in the role of a borrower or in the role of an enforcer. Roles are assigned in the beginning of the session and remain constant throughout all periods of the experiment. Matching groups consist of 12 subjects, eight of whom are borrowers and four of whom are enforcers. In these conditions two borrowers and one enforcer are randomly re-matched in four groups of three players at the beginning of each period.

At the end of each period borrowers and enforcers receive information about the number of points they earned in that period. Borrowers only receive information about their own income, so that they cannot infer the income of the other borrower from the payoff information. Each subject also receives aggregate information regarding the behavior of all subjects in his or her matching group. This information differs depending on the information structure of the treatment: In the no enforcer conditions the post period information summarizes: i) the number of borrowers in a borrowers' matching group who could repay their loan and repaid, ii) the number of borrowers within a matching group who could repay their loan and did not repay and, iii) the number of borrowers within a matching group who did not have an income. In the partial information conditions participants receive the same information as in the no enforcer conditions and are additionally informed about: iv) the average number of punishment points assigned to defaulters in their matching group, and v) the average number of punishment points assigned to borrowers who repay loans in their matching group. Participants in the full information conditions are shown the same post period information as the ones in the partial information condition except for the fact that there is separate information on: iv.a) the average number of punishment points assigned to strategic defaulters in their matching group, and iv.b) the average number of punishment points assigned to forced defaulters in their matching group.[10]

The experiment was programmed in z-Tree (Fischbacher, 2007) and conducted at the University of Hamburg Experimental Laboratory between April and July 2014. Subjects were undergraduate and graduate students from various disciplines of the University of Hamburg. The University of Hamburg uses the HROOT software by Bock et al. (2014) to recruit subjects and has a strict no deception policy. No restrictions on the recruitment of subjects were made. A session lasted about 90 minutes and included two to three matching groups (16 - 24 subjects). Before an experimental session was started each subject had to read a detailed set of instructions which explained the experiment in detail. [11] At the end of the instructions there was a set of exercises in

[10]In principle, it would have been possible to provide the same information in partial and full information conditions. However, we decided not to give separate punishment information for forced and strategic defaults in partial information conditions, because any difference between these two numbers would have been random (as enforcers could not distinguish between the two cases when they assigned punishment points) and could have misled participants to false conclusions.

[11]See Appendix E for an English translation of the originally German instructions.

which participants had to execute a series of payoff calculations for different scenarios that could potentially have arisen during the experiment. The experiment was not started before each subject had correctly understood the game and consequences from their and the other subjects' actions and solved all exercises. All subjects were thus aware of the γ parameter determining the economic condition in their matching group (0.5 or 0.1) and the consequences of each possible choice in the experiment at the beginning of their session.

Two out of the 20 periods were randomly chosen for payment. We converted experimental points to Euro at an exchange rate of 100 points = 2.5 Euro. Subjects received a fixed show-up fee of 5 Euro. On average subjects received a payment of EUR 15.78.[12] Between the end of the experiment and the payment phase, subjects had to complete a post-experimental questionnaire in which we elicited demographics.

2.4 Discussion of the Experiment Design

Our aim is to study the role of moral constraints and social norms in mitigating strategic defaults across economic conditions. A default by a debtor may impose two types of costs: First, the lender suffers a financial loss proportionate to the private benefit of the defaulting borrower. The lender's loss will depend on the outstanding loan amount and the amount potentially recovered through bankruptcy or foreclosure proceedings.[13] Second, a default may impose costs on outsiders to the contract. In joint-liability microfinance, a delinquency shifts the burden of repayment to other borrowers and may also jeopardize future credit access for a whole group of borrowers (Besley and Coate, 1995). In mortgage lending, for example, foreclosures associated with defaults may trigger substantial price declines for owners of nearby properties (Anenberg and Kung, 2014; Hartley, 2014). In addition, existing and potential borrowers may face a reduced supply of local credit (Gupta, 2019).

The costs suffered by the lender and/or other third parties will give rise to moral constraints so that many borrowers will refrain from defaulting strategically even if repaying goes against their personal financial interests. Moreover, as a default imposes negative externalities on others, strategically defaulting households may be confronted with social costs and stigma (Fay et al., 2002; Gross and Souleles, 2002). In particular, since strategic defaulters violate the repayment norm, they may be subjects to various

[12] The average hourly wage of a student subject in Germany is about EUR 10.

[13] In credit markets the loss to the lender will typically exceed the private benefit to the borrower due to the substantial costs of the loan recovery process. The World Bank "Doing Business" database documents that the recovery rate on a private claim secured by a mortgage is on average 72% in OECD economies while the resolvement of the claim through a bankruptcy process takes on average 1.7 years. See http://www.doingbusiness.org/data/exploretopics/resolving-insolvency for details.

sanctions by peers who see it as their duty to enforce the norm.

In this experiment we focus on externalities of strategic defaults on parties outside of the contract and we consciously abstract from the impact of defaults on creditors. Several papers already study the effects of opportunistic borrower behavior on credit relationships between borrowers and lenders. For example, Brown and Zehnder (2007) and Brown et al. (2018) provide an experimental analysis of reciprocity in trust-games which capture the pure interaction between a lender and borrower.[14] Fehr and Rockenbach (2003) and Charness et al. (2008) study the role of social norms in such a setting. Our study, in contrast, is interested in isolating the impact of the state of the economy on moral concerns of borrowers and norm enforcement by peers. The presence of a creditor would make it difficult, for example, to disentangle whether repayment decisions are driven by reciprocity concerns (i.e., because a borrower received a credit from a lender), or by moral concerns (i.e., the moral cost caused by imposing economic damage form strategic default on surrounding borrowers and society). Consequently, we do not implement a lender in our experimental conditions (put differently: we normalized the cost from credit default for the lender to zero in our experiment). This eliminates borrowers' concerns for reciprocity or reputation towards the lender when making repayment decisions and ensures that our between treatment comparisons on moral behavior and social norms remain valid and at the center of our study.

The prisoner's dilemma underlying our experiment captures the negative externality of strategic defaults in a simple and parsimonious way: the social cost of a default is imposed directly on the other player and reduces her income by 150 points. In reality the negative externality of a strategic default by one borrower may be spread out over a larger number of other consumers. Evidence from public goods experiments highlights that cooperation is independent from group size if the benefit from cooperation is held constant (Isaac and Walker, 1988; Isaac et al., 1994). Our approach minimizes group size to facilitate the game and to increase the salience of the social cost to subjects.

An inherent feature of our prisoners' dilemma game is that subjects do not have to surrender their endowment in the case of default. This feature of the game may seem at odds with the fact that in reality defaulting debtors may have to hand over assets to creditors. Bank loans are often collateralized. Moreover, even if a claim is unsecured, creditors may seize assets of a defaulting debtor during a bankruptcy process (Ghent and Kudlyak, 2011). The way to interpret the outstanding "debt" of 100 in our experiment is thus that it is the amount by which the claim of the creditor exceeds the value of assets which the creditor can seize as collateral or through bankruptcy. The endowment

[14] In Brown et al. (2018) we study the bilateral lender-borrower relationship in the presence of uncertainty about forced or strategic defaults (as well as in presence and absence of borrower communication).

can therefore be interpreted as the value of non-pledged assets or assets exempt from bankruptcy.

An important feature of our design is the uncertainty in the prisoner's dilemma game: Borrowers are unable to repay with an exogenous probability $(1 - \gamma)$. Importantly, the ability to repay is private information so that forced and strategic defaults cannot be distinguished by the other borrower. Stochastic prisoner's dilemmas have been experimentally investigated before (see, e.g., Bereby-Meyer and Roth, 2006; Kunreuther et al., 2009; Xiao and Kunreuther, 2016; Fudenberg et al., 2012). However, existing experiments are mainly concerned with the identification of strategy selection and learning procedures in repeated two-player games. Our study, in contrast, focuses on moral constraints and third-party norm enforcement in repeated one-shot interactions with changing partners. Our design allows us to vary the state of the economy in a simple and transparent way and introduces the realistic feature that borrowers can hide their opportunistic actions behind potential economic hardship. This element distinguishes our design from the previous literature on stochastic prisoner's dilemmas.

We vary the information that enforcers in our experiment receive about the borrower's actions. This variation allows us to explore under which informational conditions the social norms to repay are more or less likely to collapse in economic downturns. In the partial information conditions enforcers can only infer from the underlying probability of forced defaults, whether or not an observed default was strategic in nature. In this condition enforcers face the risk of punishing 'innocent' borrowers who had to default. In the full information conditions, in contrast, enforcers are fully aware of the disposable income of defaulting borrowers and can take this information into account when deciding whether to sanction a borrower or not. The comparison of these conditions allows us to explore the role of information for social norm enforcement in a very clean and simple way. In particular, we can disentangle whether adverse economic conditions affects the social norm itself or only the intensity with which the norm is enforced.

3 Predictions and Hypotheses

To provide guidance and structure for our empirical analysis this section develops a set of testable hypotheses. Building on the results of Guiso et al. (2013), we formalize two central assumptions: i) borrowers may consider strategic defaults to be morally wrong and face individual moral (psychological) cost, and ii) violators of the repayment norm may face social costs in the form of peer punishment. It is important to emphasize that our experiment is not designed to test the particular model that we outline in this section against alternative behavioral models. The model is useful, because it provides a

precise intuition for the impact of moral constraints and norm enforcement on behavior in the context of strategic default decisions.

3.1 The Strategic Default Game

We first describe the strategic situation in the no enforcer condition. Consider a game in which a borrower i interacts with another borrower j. Table 3 describes the payoffs associated with all possible strategy combinations in this simultaneous game.

Table 3: Borrower strategies and payoffs

		Borrower j		
		Repay (r)	Strategic Default (s)	Forced Default (f)
Borrower i	Repay (r)	R,R	L,W	L,w
	Strategic Default (s)	W,L	D,D	D,d
	Forced default (f)	w,L	d,D	d,d

Notes: A borrower's payoff depends on his or her own decision, the other borrower's decision and nature (exogenous income assignment). R (300) is the payoff if both borrowers repay. W (400) stands for the payoff from strategic default if the other borrower repays. D (250) is the payoff from strategic default if the other borrower also defaults (strategically or forcedly). L (150) is the payoff from repayment if the other borrower defaults (strategically or forcedly). w (200) and d (50) are the payoffs from forced default depending on whether the other borrower repays or defaults (strategically or forcedly).

The parameters satisfy the following order: $W > R > D > w > L > d > 0$. We use $\Omega = W - R = D - L$ to denote the outstanding repayment and $\Delta = R - L = W - D$ to describe the negative externality of a borrower i's default on borrower j's payoff. The probability that a borrower has sufficient income to repay her loan is denoted by $\gamma \in (0, 1)$. We use γ_{SE} and γ_{WE} to distinguish between the strong economy (SE) and the weak economy (WE), where $\gamma_{SE} > \gamma_{WE}$.

In the partial and full information conditions the game is extended and includes an additional player: the third-party enforcer h. The enforcer receives a fixed endowment E and his or her monetary payoff is not affected by the decisions of the borrowers. However, the enforcer can induce a costly punishment for each of the two borrowers separately. For simplification, we assume that punishing a borrower is a binary decision. Punishment reduces the borrower's payoff by P and imposes a cost $\kappa < P$ on the enforcer.

If borrowers and enforcers are pure payoff-maximizers, the equilibrium of the game is straightforward: In the absence of enforcers, borrowers never repay, because conditional on having a positive income repaying is a strictly dominated strategy for both players ($W > R$ and $D > L$). The presence of enforcers has no impact on equilibrium behavior of borrowers, because self-interested enforcers have a strict incentive not to engage in costly punishment. This equilibrium holds irrespective of the economic conditions (i.e.,

equilibrium behavior is unaffected by γ). The following sections illustrate how moral constraints and social norm enforcement affect the strategic default rate in this game.

3.2 Moral constraints

We first analyze the two-player game underlying the no enforcer condition. Following Guiso et al. (2013) we incorporate the idea that borrowers may perceive strategic default as morally wrong. To capture this non-pecuniary dimension of borrowers' decisions, we assume that strategic defaults are associated with a psychological cost. A borrower's utility function has the following form:

$$U_i = \pi_i(c_i, c_j) - k_i(c_i, c_j),$$

where π_i is borrower i's material payoff, and k_i is the moral cost modeled as a function of borrower i and borrower j's repayment choices $c_i, c_j \in \{r, s, f\}$. If borrower i repays or is forced to default, there is no moral cost: $k_i(r, c_j) = k_i(f, c_j) = 0$. Strategic default, in contrast, triggers a positive moral cost. This cost is the highest if the other borrower repays and lower otherwise: $k_i(s, r) > k_i(s, c_j \in \{s, f\}) > 0$. The latter assumption relates to the finding of Guiso et al. (2013) that borrowers who know of other defaulters are more likely to engage in default themselves. Notice, however, that we consider a simultaneous move game in our setup. Borrower i's repayment choice will therefore not be affected by borrower j's actual choice, but rather by borrower i's belief about borrower j's choice. We therefore capture the intuition that borrowers face weaker moral constraints if they believe that their decision most likely hurts others who are likely to default themselves.

We allow for heterogeneity in the intensity of borrowers' moral concerns by assuming that the moral cost function k_i is borrower specific. For the sake of simplicity, we assume, that the proportional impact of borrower j's choice on borrower i's moral cost is constant so that: $k_i(s, r) = (1 + \lambda)k_i(s, c_j \in \{s, f\}) \equiv (1 + \lambda)k_i$, where $\lambda > 0$. The cost k_i is characterized by a continuously differentiable distribution function $F(\cdot)$ with support $[k_{min}, k_{max}]$, where $0 \geq k_{min} < \frac{\Omega}{1+\lambda}$ and $\Omega < k_{max} < \infty$.

Lemma 1 shows that our assumptions imply the co–existence of three different types of borrower behavior in an environment without third-party enforcers:[15]

Lemma 1 (Types of borrower behavior)**.** *Heterogeneity in moral concerns leads to three different types of borrower behavior (in the absence of enforcers):*

[15] We refer to "types of borrower behavior" rather than "types of borrowers", because the same individual borrowers may change to a different type of behavior once third-party enforcers are present.

- *Type 1: Unconditional repayments*
  Borrowers with strong moral concerns ($k_i > \Omega$) repay whenever they have a positive income, irrespective of the expected repayment behavior of other borrowers.

- *Type 2: Conditional repayments*
  Borrowers with intermediate moral concerns are willing to repay if they have a positive income and believe that there is a sufficiently large probability that other borrowers repay. In particular, a solvent borrower with $k_i \in [\frac{\Omega}{1+\lambda}, \Omega]$ repays if the probability that other solvent borrowers repay is at least equal to $\frac{\Omega - k_i}{\gamma \lambda k_i}$.

- *Type 3: Unconditional defaults*
  Borrowers with weak moral concerns ($k_i < \frac{\Omega}{1+\lambda}$) never repay irrespective of the anticipated repayment probability of other borrowers.

Proof. See Appendix A. □

The intuition behind Lemma 1 is straightforward. For borrowers with moral constraints the decision to engage in strategic default involves a trade-off: on one hand, not settling the outstanding debt increases the financial payoff by Ω; on the other hand, strategic default imposes a psychological $k_i(s, c_j)$ on the borrower. The expected moral cost depends on two factors: i) the intensity of the borrower's moral concerns (k_i), and ii) the borrower's belief about the repayment propensity among the population of fellow borrowers. Suppose that borrowers believe that all borrowers with $k_i > \bar{k}$ repay their loan whenever they can. In this case the probability that borrower j repays is $\gamma(1-F(\bar{k}))$, so that the expected psychological cost amounts to: $\mathbb{E}[k_i(s, c_j)] = (1 + \lambda\gamma(1 - F(\bar{k})))k_i$. Borrowers repay if the cost outweighs the benefit, which yields the following repayment condition:

$$k_i \geq \frac{\Omega}{1 + \lambda\gamma(1 - F(\bar{k}))}.$$

Borrowers with strong moral concerns ($k_i > \Omega$) repay whenever their income allows them to do so (type 1 behavior) even if they believe that other borrowers never repay ($\gamma \to 0$ and/or $\bar{k} \to k_{max}$). Borrowers with weak moral concerns ($k_i < \Omega/(1 + \lambda)$) never repay (type 3 behavior) even if they belief that all other borrowers repay ($\gamma \to 1$ and $\bar{k} \to k_{min}$). Borrowers with intermediate concerns only repay if they are sufficiently convinced that others repay as well (type 2 behavior).

We now turn to the analysis of equilibrium repayment behavior. In equilibrium the marginal borrower (i.e., the borrower with the lowest k_i among the repaying borrowers) must be indifferent between strategic default and repayment. To ensure uniqueness of equilibrium we need to impose a restriction on the distribution $F(\cdot)$. In particular, we need to rule out distributions that concentrate a lot of probability weight on narrow

intervals in the upper part of their support (see Assumption 1 in Appendix A). Such distributions describe borrower populations in which large groups of morally concerned borrowers have nearly identical preferences. Existing evidence in the social preference literature indicates that there typically is wide variety in the extent to which different people care about social motives (see e.g., Fischbacher et al., 2001), so that it seems unlikely that Assumption 1 excludes empirically plausible distributions. Moreover, it is important to emphasize that our assumption does not exclude the arguably relevant case in which a substantial part of the borrowers population is purely (or nearly) self-interested.

Proposition 1 characterizes the equilibrium in the absence of enforcers as a function of the state of the economy (represented by γ, the probability that a borrower's income is sufficient to repay her loan):

Proposition 1 (Repayment without enforcers)**.** *In the absence of enforcers the fraction of repaying borrowers in equilibrium is* $1 - F(k_N^*(\gamma))$*, where* $k_N^*(\gamma)$ *is implicitly defined by the condition:*

$$k_N^* = \frac{\Omega}{1 + \gamma\lambda(1 - F(k_N^*))}.$$

$k_N^*(\gamma)$ *is unique and strictly decreasing in* γ *so that that the fraction of repaying borrowers is strictly higher in the strong economy than in the weak economy:* $k_N^*(\gamma_{SE}) < k_N^*(\gamma_{WE})$*.*

Proof. See Appendix A. □

Proposition 1 formalizes the following intuition: In a weak economy forced defaults become more likely and (conditionally cooperating) borrowers interact more frequently with defaulting borrowers. This reduces the (expected) moral cost of a strategic default, because the negative externality of the default is now more likely to hit other defaulters. The decrease in the (expected) moral cost makes strategic defaults more likely. In equilibrium the negative effect on repayments is further reinforced by the fact that the increase in strategic defaults also motivates conditionally repaying borrowers with stronger moral concerns to refrain from repaying. Thus, in the absence of norm enforcers a negative economic shock unambiguously increases the strategic default rate.

3.3 Social Norm Enforcement

Next we turn to the extended game with third-party enforcers (partial and full information conditions). Guiso et al. (2013) suggest that in communities in which most people perceive strategic default as immoral repaying becomes a social norm. Violators of the norm risk being stigmatized and facing social costs (see also Fay et al., 2002; Gross and

Souleles, 2002, for a discussion). We formalize social costs as direct punishment inflicted on strategically defaulting borrowers by unaffected third-parties. We capture the motive to punish a norm violator by assuming that third-party enforcer h's utility depends on borrower i's repayment decision in the following way:

$$U_h = E_h - q_{hi}(c_i, p_{hi}, \gamma) - p_{hi}\kappa,$$

where E_h is the enforcer's endowment, q_{hi} stands for the enforcer's psychological cost and $p_{hi} \in \{0, 1\}$ is the enforcer's punishment decision regarding borrower i. The psychological cost q_{hi} is equal to zero if the borrower has either not violated the social norm or has been punished for his violation ($q_{hi}(r, 0, \gamma) = q_{hi}(f, 0, \gamma) = q_{hi}(s, 1, \gamma) = 0$) and positive otherwise ($0 < q_{hi}(f, 1, \gamma) = q_{hi}(r, 1, \gamma) < q_{hi}(s, 0, \gamma)$).

The psychological cost function captures the intuition that enforcers experience a utility loss if they either observe a violation of the social norm to repay without sanctioning the borrower for his misbehavior or if they punish a borrower without reason. We allow for the possibility that the disutility caused by an unsanctioned norm violation depends on the state of the economy (γ). This assumption captures the conjecture of Guiso et al. (2013) who argue that an economic downturn may change social norms in that it makes strategic defaults more acceptable ($\frac{\partial q_{hi}(s,0,\gamma)}{\partial \gamma} > 0$). We further hypothesize that the disutility created by an unsanctioned violation of the norm is larger than the one caused by unjustifed punishment.[16] For expositional simplicity, we use the following functional form to model the enforcer's psychological cost: $q_{hi}(f, 1, \gamma) = q_{hi}(r, 1, \gamma) \equiv q_h$ and $q_{hi}(s, 0, \gamma) = \beta(\gamma)q_h$, where $\beta(\gamma) > 1, \forall\gamma$ and $\frac{\partial \beta}{\partial \gamma} \geq 0$. Finally, we assume that q_h is enforcer-specific and characterized by a continuously differentiable distribution function $G(\cdot)$ with support $[q_{min}, q_{max}]$, where $0 \geq q_{min} < \frac{\kappa}{\beta(\gamma_{SE})} < \frac{\kappa}{\beta(\gamma_{WE})} < q_{max}$.

Lemma 2 (Enforcer behavior)**.** *Suppose that all borrowers with $k_i > \bar{k}$ repay whenever they can. An enforcer h punishes a non-repaying borrower i if and only if his belief b_{hi} that the borrower engaged in strategic default satisfies the following condition:*

$$b_{hi} \geq \frac{q_h + \kappa}{(1 + \beta(\gamma))\, q_h}.$$

This condition implies that—for a given belief b_{hi}—the probability that a non-repaying borrower i is punished amounts to

$$\rho(b_{hi}) \equiv Prob(p_{hi} = 1|b_{hi}) = 1 - G\left(\frac{\kappa}{(1 + \beta(\gamma))b_{hi} - 1}\right).$$

[16] Without this assumption enforcers would never punish in the weak economy. If $\gamma = 0.5$, enforcer's belief that a non-repayment is a strategic default is strictly lower than 0.5. If unsanctioned violations and unjustified punishments were equally costly, punishment would never occur. See Lemma 2.

$\rho(b_{hi})$ is strictly increasing in b_{hi}.

Proof. See Appendix A. □

Lemma 2 shows that punishment occurs only if enforcers are sufficiently convinced that a borrower engaged in strategic default. This is intuitive, because utility increases only if the enforcer punishes a borrower who violated the social norm to repay.

Next we consider the impact of an economic downturn on norm enforcement by unaffected, partially informed third parties. Proposition 2 details the impact of an exogenous increase in the forced default rate on punishment decisions of enforcers:

Proposition 2 (Impact of weak and strong economic conditions on norm enforcement)**.** *Compared with the strong economy a weak economy (i.e., an exogenous decrease in γ) undermines norm enforcement by partially informed third parties for two (potential) reasons:*

1. *Less precise information (the information channel)*
   For a given repayment behavior in the borrower population, weak economic conditions decrease the probability with which a partially informed enforcer believes that a non-repaying borrower engaged in strategic default:

$$\frac{\partial b_{hi}}{\partial \gamma} = \frac{F(\bar{k})}{\left[\gamma F(\bar{k}) + (1-\gamma)\right]^2} > 0,$$

   where $\bar{k}$ is the threshold level of the borrowers' moral cost above which borrowers repay when possible. This decrease in the enforcer's belief implies that ceteris paribus the probability that a non-repaying borrower i is punished decreases ($\partial\rho(b_{hi})/\partial\gamma > 0$,), even if the psychological cost of the enforcers is constant across states of the economy ($\partial\beta(\gamma)/\partial\gamma$=0, see Lemma 2).

2. *Weaker social norm (the norm channel)*
   For a given belief $\bar{b}_{hi}$ that a non-repaying borrower i engaged in strategic default, a negative economic shock potentially decreases the probability $\rho(\bar{b}_{hi})$ with which the borrower is punished, because the enforcer's psychological cost may depend on the state of the economy γ:

$$\frac{\partial \rho(\bar{b}_{hi})}{\partial \gamma} = g\left(\frac{\kappa}{(1+\beta(\gamma))\bar{b}_{hi} - 1}\right) \frac{\kappa}{\left((1+\beta(\gamma))\bar{b}_{hi} - 1\right)^2} \frac{\partial \beta(\gamma)}{\partial \gamma} \bar{b}_{hi} > 0,$$

   if $\partial\beta(\gamma)/\partial\gamma > 0$ (see Lemma 2).

Proof. See Appendix A. □

Proposition 2 establishes that if enforcers are only partially informed weak economic conditions may affect norm enforcement through two distinct channels. On the one hand, an increase in the forced default rate decreases enforcers' belief that an observed default is strategic in nature. As a consequence, partially informed enforcers face a higher risk of sanctioning innocent borrowers, which makes them less likely to intervene (because they dislike punishing innocent borrowers). On the other hand, the norm itself may be different in the weak economy so that sanctions are reduced, because enforcers perceive strategic default as more acceptable.

Fully informed enforcers cannot be affected through the information channel. Depending on the type of default they observe their belief is always either one or zero and is completely unaffected by the behavior of other borrowers in the population. The norm channel, by contrast, is equally relevant for partially and fully informed observers, because it predicts a change in the moral perception of strategic defaults as a function of the state of the economy (holding the belief constant).

Finally, we also analyze borrowers' repayment behavior in the presence of third-party norm enforcers. As in the previous section, equilibrium analysis requires the imposition of certain restrictions on the preference distributions $F(k)$ and $G(q)$. In particular, two conditions need to be satisfied. First, we assume that the distribution $G(q)$ is such that social sanctions of fully informed enforcers are not powerful enough to motivate completely self-interested borrowers ($k_i = 0$) to always repay in the strong state of the economy (see Assumption 2 in Appendix A). This assumption ensures that the problem remains interesting in all conditions and excludes the rather unrealistic case in which norm enforcement ensures the first best. Second, for the same reasons as discussed in the previous section we assume that the distributions $F(k)$ and $G(q)$ are such that there is only one level of k that equalizes the marginal borrower's costs and benefits of strategic default. This ensures equilibrium uniqueness (see Assumption 3 in Appendix A).

Proposition 3 characterizes equilibrium repayments in the presence of enforcers as a function of the state of the economy:

Proposition 3 (Equilibrium with enforcers)**.** *In the presence of third-party norm enforcers the fraction of repaying borrowers in equilibrium is* $1 - F(k_E^*(\gamma))$*, where* $k_E^*(\gamma)$ *is implicitly defined by the condition:*

$$k_E^* = \frac{\Omega - \rho(b^*)P}{1 + \gamma\lambda(1 - F(k_E^*))}.$$

where $\rho(\cdot)$ *is defined in Lemma 2 and* b^* *is determined as follows:*

- *Partially informed enforcers:* $b^* = \frac{\gamma F(k_E^*)}{\gamma F(k_E^*) + (1-\gamma)}$.

- *Fully informed enforcers:* $b^* = 1$.

$k_E^*(\gamma)$ *is unique and strictly decreasing in* γ *so that the fraction of repaying borrowers is strictly higher in the strong economy than in the weak economy:* $k_E^*(\gamma_{SE}) < k_E^*(\gamma_{WE})$.

Proof. See Appendix A. □

Proposition 3 illustrates how the presence of enforcers changes borrowers' incentives. The crucial difference to the previously discussed case without enforcers (see Proposition 1) is that borrowers now face a threat of punishment. Enforcers with a strong preference for norm enforcement (i.e., $\beta(\gamma)q_h$ is high) are willing to sanction defaulting borrowers even if they are only partially informed (see Lemma 2). The threat of sanctions lowers the expected utility of a strategic default and therefore motivates borrowers to repay. Under partial information the positive impact of sanctions is somewhat mitigated by the equilibrium effect that an increase in the fraction of repaying borrowers reduces the punishment probability (because a higher repayment rate lowers the belief that an observed default is strategic). Moreover, an increase in the forced default rate not only has a negative impact on repayment behavior (see Proposition 1), but also reduces the threat of sanctions, because the belief that an observed default is strategic is decreasing in γ (see Proposition 2). Under full information enforcers can cleanly distinguish between strategic and forced defaults. This information advantage strongly increases the punishment threat, in particular in the weak economy where partially informed enforcers have a hard time identifying strategic defaults and are therefore reluctant to punish.

3.4 Testable Hypotheses

Propositions 1 - 3 allow us to formulate four directly testable hypotheses that will guide the presentation of our results.

Hypothesis 1 (Effect of strong and weak economic conditions on moral constraints)**.** *Compared with a strong economy, weak economic conditions undermine moral constraints. The strategic default rate is higher in the WE no enforcer treatment than in the SE no enforcer treatment.*

Hypothesis 1 is directly implied by Proposition 1. The presence of fewer repaying borrowers reduces the moral cost of a strategic default, because the negative externalities are less likely to hurt repaying borrowers. This effect is further reinforced in equilibrium, because the increase in the strategic default rate at the population level further lowers the expected moral cost of a strategic default for each individual borrower. Thus, we expect that only borrowers with strong moral constraints repay in the weak economy.

Hypothesis 2 (Effect of strong and weak economic conditions on social norm enforcement)**.** *Compared with strong economic conditions a weak economy impairs the enforcement of social norms. Third-party enforcers are less inclined to punish defaulting borrowers in the WE partial information condition than in the SE partial information condition.*

According to Lemma 2 enforcers punish defaulting borrowers if the expected disutility from letting a non-repayment pass unpunished outweighs both the monetary cost of punishment and the risk of harming an innocent borrower. Proposition 2 implies that a negative shock to the economy reduces partially informed enforcers' motivation to engage in punishment of defaulters for two reasons: First, under weak economic conditions punishing an observed default entails a higher risk of sanctioning a borrower whose default was not strategic in nature (the information channel). Second, weak economic conditions may also directly affect the psychological benefit of punishing a strategic defaulter, because enforcers may be more sympathetic to strategic default if the defaulting borrower is surrounded by many other borrowers who default as well (the norm channel).

Hypothesis 3 (Effect of strong and weak economic conditions on the repayment norm)**.** *Compared with the strong economy, the weak economy impacts the repayment norm negatively. Third-party enforcers are less inclined to punish borrowers who engage in strategic default in the WE full information condition than in the SE full information condition.*

The full information conditions allow us to disentangle the norm channel from the information channel. Hypothesis 3 follows from the above discussed conjecture that weak economic conditions render strategic default more acceptable.

Hypothesis 4 (Effect of norm enforcement on repayment)**.** *Third-party norm enforcement lowers the strategic default rate. Within a given economic environment, the strategic default rate will be highest in the no enforcer conditions, intermediate in the partial information conditions, and lowest in the full information conditions.*

The expected benefit of strategic default decreases in the threat of punishment. Lemma 2 implies that for a given economic environment norm enforcement will be strongest under full information and weaker under partial information.

It is important to note, however, that without further assumptions our model makes no prediction on whether the impact of norm enforcement on the strategic default rate will be more pronounced in the strong or the weak economy. The impact of norm enforcement heavily depends on the characteristics of the distribution of moral concerns in the borrower population ($F(k)$). Even a powerful punishment threat may only have a limited impact on the strategic default rate, if there happens to be little probability weight in the relevant part of the distribution. We would like to emphasize that it is

not the purpose of our experiment to study the extent to which norm enforcement can mitigate the negative impact of weak economic conditions on the strategic default rate. Such a study would need to be carried out in the field-setting of interest to make sure that the distribution of moral constraints and the punishment technology are realistically calibrated. The strength of our laboratory experiment, in contrast, is that it allows us to cleanly disentangle behavioral mechanisms that are very difficult to isolate in the field.

4 Results

In total 640 subjects (undergraduate students and graduate students from the University of Hamburg) participated in the 29 sessions of the experiment. About 54% of the subjects were female. The average subject was 24 years old. For each of the six treatments we observe 10 independent matching groups. As there are 8 borrowers in each matching group and the experiment lasts for 20 periods our data set consists of 160 borrower level-observations within each matching group and period. The number of actual borrower decisions varies across treatments, because the probability of forced defaults differs between treatments. In the partial and full information conditions we observe 160 punishment decisions by enforcers within each matching group.[17]

Table 4 presents descriptive statistics for the main variables of interest, separately for each of the six treatments. The *Strategic Default Rate* measures the relative frequency with which borrowers decided to default although they had sufficient income to repay.[18] Third-party sanctions are reported differently for the partial and the full information conditions. As enforcers in the partial information condition cannot distinguish between forced and strategic defaults, we report average punishment for defaults irrespective of the type of default (*Punishment if Default*). In the full information condition, in contrast, sanctioning third parties know what type of default they observe and therefore we report average punishment for forced (*Punishment if Forced Default*) and strategic defaults (*Punishment if Strategic Default*) separately. For completeness we also show average punishments in case of repayment (*Punishment if Repay*).

In the first part of our results section we focus on individual moral constraints and discuss the impact of weak and strong economic conditions on repayment behavior in the absence of third-party enforcers (section 4.1). In the second part we analyze norm enforcement (section 4.2).

[17] One decision by each enforcer for two borrowers in each period.

[18] The Forced Default Rate (the frequency with which borrowers did not receive an income) is designed to be 0.5 in the weak economy and 0.1 in the strong economy. Empirically, there is a small amount of variation in these rates, because forced defaults were randomly determined at the individual level in the experiment, see also Footnote 6.

Table 4: Summary Statistics by Treatment

	no enforcer		enforcer partial info		enforcer full info	
	WE	SE	WE	SE	WE	SE
Strategic Default Rate	0.675	0.548	0.570	0.526	0.478	0.467
	(824)	(1450)	(814)	(1430)	(788)	(1473)
	0.06		*0.22*		*0.30*	
Punishment if Default			36.59	58.96		
			(1250)	(922)		
			0.06			
Punishment if Forced Default					3.23	13.54
					(812)	(127)
					0.19	
Punishment if Strategic Default					55.60	63.76
					(377)	(688)
					0.24	
Punishment if Repay			7.77	9.87	2.85	15.58
			(350)	(678)	(411)	(785)
			0.15		*0.23*	

Notes: The table provides summary statistics of experimental results showing means of variables with number of observations in parentheses. P-values from one-sided Wilcoxon Mann-Whitney tests are presented in italic. Mann-Whitney test are performed on the matching group level. *Strategic Default Rate* depicts the relative frequency with which borrowers chose not to repay although they had an income. *Punishment if Default* shows average punishment in case of a default. This variable does not distinguish between forced and strategic defaults. *Punishment if Forced Default* and *Punishment if Strategic Default* reveals average punishment of forcedly defaulting or strategically defaulting borrowers. *Punishment if Repay* shows average punishment attributed to repaying borrowers.

4.1 Moral Constraints

In this section we analyze the data of our no enforcer treatments. In this environment, personal moral constraints alone may prevent borrowers from engaging in strategic default. We exogenously increase the forced default rate from 10% in the strong economy (SE no enforcer) to 50% in the weak economy (WE no enforcer). According to Hypothesis 1 an increase in the forced default rate should weaken moral constraints and imply that only borrowers with very strong moral concerns are willing to repay their loan. Table 4 reveals that the weak economic condition is indeed associated with a substantial increase in the strategic default rate. In the strong economy – where 90% of borrowers have sufficient income to repay – the strategic default rate amounts to 54.8%. In contrast, in the weak economy – where half of the borrower are forced to default – the strategic default rate increases to 67.5%. This corresponds to an increase of 23.2% (12.7 percentage points). One-sided ranksum tests using matching group level observations indicate that this difference is significant (N=20, p=0.06).[19]

[19]The re-matching of participants implies that observations within matching groups may be dependent. We therefore treat all decisions within a matching group (8 individuals, 20 periods) as one independent observation in our tests. We use one-sided tests because we have specific directional hy-

We summarize this finding as our first result:

Result 1 (Effect of strong and weak economic conditions on the strategic default rate)**.** *In the absence of third-party enforcers, an exogenous increase in the forced default rate causes a significant increase in the strategic default rate. The strategic default rate increases by 23% in the weak economy as compared to the strong economy.*

Further analysis shows that Result 1 not only holds in the aggregate, but is present throughout the experiment. Of particular interest is the first period. In the first period borrowers were already aware of the underlying economic conditions and the consequences of their actions for payoffs. Yet, they did not have any information about the behavior of other participants in the experiment and we can therefore exclude that borrower behavior is driven by imitation or other social spillover effects. First period behavior can arguably be seen as the most pure measure of individual moral constraints that our setup delivers. Table A.2 in Appendix C shows the same descriptive statistics as Table 4, but only uses data collected in the first period of each treatment. The table confirms that already in the first period strategic defaults are significantly more frequent when the economy is weak than when the economy is strong. In the first period of the SE no enforcer treatment the strategic default rate amounts to 33.8%. In the first period of the WE no enforcer treatment, the strategic default rate is 54.8%. This corresponds to an increase of roughly 38% (21 percentage points, one-sided ranksum test on the individual level in Period 1: N=116, p=0.01).[20] Reflecting a common finding in cooperation games, the strategic default rates in period one are lower (i.e., cooperation is higher) than the strategic default rates across all periods (compare Table 4). The differences between the WE and SE treatment (21 percentage points in period one and 13 percentage points across all periods), however, is substantially large when considering both perspectives.

An analysis of the dynamics of the strategic default rate reveals that Result 1 persists over time. Figure A.3 in Appendix D reports strategic default rates for 5-period intervals. The figure uncovers two interesting insights: First, the strategic default rate exhibits an increasing time trend in both states of the economy.[21] Second, in each five-period

potheses. We present results from OLS regressions in Table A.1 (regression for all periods) and Table A.3 (observations limited to period one) in Appendix B and C. Panel A of the table presents regression results using borrowers decision to strategically default as dependent variable. Panel B of the tables focuses on enforcer punishment. Period fixed effects are included (in Table A.1 and standard errors are clustered at the unique matching group level in all regressions. The tables presents two sided p-values. Although significance levels decrease, the results directionally support the findings from our one sided tests presented in the main body of the paper.

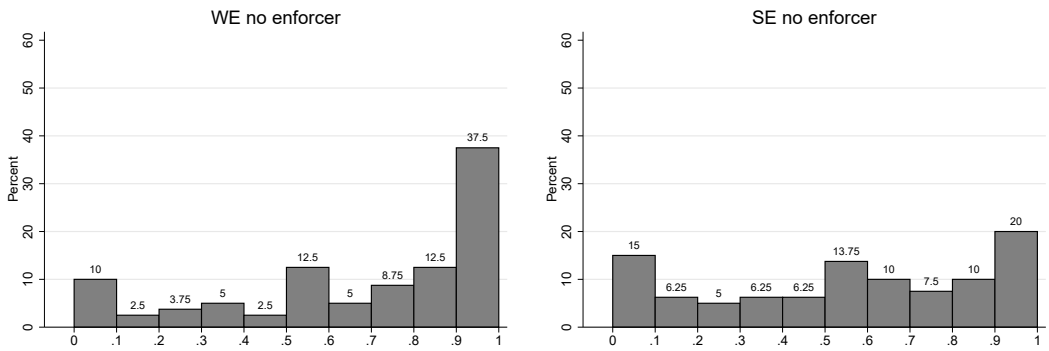
[20]Because subjects have not yet been rematched in period one, we report tests using individual borrowers as independent observations when analyzing first period results.

[21]Individual fixed effects OLS regressions using per-period strategic default rates as observations

interval the strategic default rate is higher in the weak economy than in the strong economy (although the difference is substantially smaller in the final 5 periods).[22]

The impact of the different economic conditions on repayment behavior can also be demonstrated at the individual borrower level. Figure 1 compares the distribution of borrower-specific default rates (over all 20 periods of the experiment) in the WE no enforcer treatment and the SE no enforcer treatment. The distributions of individual strategic default rates are significantly different between the two treatments (Combined Kolmogorv Smirnov (KS) test: N=160, p= 0.013). The difference in strategic default rates at the borrower level is most easily visible when looking at the extremes of the distributions in the weak and the strong economy. In the SE no enforcer treatment, about 20% of the borrowers decide to engage in strategic default more than 90% of the time. In the WE no enforcer treatment this fraction almost doubles to 37.5%. Similarly, when considering the lower end of the distribution, we observe that the fraction of borrowers who rarely default strategically is lower in the weak economy than in the strong economy. Whereas 26.25% of borrowers default less than 30% of the time in the SE no enforcer treatment, only 16.25% show such behavior in the WE no enforcer condition.

Figure 1: Borrower-level strategic default rates (WE no enforcer vs. SE no enforcer)



Notes: The figure shows the distribution of borrower-specific strategic default rates. Strategic default rates are calculated for each individual borrower over the full duration (20 periods) of the experiment. Frequencies in the WE no enforcer treatment (left-hand figure) and the SE no enforcer treatment (right-hand figure) are displayed in 10% bins.

reveal that the time trends are significantly positive in both states: SE no enforcer $N = 1450; \beta = 0.024; p < 0.01$; WE no enforcer $N = 824; \beta = 0.014; p < 0.01$. The reported p-values are based on standard errors adjusted for clustering at the matching-group level.

[22]Our statistical tests become weaker when comparing treatments for specific phases of the experiment. Although phase-specific tests are based on the same number of observations as the overall test (matching groups), the lower number of observations within each matching group implies a higher variance. Ranksum tests at the matching group level indicate that the difference is statistically significant in two of the four intervals: Periods 1-5: WE 57.5% vs. SE 36.8% ($N = 20; p = 0.04$), Periods 6-10: WE 58.7% vs. SE 46.7% ($N = 20; p = 0.12$), Periods 11-15: WE 77% vs. SE 62.3% ($N = 20, p = 0.08$), Periods 16-20: WE 75.2% vs. SE 73.2% ($N = 20, p = 0.32$).

4.2 Norm Enforcement

In this section, we discuss social norm enforcement by independent third party peers. We first analyse norm enforcement in the partial information treatments in Section 4.2.1. Second, we contrast norm enforcement of fully informed enforcers in the weak economic condition with that of fully informed enforcers in the strong economic condition in Section 4.2.2. Finally, in Section 4.2.3, we examine the effect of norm enforcement on borrower behavior in the weak and strong economy.

4.2.1 Partially informed enforcers

Enforcers in the partial information conditions cannot distinguish between forced and strategic defaults. In this condition we therefore analyze sanctions in response to observed defaults. Hypothesis 2 predicts that weak economic conditions soften the third-party enforcement of the repayment norm. Table 4 shows that partially informed enforcers indeed punish defaulters more harshly in the strong economy than in the weak economy. The average punishment is 58.96 points in the SE compared to an average punishment of 36.59 points in the WE (one-sided ranksum tests: N=20, p=0.06).[23] These data indicate that weak economic conditions substantially weaken the enforcement of the repayment norm. The punishment threat that defaulters face decreases by about 38%.

We summarize this finding as our second result:

Result 2 (Effect of strong and weak economic conditions on social norm enforcement)**.** *When enforcers cannot distinguish forced from strategic defaults, an exogenous increase in the forced default rate in the weak economy causes a large decrease in sanctions imposed on defaulters. Average punishments that partially informed enforcers target at observed defaulters are about 38% lower in the weak economy than in the strong economy.*

To get a more detailed understanding of the sanctioning decisions under partial information, we examine first period results and time trends. Punishment behavior in the first period confirms Result 2. Enforcers reduce a defaulting borrowers' income on average by 37.43 points in the SE partial information treatment and only by 11.67 points in the WE partial information treatment. This constitutes a significant difference

[23]Evidence that enforcers do not punish randomly but rather enforce a social repayment norm is given by comparing the mean punishment levels for repaying and defaulting borrowers in Table 4. In the WE partial information treatment, enforcers punish borrowers who repay on average with about 7.77 points. Defaults are punished with an average of about 36.59 points. This difference is significant at the 1% level as a one-sided signrank test shows (N=10; p<0.01).

of 25.76 points between the two economic conditions (N=89; p= 0.03).[24] However, when comparing the punishment level in period one to the overall punishment level, it seems evident that punishment is lower early on in the experiment. Figure A.4 in Appendix D shows the development of punishment over time by reporting data for intervals of five periods. The figure confirms that punishment levels show an increasing time trend in both economic conditions.[25] Moreover, the figure also reveals that average punishment in the weak economy is lower than punishment in the strong economy in each single time interval. This confirms that the impact of the weak economic condition is a robust finding that persists irrespective of the development of the punishment levels over time.[26]

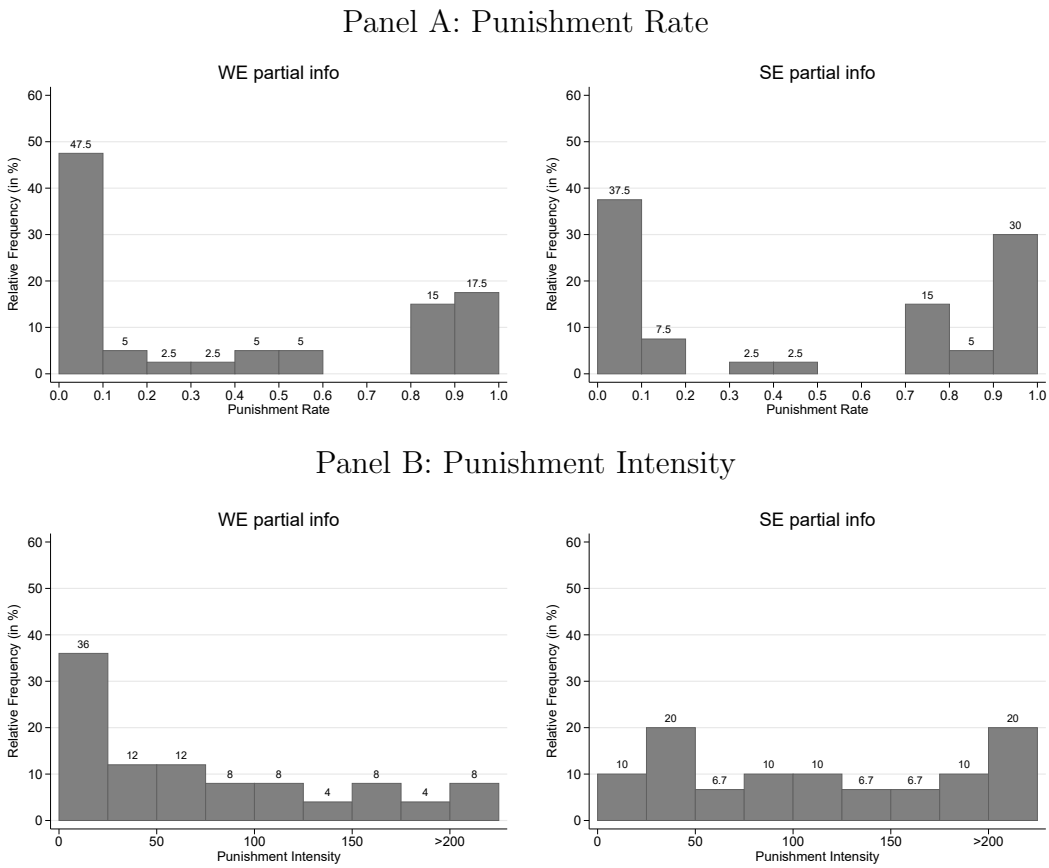
The impact of the weak economy on norm enforcement is also evident when considering enforcers' individual punishment behavior. Figure 2 shows the distribution of enforcer-specific punishment rates (i.e., the frequency with which an individual enforcer imposes a positive number of punishment points on a defaulting borrower) and punishment levels (i.e., average number of punishment points that an individual enforcer imposes on a defaulting borrower when punishing). Panel A shows that enforcers tend to punish less often in the weak economy than in the strong economy. For example, in the strong economy half of the enforcers (50%) punish defaulting borrowers in more than half of the cases. In the weak economy this fraction drops to 37.5%. However, overall the shift of the punishment frequencies is not strong enough to be statistically significant (Kolmogorv Smirnov (KS) test: N=80, p= 0.58). Panel B reveals that the shift in the distribution of punishment intensity is more pronounced. In the strong economy only 10% of the enforcers assign very small sanctions (i.e., 25 punishment points or fewer). In the weak economy, 36% of the enforcers assign such small sanctions on average. At the other end of the distribution we observe that 53.3% of the enforcers assign on average more than 100 points when they punish in the strong economy, while this is only true for 32% of the enforcers in the weak economy. This shift is statistically significant (Kolmogorv Smirnov (KS) test: N=51, p= 0.07). These data on individual enforcer behavior further support our hypothesis that an increase in the forced default

[24] Also in Period 1 punishment is anything but random (see also Table A.2 in Appendix C). Enforcers clearly target defaulters. In the WE partial information treatment, enforcers punish borrowers who repay on average with about 1.15 points. Defaults are punished with an average of about 11.67 points. This difference is significant (N=18; p=0.02). The same punishment pattern is again observed in period one of the SE partial information treatment: Repayments are punished with an average of 9.87 points and defaults are punished with an average of 37.43 points (N=23; p= 0.03).

[25] Fixed effects OLS regressions using per-period average punishment levels at the individual level as observations reveal that the time trends are significantly positive in both states: SE partial information: $N = 639; \beta = 1.19; p = 0.06$; WE partial information: $N = 761; \beta = 1.37; p = 0.05$. Standard errors clustered at the matching-group level.

[26] One-sided ranksum test at the matching group level show that differences in all but one five-period intervals are statistically significant: Periods 1-5: WE 22.6 points vs. SE 41.7 points ($N = 20, p = 0.01$), Periods 6-10: WE 35.7 points vs. SE 64 points ($N = 20, p = 0.05$), Periods 11-15: WE 53 points vs. SE 67.4 points ($N = 20, p = 0.20$), Periods 16-20: WE 44.3 points vs. SE 69.6 points ($N = 20, p = 0.07$).

Figure 2: Punishment Rate and Punishment Intensity under Partial Information



Notes: Panel A shows the distribution of enforcer-specific punishment rates. The horizontal axis displays the frequency with which an individual borrower assigns a positive punishment in response to an observed default. Individual punishment rates are categorized in bins of 10%. Panel B shows the distribution of enforcer-specific punishment intensities. The horizontal axis displays the average number of points that an enforcer imposes on a defaulter if he decides to inflict a positive punishment in response to a default (in bins of 25 points).

rate makes third-parties more reluctant to enforce the repayment norm.

Our model in Section 3 points out that there may be two reasons for the negative effect of the weak economy on social norm enforcement: First, the social norm itself may be undermined by the weak economic condition. The intuition is that enforcers may perceive strategic defaults as more acceptable when they occur in an environment in which many borrowers are forced to default in any case. If this is the case, enforcers in the weak economy have a smaller motivation to intervene when observing a default (the norm channel). Second, the increase in forced defaults in the weak economic condition compared with the strong economic condition leads to more uncertainty about the reasons for why borrowers default. As a consequence, enforcers in the weak economy become less sure whether an observed default is strategic in nature or whether the borrower was forced to default. If partially informed enforcers fear that they might wrongfully punish an innocent borrower, they become more reluctant to punish in the weak economy (the information channel). The next section attempts to disentangle these two phenomena.

4.2.2 Fully informed enforcers

Our full information treatments allow us to shed more light on the channels underlying Result 2. In these treatments enforcers not only observe a borrower's repayment decision, but they also know the borrower's income, so that they can perfectly distinguish between forced and strategic defaults. This implies that in these treatments the weak economic condition cannot affect norm enforcement through the information channel, because enforcers information on the nature of an observed default remains constant. If sanctions imposed on strategic defaulters in the weak economy were to differ from those in the strong economy, this could therefore be interpreted as direct evidence for a change in the repayment norm itself.

Table 4 reveals that with fully informed enforcers strategic defaults trigger slightly weaker average sanctions in the weak economy (55.60) than in the strong economy (63.76). However, the decrease is modest (about 13%) and not statistically significant (N=20, p=0.24).[27] These observations contradict Hypothesis 3. It seems that a weak economy does not affect social norm enforcement and punishment by peers. Contrary to the assumption put forward in Section 3, third-party enforcers do not deem strategic default more acceptable when borrowers are surrounded by others who are forced to default.

We summarize this finding as our third result:

Result 3 (The effect of strong and weak economic conditions and full information on the repayment norm)**.** *When enforcers can unambiguously identify strategic defaults, an exogenous increase in the strategic default rate in the weak economy has only a small, statistically not significant negative impact on norm enforcement.*

Result 3 has important implications for the interpretation of Result 2. It seems that

[27] As in the partial information conditions also the punishment pattern in the full information conditions is very systematic. Table 4 highlights that fully informed enforcers in the strong economy assign on average 63.76 points to strategic defaulter, while they punish borrowers who repay with 15.58 points and forced defaulters with 13.54 points on average. Both differences in punishment levels are highly significant (one-sided signrank tests: strategic defaults vs. repayments: N=10, p<0.01 / strategic vs. forced defaults: N=10, p<0.01). In the weak economy enforcers assign on average 55.60 punishment points to strategic defaulters, 2.85 points to borrowers who repay, and 3.2 points to forced defaulters. Again both differences are significant (one-sided signrank tests: strategic defaults vs. repayments: N=10, p<0.01 / strategic vs. forced defaults: N=10, p<0.01). These results show that independent of the partial or full info condition some enforcers punish borrowers who repaid or were forced to default (in the full info condition). This suggest that some enforcers might have punished borrowers either because of confusion, because they might receive utility from punishing cooperators or because they occasionally made mistakes. We observe that these behaviors were present from the outset (see Table A.2), persist over time (see Table 4) and occur in both economic conditions. This indicates that our interpretation and comparisons remain valid irrespective of the reasons for the observed patterns (confusion, mistakes, preferences) as the behavior does not seem to be confined to one specific treatment or time of the experiment.

the substantial decrease in the intensity of punishment and associated norm enforcement under partial information is predominantly a consequence of the informational uncertainty that the weak economy creates. Put differently, enforcers in the SE partial info have more information about the nature of a default than enforcers in the WE partial info condition which explains the higher punishment levels in the SE partial info condition. The view that the information channel is decisive receives further support when we analyze the impact of a change in enforcers' information for a given economic environment. In the strong economy having partial instead of full information should not strongly affect enforcers beliefs about the nature of an observed default. The reason is that in the SE partial information condition borrowers have sufficient income to repay most of the time (with probability 90%). Thus, while there is no longer certainty about the type of a default, rational enforcers should still have the belief that an observed default is strategic in nature with high probability.[28] Consistent with this reasoning, we observe that the small uncertainty created by partial information induces enforcers in the SE partial information condition to punish a bit less than those in the SE full information condition. Partially informed enforcers assign on average 58.9 punishment points to defaulters, while fully informed enforcers impose on average 63.8 points on strategic defaulters. Statistically, there is no significant difference between these two punishment levels (N=20; p=0.24).

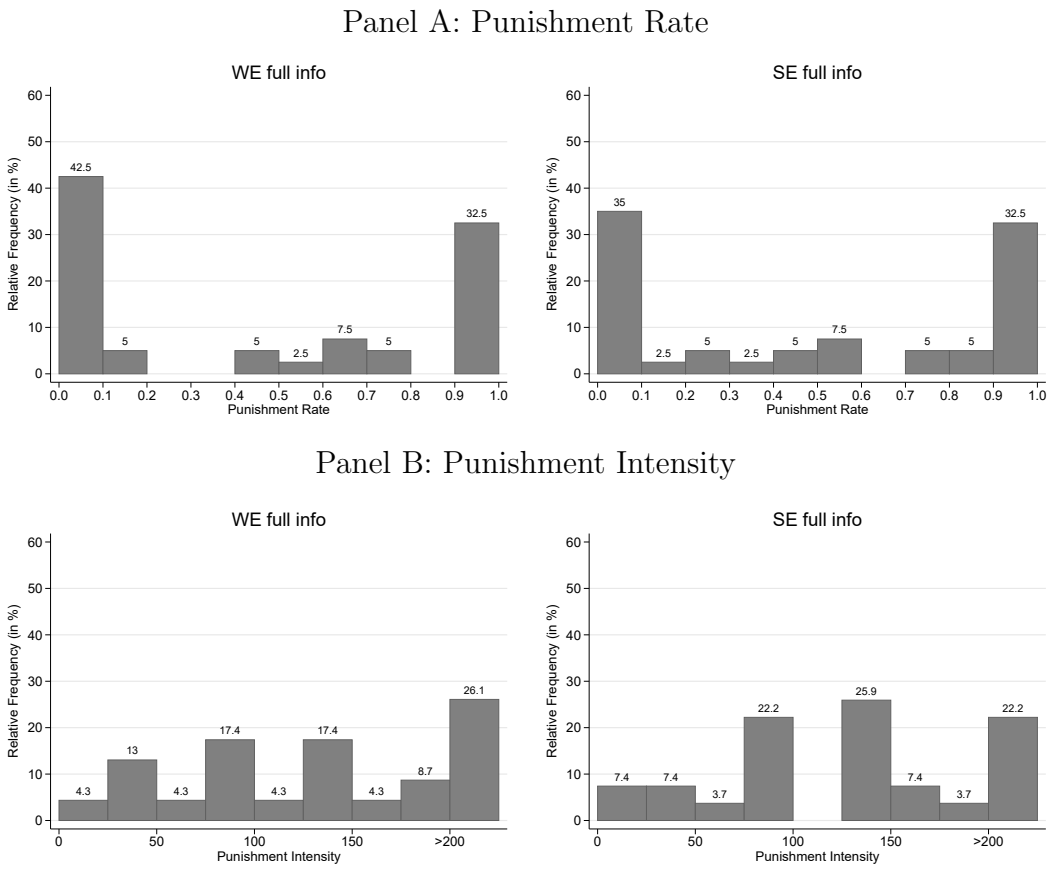
If the economic condition is weak, in contrast, the high rate of forced defaults implies that partially informed enforcers face strong uncertainty about the nature of an observed default. In fact, under realistic beliefs enforcers will think that an observed default is most likely not strategic in nature.[29] As a consequence, sanctions include a high risk that innocent borrowers are punished. Our data are in line with these arguments and confirm uncertainty impacts strongly enforcers' punishment behavior in the weak economy. Enforcers in the WE partial information conditions assign on average only 36.59 punishment points to defaulters. Enforcers in the WE full information condition instead attribute on average 55.60 punishment points to strategic defaulters. This is a substantial and statistically significant difference in the punishment intensity (N=20; p=0.06).

When only considering first period results there seems to be more support for the change in the repayment norm put forward in Hypothesis 3 than in the full data set. In the first period fully informed enforcers in the strong economy punish strategic defaulters on average with 48.2 punishment points, while fully informed enforcers in the weak

[28] If enforcers in the SE partial info condition (correctly) believe that solvent borrowers repay with about 47%, their belief that an observed default is strategic should be about 81%.

[29] If enforcers in the WE partial info condition (correctly) believe that solvent borrowers repay with about 43%, their belief that an observed default is strategic should be about 30%.

Figure 3: Punishment Rate and Punishment Intensity under Full Information



Notes: Panel A shows the distribution of enforcer-specific punishment rates. The horizontal axis displays the frequency with which an individual borrower assigns a positive punishment in response to an observed strategic default. Individual punishment rates are categorized in bins of 10%. Panel B shows the distribution of enforcer-specific punishment intensities. The horizontal axis displays the average number of points that an enforcer imposes on a defaulter if he decides to inflict a positive punishment in response to a strategic default (in bins of 25 points).

economy only assign 24.3 points. This difference seems large, but there is considerable variance so that the effect is not statistically significant (N=29; p=0.20). Thus, when considering first reactions very early on in the experiment, it seems that enforcers tend to be less inclined to punish in the weak economy than in the strong economy, indicating a possible weakening of the repayment norm under adverse economic conditions. However, the time trend displayed in Figure A.5 in Appendix D (the development of punishment over time in intervals of five periods) shows that this difference in punishment levels rapidly disappears over time.[30]

[30]Ranksum test at the matching group level show that the difference is only significant in the first few periods of the experiment: Periods 1-5: WE 51.30 points vs. SE 73.57 points ($N = 20, p = 0.09$), Periods 6-10: WE 62.97 points vs. SE 69.92 points ($N = 20, p = 0.41$), Periods 11-15: WE 72.85 points vs. SE 66.92 points ($N = 20, p = 0.34$), Periods 16-20: WE 63.21 points vs. SE 68.39 points ($N = 20, p = 0.38$). Fixed effects OLS regressions using per-period punishment levels at the individual level as observations reveal that the time trend is positive in the weak economy, but not in the strong economy: WE full information $N = 319; \beta = 1.15; p = 0.23$; SE full information $N = 517; \beta = -.33; p = 0.78$. Standard errors clustered at the matching-group level.

The limited impact of weak economy on norm enforcement is also evident from the data on individual enforcer behavior. Figure 2 shows distributions of individual, enforcer-specific punishment rates and punishment levels. The distributions are similar across the two treatments and statistical tests detect no difference (Kolmogorv Smirnov (KS) tests: Punishment rate: N=80, p= 0.99; Punishment intensity: N=50, $p = 0.98$).

4.2.3 Implications of Norm Enforcement for Strategic Defaults

In this final results section we analyze the effect of social norm enforcement on the strategic default rate in the strong and the weak economy. Hypothesis 4 predicts that the presence of third-party enforcers reduces the strategic default rate, because borrowers face the risk of being sanctioned. This punishment threat reduces the benefit of a strategic default. Even if average punishment levels are unlikely to be high enough to fully overcome the monetary incentive to strategically default, they may be sufficient to change the behavior of borrowers who are torn between their moral concerns and their financial interests. Table 4 reveals that the presence of enforcers indeed reduces the strategic default rate in both economic conditions. However, in the strong economy these effects are rather weak. The strategic default rate drops from 54.8% in the SE no enforcer condition to 52.6% in the SE partial information condition and to 46.7% in the SE full information condition. These effects are not statistically significant (no enforcers vs. partial information: N=20, p=0.46 / partial information vs. full information: N=20, p=0.30 /no enforcers vs. full information: N=20, p=0.35). In the weak economy, in contrast, the effects are substantially larger and significant. While the strategic default rate amounts to 67.5% in the WE no enforcer condition, it decreases to 57.0% (-16%) in the WE partial information condition and to 46.7% (-31%) in the WE full information condition (no enforcers vs. partial information: N=20, p=0.09 / partial information vs. full information: N=20, p=0.09 / no enforcers vs. full information: N=20, p=0.01).

We summarize these findings as our fourth result:

Result 4 (Effects of norm enforcement on the strategic default rate)**.** *The presence of third-party enforcers reduces the strategic default rate among borrowers in both states of the economy. However, the effects are only sizeable and statistically significant in the weak economy. Fully informed enforcers have a more pronounced effect (-31%) on the strategic default rate in the weak economy than partially informed enforcers (-16%).*

As discussed in Section 3.4, the finding that the presence of partially informed enforcers has a stronger impact on the strategic default rate in the weak economy, although enforcers punish less harshly than those in the strong economy, is not in conflict with our theory. The effectiveness of punishment in a particular state of the economy strongly

depends on the distribution of types in the borrower population. Thus, whether punishment is more effective in the weak economy or in the strong economy is ex ante ambiguous. In our case, the result that punishment is more effective in reducing the strategic default rate in the weak economy suggests that the distribution is such that there is little probability mass around the point at which borrowers are indifferent between repaying and defaulting in the strong economy. As a consequence, even the relatively strong punishment threat created by enforcers does not seem to motivate many additional borrowers to repay. This is different in the weak economy where there seems to be more probability mass around the indifference point. Here even the relatively weak threat of punishment established by enforcers is sufficient to motivate borrowers with intermediate moral concerns who engage in strategic default in the absence of social norm enforcement to abstain from doing so. As a consequence we do not observe substantial differences in the strategic default rates between the WE and SE conditions with punishment (see Table 4).

A look at the results in the first period confirms that this finding is present from the outset. Table A.2 in Appendix C shows that the effect of the presence of enforcers on the strategic default rate in the weak economy is even more pronounced in the first period than in the full experiment. The strategic default rate drops from 54.8% in the WE no enforcers treatment to 40.9% in WE partial information condition and to 21.2% in the WE full information condition. All these differences are statistically significant (no enforcers vs. partial information: N=86, p=0.1 / partial information vs. full information: N=77, p=0.04 / no enforcers vs. full information: N=75, p<0.01). In the strong economy, in contrast, the presence of enforcers has almost no effect in the initial period.[31] Figure A.3 reveals that roughly the same ordering of strategic default rates persists over the full duration of the experiment. This indicates that a higher fraction of borrowers in the SE conditions is already motivated to repay without norm enforcement. The punishment threat in the SE conditions is not strong enough to motivate additional borrowers who would otherwise default to repay. In the WE conditions this is different. A larger fraction of borrowers is unwilling to repay without the threat of sanctioning by peers. Coming from this higher level of strategic default, social norm enforcement can motivate (more) additional borrowers to repay leading to comparable strategic default rates in the SE and WE conditions with enforcers.

[31]The relevant strategic default rates are: 33.8% in the no enforcer condition, 33.8% in the partial information condition, and 30.6% in the full information condition. None of the differences is significant (no enforcers vs. partial information: N=142, p=0.45 / partial information vs. full information: I: N=140, p=0.34 / no enforcers vs. full information: I: N=146, p=0.34).

5 Conclusion

Strategic defaults occur in a variety of important economic settings. Typical examples include debtors failing to repay loans, entrepreneurs who do not pay supplier bills thereby raising prices for other economic actors, or citizens who evade taxes. Recent field evidence suggests that a negative shift in the surrounding economic conditions can weaken repayment norms and undermine morale, thus triggering a substantial increase in debtors' propensity to engage in strategic default. However, with observational or survey data alone it is difficult to disentangle the impact of the surrounding economic conditions on repayment moral and norms from confounding factors. To make a first step towards closing this gap, we make use of a controlled laboratory experiment. The laboratory offers two crucial advantages for the purpose of our study: First, our experiment enables us to directly observe strategic defaults and possible sanctions imposed by surrounding peers. Second, we are able to exogenously vary both the state of the economy and the information situation. These features make it feasible to directly study causal effects of strong and weak economic conditions on repayment behavior and to separate the different channels that are confounded in the field data.

The results of our experiment contribute to the literature by providing clean empirical evidence showing that the increase in the strategic default rate in a weak economy is driven by two distinct behavioral forces: First, in weak economic conditions individual moral constraints that deter strategic defaults in times when economic conditions are good are undermined. An increase in the rate of forced defaults leads solvent debtors to feel less obliged to repay their loans. This suggests that the (psychological) moral cost associated with strategic defaults decreases when the negative externalities imposed on society are more likely to hit others who are likely to default themselves (because of forced or strategic default).

Second, an economic contraction also weakens peer enforcement of social repayment norms. In an economy where many debtors suffer from solvency problems, third-party peers become less inclined to sanction debtors who fail to repay their debt. Interestingly, the reluctance to take action against defaulters does not seem to be a consequence of a break-down of the social norm per se. In fact, if the information conditions are such that enforcers can identify the nature of a default, their willingness to intervene does not diminish much in response to a shift in the economic conditions. This implies that observers do not find strategic defaults more acceptable when the economy is weak. The reason why enforcers sanction less is that an economic downturn and the associated weak economic condition creates informational uncertainty: Peers cannot perfectly identify whether an observed default is strategic or forced. If the forced default rate s driven up by a weak economy, it becomes increasingly difficult to identify the true nature of

a default. As a result, sanctioning observed defaulters entails a large risk of hurting innocent debtors who did not deliberately default on their repayment, but were forced to do so by an exogenous negative shock. It seems that many enforcers are reluctant to take this risk and prefer to give defaulters the benefit of the doubt and not to punish them.

Our findings are based on conservative statistical analysis of behavior on the experimental matching group level limiting sample size. The findings therefore mark an important step in disentangling the effect of weak and strong economic conditions on moral constraints and social norm enforcement by third party peers – but they need to be interpreted with caution. Notwithstanding, our findings suggest that the impact of negative economic conditions on the strategic default rate also depends on the information situation in a particular environment. The more transparency there is, the less severely a weak economy prevailing in an economic crisis will augment the strategic default rate. These insights are useful for predictive purposes: Based on our evidence we would expect that close-knit environments with high disclosure of debtors' behavior (e.g. microfinance settings) will experience a smaller increase in strategic defaults than large and very anonymous environments (e.g. mortgage markets in urban areas). Similarly, transparency initiatives which are frequently implemented or discussed and aim at exposing strategic defaulters, see, e.g., by tax authorities (see, Norway or Slovenia) or by state run banks (see, Bangladesh, India or China), may only reveal their full potential in weak economic conditions during a crisis.

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Appendix (for online publication)

A Appendix: Proofs

Proof: Lemma 1. Unconditional repayments occur if a borrower repays his loan even if he knows that no other borrower ever repays. For this behavior to be optimal the borrower's utility function needs to satisfy the following condition: $D - k_i(s, c_j \neq r) < L$. Recalling that $k_i(s, c_j \neq r) \equiv k_i$ and $D - L = W - R \equiv \Omega$, this yields $k_i > \Omega$. Unconditional defaults occur, if a borrower does not repay even if he knows that all other borrowers repay with certainty (and have the necessary income to do so). For this behavior to be optimal the borrower's utility function needs to satisfy the following condition: $W - k_i(s, r) > R$. Using the assumption that $k_i(s, r) = (1 + \lambda)k_i$, this yields $k_i < \frac{\Omega}{1+\lambda}$. The remaining part of the borrower population ($\frac{\Omega}{1+\lambda} < k_i < \Omega$) make their repayments contingent on the repayment rate in the population, i.e., they are willing to repay if the probability that other borrowers repay is sufficiently high. Denote the probability that other borrowers repay (conditional on having a positive income) as α. To ensure that repaying is optimal for a conditional cooperator the following condition needs to be met: $U_i(r) = L + \gamma\alpha\Delta \geq D + \gamma\alpha\Delta - (1 - \gamma\alpha)k_i(s, c_j \neq r) - \gamma\alpha k_i(s, r) = U_i(s)$. This condition simplifies to: $k_i(1 + \gamma\alpha\lambda) \geq \Omega$. Rearranging and solving for α yields the following condition for the minimally necessary repayment rate of solvent other borrowers: $\alpha \geq \frac{\Omega - k_i}{\gamma\lambda k_i}$. □

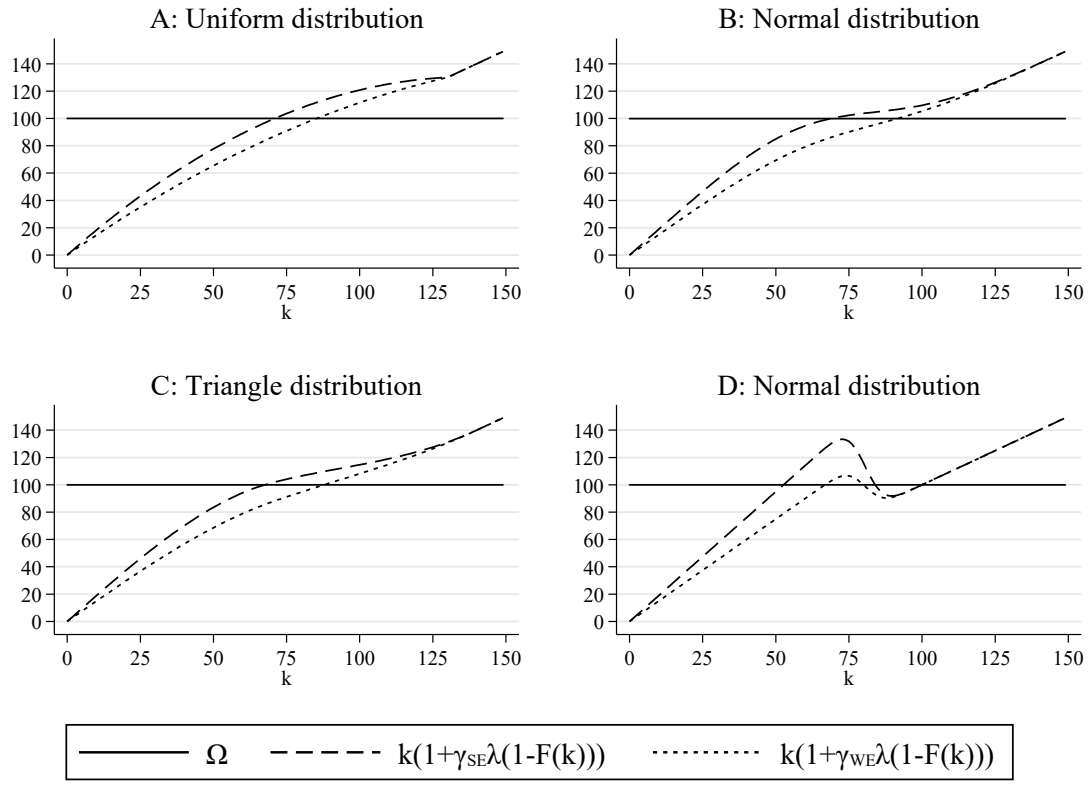
Assumption 1 (Distribution of borrowers' moral concerns)**.** *The distribution $F(k)$ fulfills the following property:*

$$\textit{If } k'(1 + \gamma\lambda(1 - F(k')) > \Omega, \textit{ then } k''(1 + \gamma\lambda(1 - F(k'')) > \Omega, \forall k'' > k'.$$

Justification for Assumption 1: In equilibrium the marginal borrower (exhibiting moral costs k_N^*) must be indifferent between strategic default and repayment. Borrowers with higher moral costs strictly prefer to repay, borrowers with lower moral costs strictly favor strategic default. Using the notation introduced in the proof of Lemma 1 this implies that in equilibrium $\alpha = 1 - F(k_N^*)$. Equalizing the marginal borrower's expected cost of strategic default with the cost of repayment therefore yields the following condition: $k_N^*(1 + \gamma\lambda(1 - F(k_N^*))) = \Omega$ (this is just restating the equilibrium condition of Proposition 1). The left-hand side of the condition (the marginal borrower's expected cost of a strategic default) is not necessarily monotonically increasing in k_N^*: the derivative of the left-hand side with respect to k_N^* is equal to $1 + \gamma\lambda(1 - F(k_N^*) - kf(k_N^*))$ and can be positive or negative depending on the characteristics of of the distribution $F(k)$. Intuitively, a higher k_N^* can reduce the marginal borrower's expected cost if the cost-reducing effect

caused by the smaller population fraction of repaying borrowers dominates the cost-increasing effect of a higher cost parameter. Such non-monotonicities can give rise to multiple equilibria if the above condition is fullfilled for multiple levels of k. Because we assume that $k_{min} < \frac{\Omega}{1+\lambda}$ and $k_{max} > \Omega$, Assumption 1 ensures uniqueness of equilibrium in that it guarantees that the curve defined by the left-hand side of the condition intersects the horizontal line at Ω exactly once from below.

Figure A.1: Graphical Representation of Equilibrium Condition in Proposition 1



The figure shows a graphical representation of the equilibrium condition presented in Proposition 1. The curves are drawn using the following parameters: $\Omega = 100$, $\gamma_{SE} = 0.9$, $\gamma_{WE} = 0.5$, and $\lambda = 1$, and different possible distributions of k in the borrower population. Panel A is based on a uniform distribution: $F(k) = \mathcal{U}(0, 130)$. Panel B uses a normal distribution with a "relatively large" variance: $F(k) = \mathcal{N}(69, 25)$. Panel C relies on a symmetric triangular distribution with support $[0, 140]$. In Panel D, finally, the underlying distribution is a normal distribution with a "small variance": $F(\delta) = \mathcal{N}(80, 5)$. Strictly speaking, the normal distributions used in Panels B and D do not correspond to our assumption that $F(\cdot)$ is a distribution function with finite support $[k_{min}, k_{max}]$. However, since there is only very little probability mass in the tails, truncated versions of these distributions would essentially yield the same picture.

Figure A.1 provides graphical representations of the equilibrium condition for four different distributions of k. Panels A to C of Figure A.1 show distributions that satisfy Assumption 1. Panel D depicts an example of a distribution that violates Assumption 1. In general, Assumption 1 allows for a wide set of different distributions. Violations of Assumption 1 occur, however, if $F(k)$ puts a lot of probability weight on narrow ranges with high values of k (so that the term $kf(k)$ becomes very large). Assumption 1

therefore rules out distributions with a small number of clearly distinct borrowers types who have strong moral concerns (e.g., unimodal distributions with a high mean and small variance or distributions with multiple peaks at high levels of k). Importantly, Assumption 1 does not exclude (arguably realistic) distributions with a concentration of (nearly) selfish types. Existing evidence in the social preference literature indicates that among the non-selfish part of the population there is usually wide variety in the extent to which different people care about social motives (see e.g., Fischbacher et al., 2001), so that it seems unlikely that Assumption 1 excludes plausible distributions.

Proof: Proposition 1. The equilibrium condition stated in Proposition 1 directly follows from the proof of Lemma 1 (see the justification for Assumption 1 above for more details). Totally differentiating and rearranging this condition yields: $\frac{\partial k_N^*}{\partial \gamma} = -\frac{k\lambda(F(k))}{1-\gamma\lambda(1-F(k)-kf(k))}$. Assumption 1 ensures that this derivative is strictly negative. Notice: k_N^* is bound above by Ω, because borrowers with k's above Ω repay even if they believe that no other borrower ever repays. Moreover, k_N^* cannot be inferior to $\frac{\Omega}{1+\lambda}$, because borrowers with k's below $\frac{\Omega}{1+\lambda}$ do never repay irrespective of other borrowers' behavior (see Lemma 1). □

Proof: Lemma 2. Enforcers punish borrowers if the expected utility of punishing is larger than the expected utility of not punishing. Assume that the enforcer h's belief that borrower i has engaged in strategic default is given by b_{hi}. The expected utility of punishing the borrower is given by: $U_k(p_{hi} = 1) = E_h - (1 - b_{hi})q_{hi}(f, 1, \gamma)) - \kappa = E_h - (1 - b_{hi})q_h - \kappa$. The expected utility of not punishing the borrower amounts to: $U_k(p_{hi} = 0) = E_h - b_{hi}q_{hi}(s, 0, \gamma) = E_h - b_{hi}\beta(\gamma)q_h$. Equalizing $U_k(p_{hi} = 1)$ and $U_k(p_{hi} = 0)$ yields the threshold belief necessary to make punishment optimal: $b_{hi} = \frac{q_h+\kappa}{(1+\beta(\gamma))q_h}$. Rearranging terms and solving for q_h leads to the minimally necessary concern for norm violations: $q_h = \frac{\kappa}{(1+\beta(\gamma))b_{hi}-1}$. q_h is decreasing in b_{hi}. □

Proof: Proposition 2.

1. Suppose that all borrowers with a moral cost level above $\bar{k}$ repay whenever they can. A partially informed enforcer's belief that a non-repaying borrower engaged in strategic default is then given by: $b_{ti} = \frac{\gamma F(\bar{k})}{\gamma F(\bar{k})+(1-\gamma)}$. Taking the first derivative of this belief with respect to the probability that borrowers have an income that is sufficient to make the repayment (γ) yields: $\frac{\partial b_{hi}}{\partial \gamma} = \frac{F(\bar{k})}{(\gamma F(\bar{k})+(1-\gamma))^2} > 0$.

2. The effect of a negative economic shock on the probability that a non-repaying borrower i is punished directly follows from Lemma 2. Taking the first derivative of $\rho(b_{hi})$ with respect to γ yields: $\frac{\partial \rho(b_{hi})}{\partial \gamma} = g\left(\frac{\kappa}{(1+\beta(\gamma))b_{hi}-1}\right)\frac{\kappa}{((1+\beta(\gamma))b_{hi}-1)^2}\frac{\partial \beta(\gamma)}{\partial \gamma}b_{hi}$. □

Assumption 2 (Punishment intensity)**.** *The distribution $G(q)$ is such that $(1 - G(\kappa/\beta(\gamma_{SE})))\, P < \Omega$.*

Justification for Assumption 2: Assumption 2 ensures that norm enforcement by perfectly informed third-parties is not powerful enough to completely solve the strategic default problem (even in the strong economy). Violation of this assumption would imply that the punishment threat established by perfectly informed enforcers in the strong economy would be so powerful that even completely self-interested borrowers who do not face any moral constraints would always repay. Assumption 2 guarantees that the repayment problem remains interesting for all information conditions and states of the economy.

Assumption 3 (Distributions of borrowers' and enforcers' moral concerns)**.** *The distributions $F(k)$ and $G(q)$ jointly fulfill the following properties:*

1. $k_{min}(1 + \gamma\lambda(1 - F(k_{min})) < \Omega - \rho P$,
2. *If* $k'(1 + \gamma\lambda(1 - F(k')) > \Omega - \rho P$, *then* $k''(1 + \gamma\lambda(1 - F(k'')) > \Omega - \rho P$, $\forall k'' > k'$,

where $\rho = 1 - G\left(\frac{\kappa}{(1+\beta(\gamma))b_{hi}-1}\right)$ and the enforcer's belief b_{hi} is defined as follows:

a) $b_{hi} = \frac{\gamma F(\bar{k})}{\gamma F(\bar{k})+(1-\gamma)}$ under partial information.

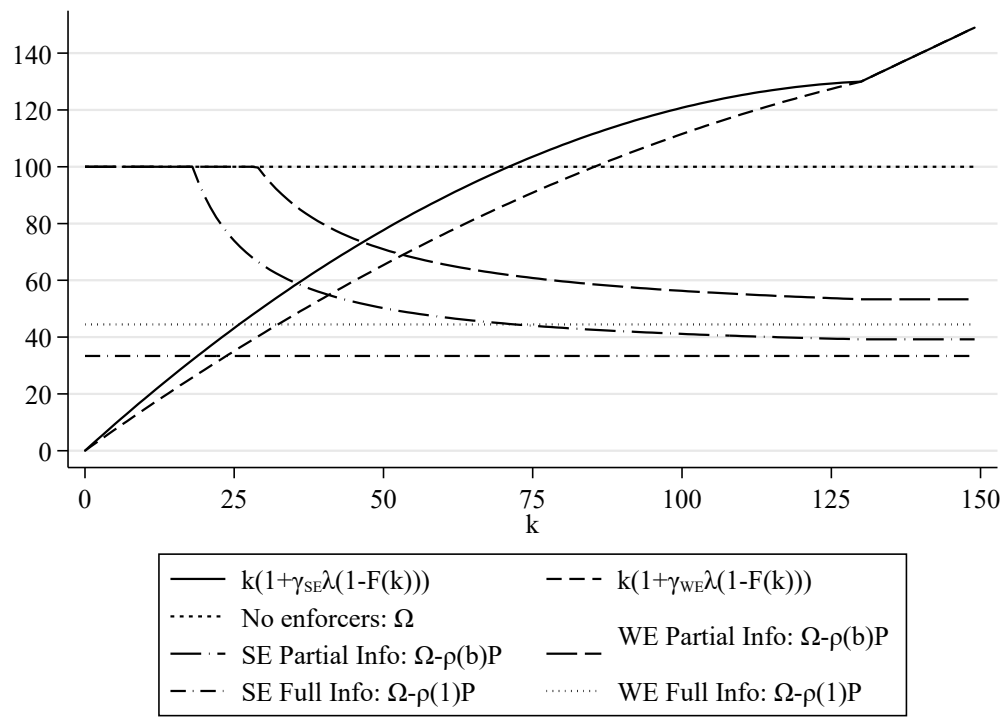
b) $b_{hi} = 1$ under full information.

Justification for Assumption 3: The presence of enforcers implies that strategically defaulting borrowers may get punished. Lemma 2 shows that enforcers are willing to punish if they care sufficiently about norm violations and are sufficiently convinced that a borrower engaged in strategic default: the probability that a non-repaying borrower i is punished amounts to $\rho(b_{hi}) = 1 - G\left(\frac{\kappa}{(1+\beta(\gamma))b_{hi}-1}\right)$. The borrower's expected benefit from strategic default therefore decreases by ρP. Figure A.2 shows a graphical example. The figures illustrates how the presence of enforcers affects the borrower's benefit from engaging in a strategic default as a function of the repaying fraction of borrowers in the population (k signifies the threshold value of a borrower's moral concern). Under full information the punishment threat leads to a constant shift in the benefit (depending on whether the norm changes with the state of the economy, the size of the shift may depend on the economic conditions). Under partial information, in contrast, the shift of the benefit depends on how many borrowers repay. The reason is that enforcers condition their punishment on their belief about the observed borrower's behavior and this belief crucially depends on the repayment behavior of the population (in addition, the

shift may also depend on the state of the economy). Assumption 3 excludes multiplicity of equilibria in the presence of enforcers. Part 1 ensures that the expected cost of strategic default for borrowers with the lowest moral concern (k_{min}) are lower than the corresponding marginal benefit. In other words this means that we assume that there are always some borrowers who have a strict incentive to engage in strategic default. Part 2 ensures that the curve representing the marginal costs intersects curve representing the marginal benefits exactly once from below. This assumption ensures that there is at most one repayment threshold at which expected costs and benefits of a strategic default are equal. The intuitive rationale is very similar to the one outlined above for Assumption 1.

Proof: Proposition 3. This proof follows directly from the justification of Assumption 3. Notice: In the presence of enforcers k^* is still bound above by Ω. However, it is now possible that k^* is inferior to $\frac{\Omega}{1+\lambda}$. The reason is that the threat of punishment may induce repayments from borrowers with weak moral concerns who never repay in the absence of enforcers (see also Figure A.2). □

Figure A.2: Representation of Equilibrium Conditions in Propositions 1 and 3



The figure shows a graphical representation of the equilibrium conditions presented in Propositions 1 and 3. The figure is based on the following parameter assumptions: $\Omega = 100$, $\gamma_{SE} = 0.9$, $\gamma_{WE} = 0.5$, $\lambda = 1$, $P = 100$, $\kappa = 10$, $\beta_{SE} = 2$, and $\beta_{SE} = 1.5$. The distribution $F(\delta)$ is assumed to be $\mathcal{U}(0, 130)$ and the distribution $G(q)$ is assumed to be $\mathcal{U}(0, 15)$.

B Appendix: Regression results

Table A.1: Linear regressions: Strategic default (Panel A) and punishment points assigned (Panel B) – All periods

Panel A: Strategic default	Between economic conditions SE vs. WE			Within economic condition No Enforcer vs. Partial info vs. Full info	
	No Enforcer	Partial Info	Full Info	Within WE	Within SE
	(1)	(2)	(3)	(4)	(5)
Weak economy	0.124	0.0458	0.0101		
	(0.0805)	(0.0698)	(0.0863)		
Partial info				-0.103	-0.0211
				(0.0747)	(0.0754)
Full info				-0.198**	-0.0799
				(0.0856)	(0.0802)
Constant	0.369***	0.348***	0.273***	0.496***	0.361***
	(0.0500)	(0.0467)	(0.0529)	(0.0793)	(0.0543)
Observations	2274	2244	2261	2426	4353
R^2	0.0829	0.0253	0.0170	0.0483	0.0370
Period FE	YES	YES	YES	YES	YES
Panel B: Punishment	Between economic conditions SE vs. WE			Within economic condition No Enforcer vs. Partial info vs. Full info	
	No Enforcer	Partial Info	Full Info	Within WE	Within SE
	(1)	(2)	(3)	(4)	(5)
Weak Economy		-21.36	-7.038		
		(12.62)	(18.39)		
Full Info				23.98	9.687
				(18.31)	(12.86)
Constant		36.37***	40.74**	12.26**	35.96***
		(7.839)	(14.45)	(5.348)	(9.773)
Observations		1400	836	1080	1156
R^2		0.0331	0.0168	0.0380	0.0107
Period FE		YES	YES	YES	YES

Note:Linear (OLS) regressions with standard errors in parentheses. Standard errors are clustered on the unique matching group within a session are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. **Panel A:** A borrower's decision to strategic default (conditional on having an income) as dependent variable. **Panel B:** An enforcer's decision to punish default (in the partial info conditions and strategic default (in the full info conditions) as dependent variables. *Weak economy* is a dummy variable representing the weak economic condition. *Partial info* is a dummy variable representing the SE partial info or WE partial info condition with enforcers. *Full info* is a dummy variable representing the SE full info or WE full info condition with enforcers. Columns (1)-(3) compare the SE with the WE condition: No Enforcer treatments (Column (1)); SE and WE partial info condition (Column (2)); SE and WE full info condition (Column (3)). Columns (4) and (5): Compare behavior within the WE condition (Column (4)) and within the SE condition (Column (6)). In Column (5) and (6) of Panel B, the regressions capture the change in punishment of default in the partial info conditions to punishment of strategic default in the full info conditions (the dependent variable is punishment of default in the partial info condition (baseline category) and punishment of strategic default in the full info condition).

C Appendix: Period one results

Table A.2: Summary Statistics by Treatment for Period One

	no enforcer		enforcer partial info		enforcer full info	
	WE	SE	WE	SE	WE	SE
Strategic Default	0.548	0.338	0.409	0.338	0.212	0.306
	(42)	(74)	(44)	(68)	(33)	(72)
	0.014		*0.22*		*0.16*	
Punishment if Default			11.67	37.43		
			(54)	(35)		
			0.033			
Punishment if Forced Default					3.404	25
					(47)	(8)
					0.35	
Punishment if Strategic Default					24.29	48.18
					(7)	(22)
					0.205	
Punishment if Repay			1.154	9.778	0	11
			(26)	(45)	(26)	(50)
			0.105		*0.02*	

Notes: The table provides summary statistics of experimental results for period one showing means of variables with number of observations in parentheses. P-values from one sided Wilcoxon Mann-Whitney tests are presented in italic. Mann-Whitney test are performed on the individual level. *Strategic Default Rate* depicts the relative frequency with which borrowers chose not to repay although they had sufficient income to do so. *Punishment if Default* shows average punishment in case of a default. This variable does not distinguish between forced and strategic defaults. *Punishment if Forced Default* and *Punishment if Strategic Default* reveals average punishment of forcedly defaulting or strategically defaulting borrowers. *Punishment if Repay* shows average punishment attributed to repaying borrowers.

Table A.3: Linear regressions: Strategic default (Panel A) and punishment points assigned (Panel B) – Period One

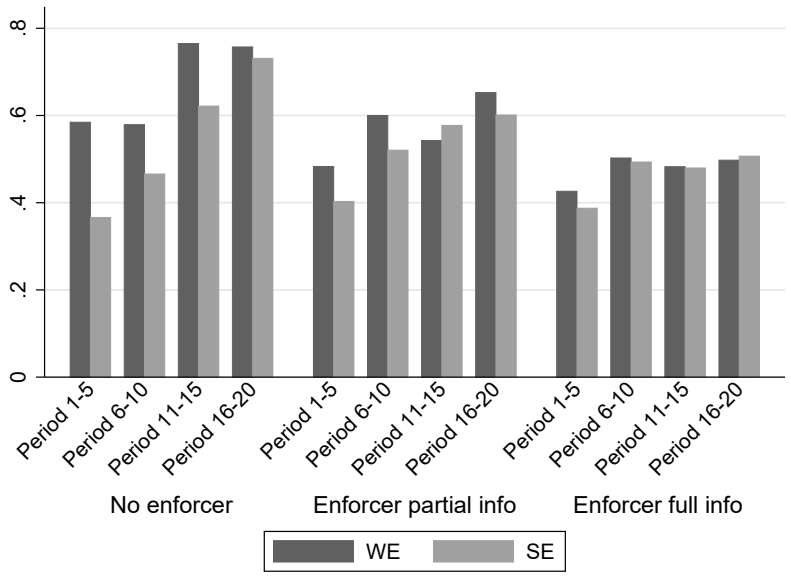
Panel A: Strategic default	Between economic conditions SE vs. WE			Within economic condition No Enforcer vs. Partial info vs. Full info	
	No Enforcer	Partial Info	Full Info	Within WE	Within SE
	(1)	(2)	(3)	(4)	(5)
Weak economy	0.210*	0.0709	-0.0934		
	(0.120)	(0.0885)	(0.0880)		
Partial info				-0.139	0.000397
				(0.132)	(0.0664)
Full info				-0.335**	-0.0323
				(0.130)	(0.0709)
Constant	0.338***	0.338***	0.306***	0.548***	0.338***
	(0.0448)	(0.0498)	(0.0557)	(0.111)	(0.0444)
Observations	116	112	105	119	214
R^2	0.0419	0.00516	0.00941	0.0727	0.00107

Panel B: Punishment	Between economic conditions SE vs. WE			Within economic condition No Enforcer vs. Partial info vs. Full info	
	No Enforcer	Partial Info	Full Info	Within WE	Within SE
	(1)	(2)	(3)	(4)	(5)
Weak economy		-22.31**	-19.92		
		(8.444)	(24.98)		
Full info				9.702	7.314
				(17.50)	(19.26)
Constant		36.90***	44.21**	14.58***	36.90***
		(7.339)	(18.15)	(4.232)	(7.370)
Observations		65	26	43	48
R^2		0.0678	0.0108	0.0121	0.00244

Note:Linear (OLS) regressions with standard errors in parentheses. Observations limited to period one. Standard errors are clustered on the unique matching group within a session are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. **Panel A:** A borrower's decision to strategic default (conditional on having an income) as dependent variable. **Panel B:** An enforcer's decision to punish default (in the partial info conditions and strategic default (in the full info conditions) as dependent variables. *Weak economy* is a dummy variable representing the weak economic condition. *Partial info* is a dummy variable representing the SE partial info or WE partial info condition with enforcers. *Full info* is a dummy variable representing the SE full info or WE full info condition with enforcers. Columns (1)-(3) compare the SE with the WE condition: No Enforcer treatments (Column (1)); SE and WE partial info condition (Column (2)); SE and WE full info condition (Column (3)). Columns (4) and (5): Compare behavior within the WE condition (Column (4)) and within the SE condition (Column (6)). In Column (5) and (6) of Panel B, the regressions capture the change in punishment of default in the partial info conditions to punishment of strategic default in the full info conditions (the dependent variable is punishment of default in the partial info condition (baseline category) and punishment of strategic default in the full info condition).

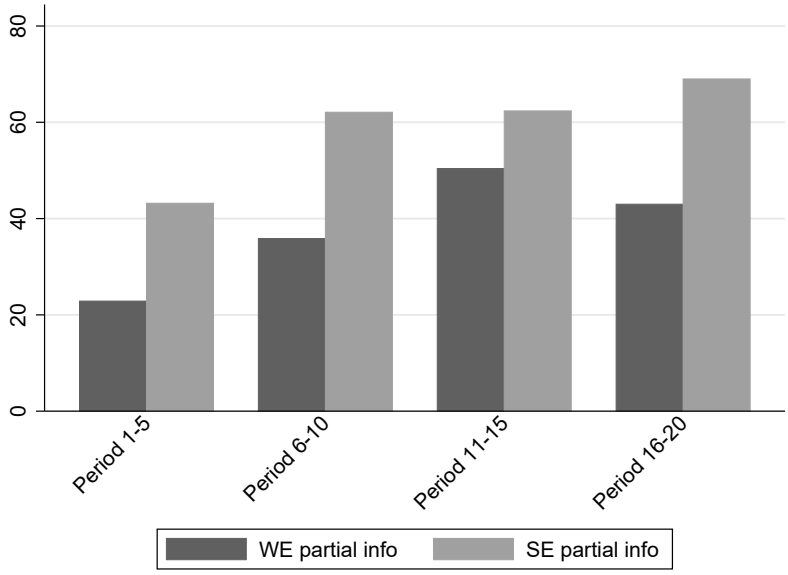
D Appendix: Treatment outcomes over time

Figure A.3: Strategic Default Rate over Time (five-period intervals)



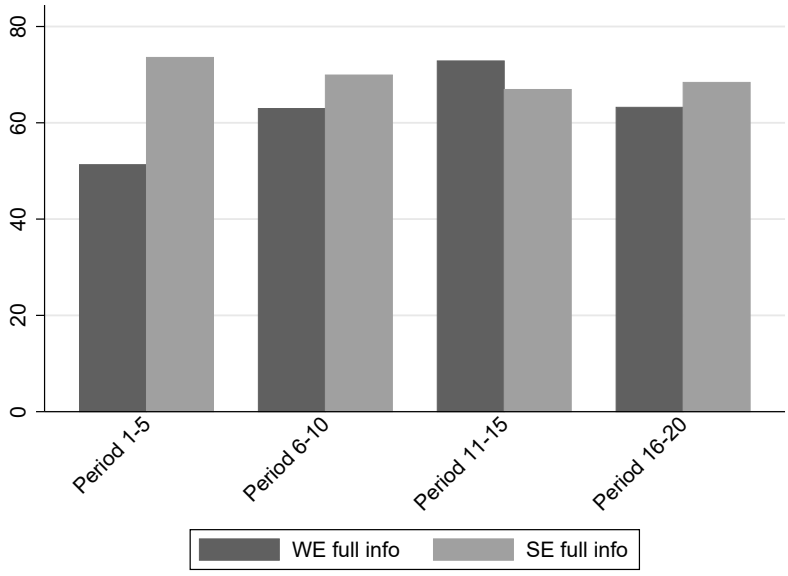
Notes: The figure displays strategic default rates for five-period intervals for our weak and strong economy treatments in each of the three conditions (no enforcers, enforcer partial information, enforcer full information).

Figure A.4: Punishment of Default in Enforcer Partial Info Conditions over Time



Notes: The figure displays average punishment of defaults in the WE partial info treatment and SE partial info treatment.

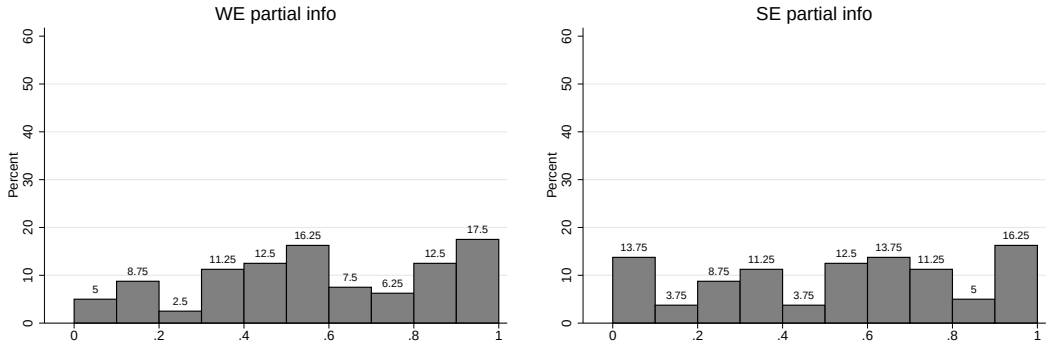
Figure A.5: Punishment of Strategic Default in Enforcer Full Info Conditions over Time



Notes: The figure displays average punishment of strategic defaults in the WE full info treatment and SE full info treatment.

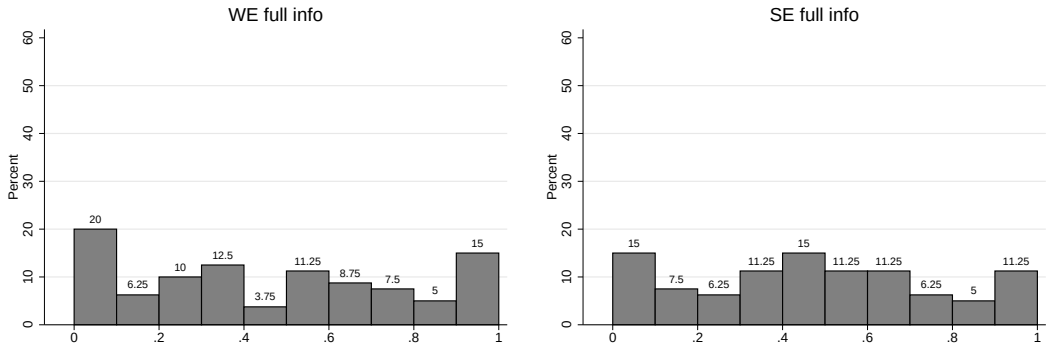
E Appendix: Social norm enforcement and strategic default rates

Figure A.6: Borrower-level strategic default rates (WE partial info vs. SE partial info)



Notes: The figure shows the percentage of borrowers who strategic default with different frequencies in the WE no enforcer treatment (left hand figure) and the SE no enforcer treatment (right hand figure). The x-axis highlights the different frequencies with which borrowers strategic default (including the lower bound and excluding the upper bound of the bins).

Figure A.7: Borrower-level strategic default rates (WE full info vs. SE full info)



Notes: The figure shows the percentage of borrowers who strategic default with different frequencies in the WE no enforcer treatment (left hand figure) and the SE no enforcer treatment (right hand figure). The x-axis highlights the different frequencies with which borrowers strategic default (including the lower bound and excluding the upper bound of the bins).

E Appendix: Instructions for Participants

Borrower Instructions

Instructions translated from German. Note that we present the instructions for borrowers in the weak economy. In the strong economy, instructions are similar, yet the probability of an income of 200 points is 90% and the probability of an income of 0 points is 10%. In the experiment, the relevant passages in the instructions as well as the computer screens are adjusted accordingly. For reasons of simplicity we only present one document here. Changes in instructions in the Enforcer Partial Information treatment are highlighted in *italic.* Further changes in the Enforcer Full Information treatment are highlighted in CAPITAL LETTERS. Thus, text in italic indicates changes from the baseline no observer treatments to the partial information treatments. Text in capital letters highlights changes in the enforcer full information treatment compared to the enforcer partial information treatment.

General Explanations for Borrowers

Welcome to the experimental laboratory!

Today, you are participating in an economics experiment. By participating, you can earn money. How much money you make depends on your own decisions and the decisions of other participants. Therefore it is important that you carefully read the following instructions.

The instructions you have received from us are for your private information. During the experiment, communication is absolutely prohibited. If you have any questions, please contact us by raising your hands. An experimenter will come to you and answer your questions. Failure to comply with the rules will result in exclusion from the experiment and all payments. The decisions you make during the experiment are anonymous. Only the experimenter learns your identity but your decisions can not be assigned to your identity.

For the participation in the experiment, you will receive a show up fee of 5 Euros. The additional payment depends on your decisions and the decisions of other participants. Your payment during the experiment will be calculated in points.

The experiment is divided into different periods. In each period, you have to make decisions that you enter in the computer. In total there are 20 periods. At the end of the experiment, 2 periods are randomly selected for your payment. The total number of points obtained in the two selected periods will be converted into Euro and then paid to you in cash. For the conversion the following exchange rate applies:

100 Points = 2.50 Euro.

In total, you receive your earnings from the 2 payment periods plus the show up fee of 5 Euro in cash.

Please wait in your cabin during the payout phase until you are summoned by us to collect your payment. Please bring all documents you have received from us when you receive your payment.

Before the experiment, all 24 participants were divided into three (*two)* groups of 8 (*12)* who independently participate in the experiment. In each group, there are 8 borrowers (*and 4 observers)*.

Throughout the experiment you are a borrower in your group of 8 *(12)*.

Brief overview about the experimental procedure

Throughout the experiment, your group consists of the same 8 *(12)* persons: you (as a borrower) and 7 other borrowers (*and 4 observers)*.

In each period, you will be randomly paired with another borrower from your group of 8. You will interact with this borrower in this period. (*In addition, a randomly selected observer from your group of 12 is assigned to each pair of borrowers. The observer observes your decision and the decision of your paired borrower*.)

At the beginning of each period, you and the other borrower have an outstanding loan debt of 100 points.

In each period, borrowers earns an income. With a probability of 50% the income is 200 points. With a probability of 50%, the income is 0.

Borrowers with an income of 200 points can decide whether they want to settle their outstanding loan debt of 100 points or not. Borrowers with an income of 0 points cannot repay the outstanding loan debt of 100 points.

In addition to the income, borrowers have an initial endowment of 200 points in each period. This initial endowment is included in the final payment but cannot be used to settle the outstanding loan debt.

An unpaid loan debt of one borrower has consequences for the other borrower, with whom she is paired in this period: If one borrower does not repay the loan debt, the payment of the other borrower is reduced by 150 points.

(After the income of both borrowers is determined and their decisions are made, the observers make their decision. The observer has an endowment of 300 points in each period. The observer receives information for each of the borrowers if the loan debt was repaid or not. The observer

can deduct between 0 and 400 points from each borrower's payout. Reducing the payoff of a borrower is associated with a cost for the observer. For every 10 points reduction of a borrowers` payoff, the observer has to pay a point.)

Your payoff as a borrower in a period will depend on your initial endowment of 200 points plus your income (either 200 points or 0 points). If a loan debt is repaid, the costs to repay the loan debt (100 points) are deducted. Additionally, in case of an unpaid loan debt of the other borrower, your payout will be reduced by 150 points. (*Additionally, your payoff will be reduced if an observer decides to deduct points from your income.)*

The payment of the observer is her initial endowment (300 points) minus the costs she incurs to deduct points from borrowers (between 0 and 80 points).

Overall, the experiment lasts for 20 periods. The procedure for the individual periods is organized as follows:

1. At the beginning of each period, each borrower is randomly paired with another borrower from the group of 8 *(12).*
2. You and the other borrower learn if your income is 200 points or 0 points in this period.
3. If your income is 200 points, you can decide whether you want to pay your loan debt or not. If your income is 0, you cannot settle your loan debt.
4. Each borrower receives information about the calculation of her payoff for this period.
5. *(The observer learns for each of the two borrowers if the loan debt was repaid or not. The observer decides whether she wants to reduce the payment of the borrowers.)*
6. Each borrower receives information about their period income. (*The observers are informed about their payoff.)*
7. At the end of the period borrowers *(and observers)* obtain information about the behavior of all borrowers (*and observers)* in their group of 8 *(12).* You get information about how many borrowers have paid their loan debts. How many borrowers did not repay their loan debt, even though they had an income of 200 points. And you get information about how many borrowers could not repay their loan debt because they had an income of 0 points. (*In addition, borrowers and observers learn for each of the following cases how many points the observers have deducted from the borrowers`*

payoffs: i) if the borrowers have paid their debt, ii) if the borrowers did not pay their debt ALTHOUGH THEY HAD AN INCOME OF 200 POINTS AND III)IF THE BORROWERS COULD NOT REPAY THEIR DEBT BECAUSE THEIR INCOME WAS 0)

After completing all 20 periods 2 periods are randomly selected for payment. The points from these 2 periods will be converted in Euros and, additionally to the 5 Euro show up fee, paid in cash.

Detailed information about the experimental procedure

Throughout the experiment you are in a group of 8 *(12)* people. The 7 *(11)* others in your group are the same people during the whole experiment. Your group of 8 *(12)* consists of 8 borrowers *(and 4 observers).* You are a borrower during the entire experiment.

In every period, you are paired with another randomly selected borrower from your group of 8 *(12)*. (*In addition, a randomly selected observer from your group of 12 is assigned to each pair of borrowers. The observer observes your decision and the decision of your paired borrower*.) Pairs of borrowers (*and the assigned observer)* are randomly allocated anew in each period so that you are always paired *(grouped)* with other borrowers *(and observers)* from your group of 8 *(12)* during the course of the experiment.

At the beginning of each period, you and the other borrower have an outstanding loan debt of 100 points.

In each period, you and the other borrower each have an initial endowment of 200 points. This initial endowment is included in your payoff, but cannot be used to settle the loan debt.

During the experiment, all participants enter their decisions on the computer. The following explanation describes in detail how you can make your decisions in each period:

Income of borrowers

In each period, your income and the income of the other borrower is determined at random. With a 50% chance, your income is 200 points. With the counter probability of 50% your income is 0 points.

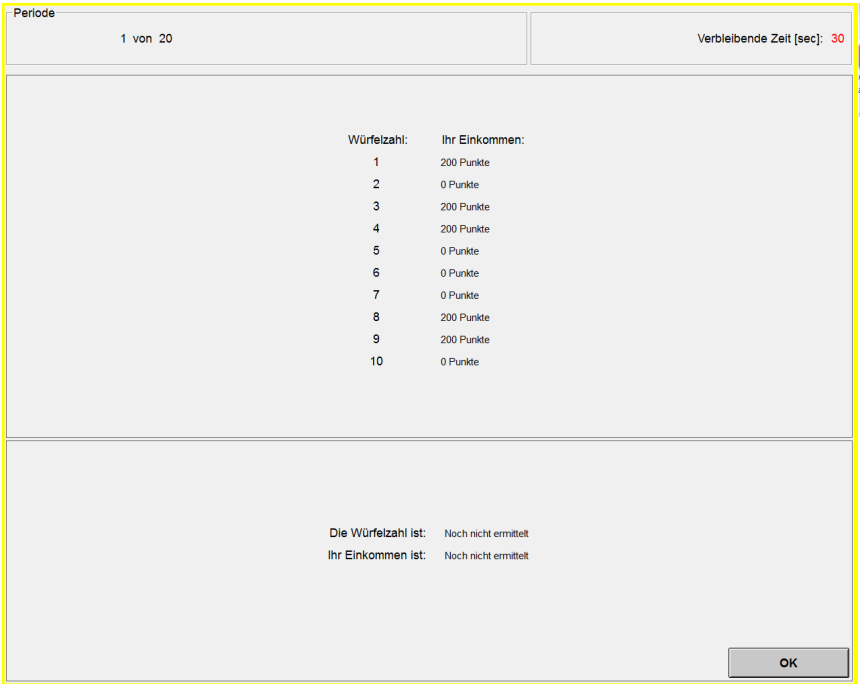
Your income is determined by the outcome of a 10 - sided die role by the experimenter. The die number is publicly announced by the experimenter and then entered into the computer program.

Already before the die role by the experimenter, you will see the numbers 1 to 10 on your screen, which correspond to the possible outcomes of the 10 - sided die role. Behind every number on the screen you can see if your income is 200 points or 0 if the corresponding number is rolled. In 5 of the 10 possible cases you receive an income of 200 points in the other 5 cases you receive an income of 0 points.

IMPORTANT!

The assignment of the die numbers to possible incomes is made independently for all borrowers. Thus, if you see that you receive a certain income; you cannot infer the income of other borrower from this. The other borrower might have the same income or another income as you. After the die number is rolled and entered into the computer program, you will see the outcome of the die role and your corresponding income at the bottom of the screen.

Example: Income screen before the die role

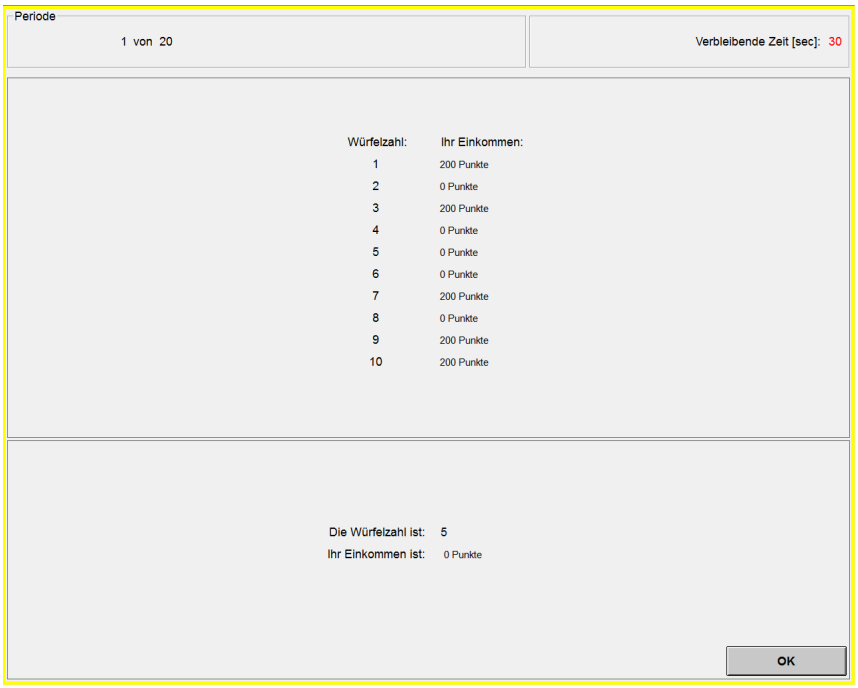


Translation:
Upper box:
1st line: Die number: Your Income
2nd – 11th row: numbers 1-10, 200/0 points
Lower box:
1st line: The die number is: Not yet determined
2nd line: Your income is: Not yet determined

The screenshot below shows an example of an income of 0 points. In this example, you would have received an income of 200 points if the numbers 1, 3, 7, 9 and 10 were rolled and an

income of 0 points if the numbers 2, 4, 5, 6 and 8 were rolled. The number diced by the experimenter in this example is a 5. You see it in the bottom box of the screen. Your also receive information about your corresponding income.

Example:

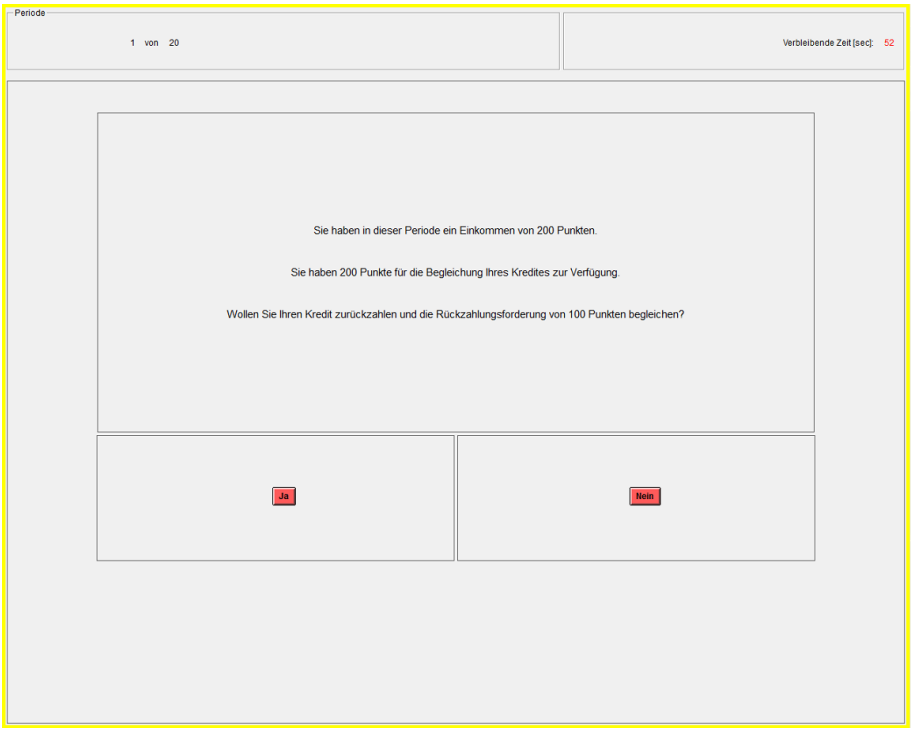


Repayment of the loan debt

If your income in a period is 0 points, you cannot repay your debt.

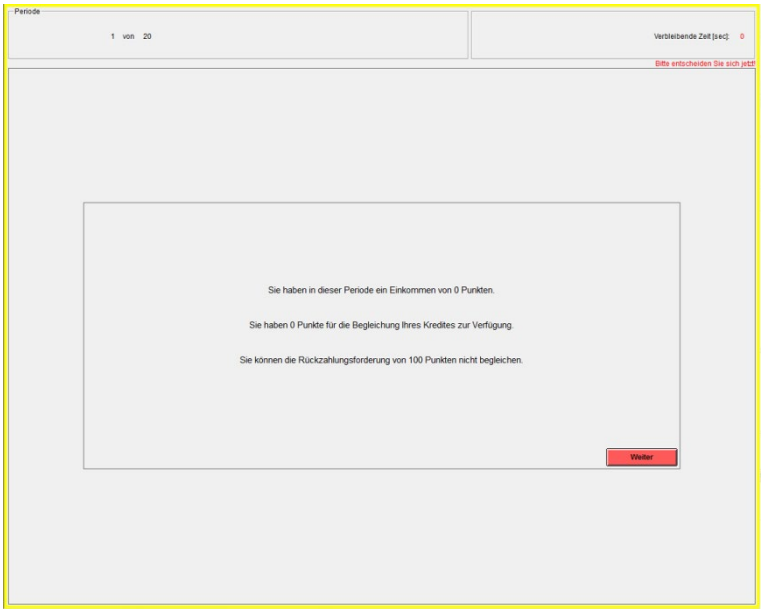
If your income is 200 points, you can choose to settle your loan debt of 100 points. If you repay the debt your payoff is reduced by 100 points. 100 points because this is the outstanding loan debt of every borrower. If you choose not to settle your loan debt, your payoff is not reduced by 100 points. You see the following screen:

Example for the repayment decision of a borrower with an income of 200 points:



Translation: 1st row: In this period you have an income of 200 points
2nd row: You have 200 points for the settlement of your debt.
3rd row: Do you want to repay your loan and settle the outstanding debt of 100 points?
4th row: Left button: Yes, Right button: No

Example for the repayment decision of a borrower with an income of 0 points:



Translation: 1st row: In this period you have an income of 0 points
2nd row: You have 0 points for the settlement of your debt.
3rd row: You cannot repay your outstanding loan debt of 100 points.
4th row: Button: Continue

If your loan debt is not repaid, the payoff of the other borrower is reduced by 150 points. This is the case regardless of whether you have an income of 0 and cannot pay your credit debt, or if you have an income of 200 points and have decided not to settle your loan debt.

If the outstanding loan debt of the other borrower is not settled, your payment will be reduced by 150 points. This is the case regardless of whether the other borrower has an income of 0 and her debt was not paid because she could not repay or if she has an income of 200 points and has decided not to settle the outstanding loan debt.

Information about the decisions of borrowers

After the income is determined and the decisions of both borrowers are made, your payment for this period is calculated.

Your payoff is calculated as follows:

Your payoff=		Your endowment (200)
	+	Your income (200 or 0)
	-	The cost of repaying the outstanding loan debt (100 or 0)
	-	Reduction of your income due to a not repaid loan of the other borrower (150 or 0)

Example 1: You have an income of 200 points. You decide to repay the outstanding loan debt. The other borrower also has an income of 200 points and also settles her debt.

- Your payoff: 200 + 200 – 100 – 0 = 300 points
- The payoff of the other borrower: 200 + 200 – 100 – 0 = 300 points

Example 2: You have an income of 200 points. You decide to repay the outstanding loan debt. The other borrower has an income of o points and therefore cannot settle her debt.

- Your payoff: 200 + 200 – 100 – 150= 150 points
- The payoff of the other borrower: 200 + 0 – 0 – 0 = 200 points

Example 3: You have an income of 200 points. You decide not to repay the outstandning loan debt. The other borrower has an income of 0 points and therefore cannot settle her debt.

- Your payoff: 200 + 200 – 0 – 150= 250 points
- The payoff of the other borrower: 200 + 0 – 0 – 150= 50 points

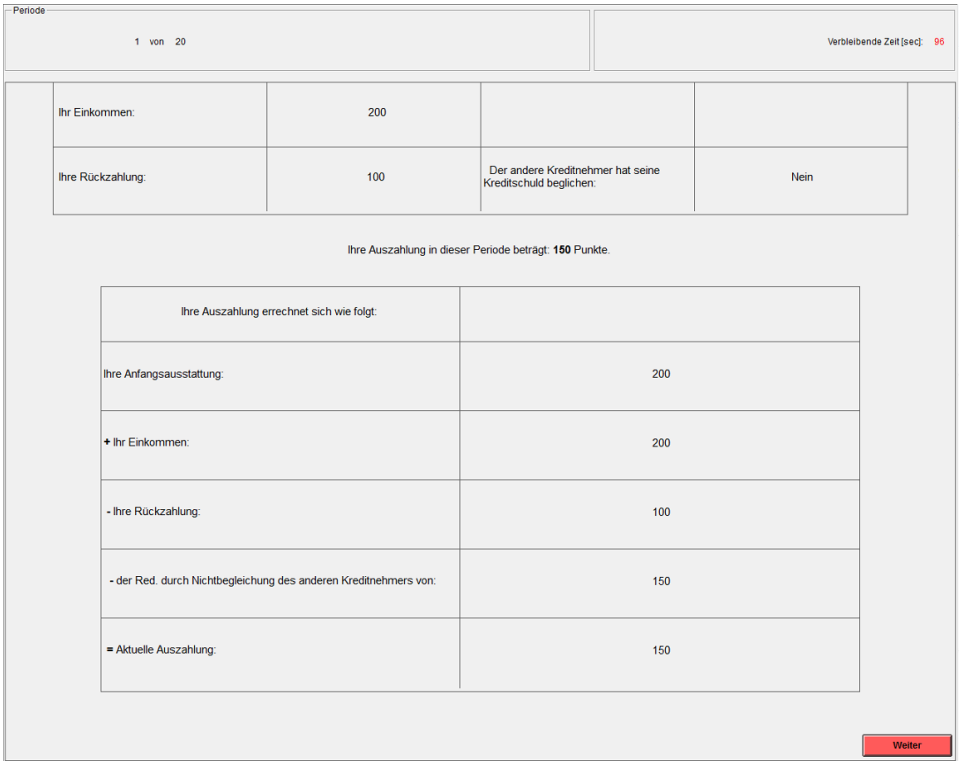
Example 4: You have an income of 0 points. The other borrower also has an income of 0 points. Both, you and the other borrower cannot settle your debts.

- Your payoff: 200 + 0 – 0 –150= 50 points
- The payoff of the other borrower: 200 + 0 – 0 –150= 50 points

---

On your computer screen you will receive information about: your income, your decision to repay or not, as well as the decision of the other borrower. The resulting payoff is also displayed:

Overview over your decision and the decision of the other borrower:



Periode

1 von 20

Verbleibende Zeit [sec]: 96

Ihr Einkommen:	200		
Ihre Rückzahlung:	100	Der andere Kreditnehmer hat seine Kreditschuld beglichen:	Nein

Ihre Auszahlung in dieser Periode beträgt: **150** Punkte.

Ihre Auszahlung errechnet sich wie folgt:	
Ihre Anfangsausstattung:	200
+ Ihr Einkommen:	200
- Ihre Rückzahlung:	100
- der Red. durch Nichtbegleichung des anderen Kreditnehmers von:	150
= Aktuelle Auszahlung:	150

Weiter

Translation:
Upper Box: Left: Top: Your income 200, Bottom: Your repayment: 100
Right: The other borrower repaid her loan debt: No
Middle Text: Your payoff in this period is: 150 points.
Lower Box:
1st row: Your payoff is computed as follows:
2nd row: Your endowment: 200
3rd row: + Your income: 200
4th row: - Your repayment: 100
5th row: - Reduction due to non repayment of the other borrower: 150
6th row: = Actual payoff: 150

Information and decision of observers *(only in observer treatments)*

Once the income of the borrowers is determined and both borrowers made their decision, the observer receives information about the outcome of the borrowers' actions.

The observer will now decide whether to deduct points from your/or the other borrower's payoff.

A deduction can only be made in increments of 10 points and an observer can deduct up to 400 points from each borrower.

A point deduction by the observer cannot reduce your (or the other borrower's) income below 0. I. e., when the observer deducts more points than a borrower has, the payoff is only reduced to 0 but not further.

A deduction of 10 points is associated with a cost of one point to the observer. The observer bears all cost of the points deducted. Even if the observer deducts more points than a borrower has. Thus, while your income as a borrower cannot be below 0 points, the points that an observer deducts that would make a borrowers income negative are still costly to the observer.

Information about your final payoff *(only in observer treatments)*

After the observer made her decision, you will receive information about your final payoff for that period. Your payoff is calculated now as follows:

Your payoff =		*Your endowment (200)*
	+	*Your income (200 or 0)*
	-	*The cost of repaying the outstanding loan debt (100 or 0)*
	-	*Reduction of your income due to a not repaid loan of the other borrower (150 or 0)*
	-	*Point reduction by the observer (between 0 and 400)*

Example 5: *You have an income of 200 points. You decide to repay the outstanding loan debt. The other borrower also has an income of 200 points also settles her debt. The observer decides to not deduct points from your payoff nor the payoff of the other borrower.*

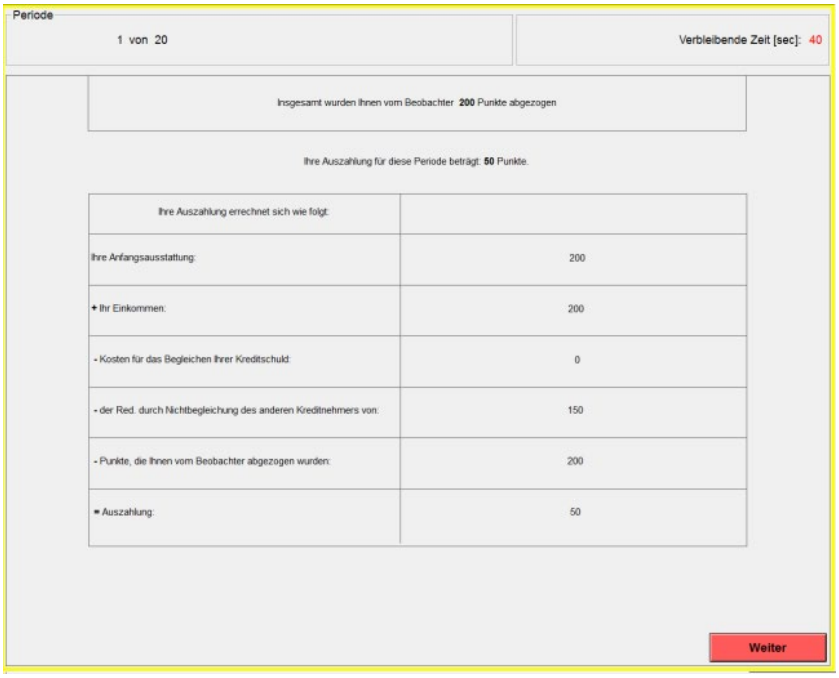
- *Your payoff: 200 + 200 – 100 – 0 – 0 = 300 points*
- *The payoff of the other borrower: 200 + 200 – 100 – 0 – 0 = 300 points*
- *The payoff of the observer: 300 points (the observer keeps her entire endowment)*

Example 6: *have an income of 200 points. You decide not to repay the outstanding loan debt. The other borrower has an income of 0 points cannot settle her debt. The observer decides to deduct 100 points from you and from the other borrower.*

- *Your payoff: 200 + 200 – 0 –150 – 100= 150 points*
- *The payoff of the other borrower: 200 + 0 – 0 – 150 – 100 = 0 points (The payoff cannot be below 0 points)*
- *The payoff of the observer: 300 – 10 – 10 = 280 points (Because every deduction of 10 points cost 1 point to the)*

An example of the decision of the observer and your final payment for a period can be seen on the following screen. If this period would be chosen as one of the two payment relevant periods you will receive this payment converted in Euros.

Example: Payoff borrower



Translation:
Top Box: In total, the observer deducted 200 points from you.
Middle: Your payoff in this period is: 50 points
Table:
1st row: Your payoff is calculated as follows:
2nd row: Your endowment: 200
3rd row: + Your income: 200
4th row: - Your repayment: 0
5th row: - Reduction due to non repayment of the other borrower: 150
6th row: - Points that were deducted from your payoff by the observer: 200
7th row: = Payoff: 50

Information about the decision of other borrowers in your group of 8

At the end of each period, you will receive a summary of information about the decisions in your group of 8 borrowers. You will be informed about how many borrowers have paid their loan debt in your group of 8, as well as how many borrowers tin your group could not settle their debt because they had an income of 0 points, and how many borrowers in your group did not pay their loan debt in your group although they had an income of 200 points.

Example: Decisions of all borrowers in your group over 5 periods

Periode

5 von 20

Übersicht über die Entscheidungen aller Kreditnehmer in Ihrer Gruppe:

Periode:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld nicht beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 0, und somit die Kreditschuld nicht beglichen haben:
1	1	3	4
2	6	1	1
3	5	1	2
4	2	1	5
5	3	0	5

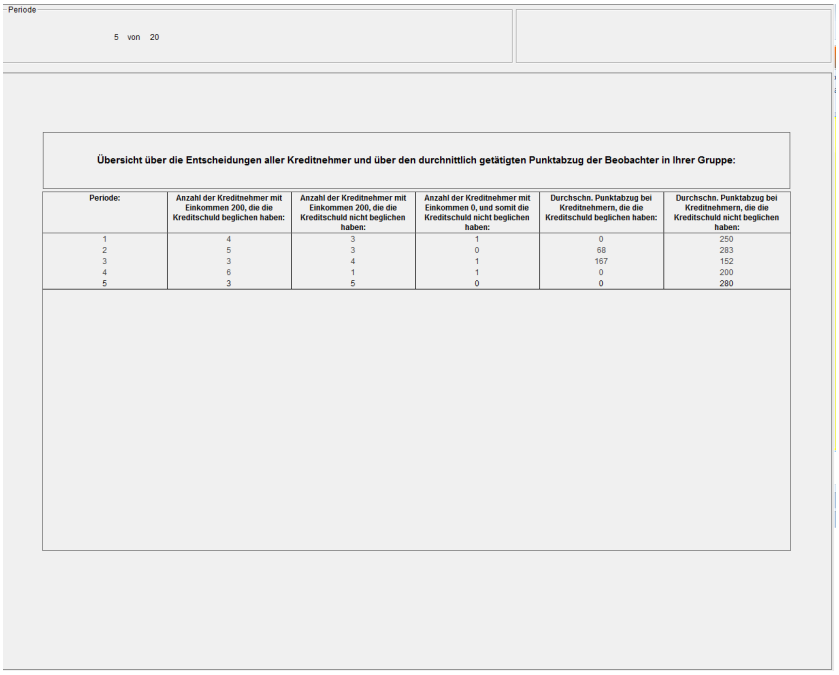
Translation:
Title: Overview over the decisions of all borrowers in your group:
First row:
Column 1: Period:
Column 2: Number of borrowers with income 200 who repaid their loan debt:
Column 3: Number of borrowers with income 200 who did not repay their loan:
Column 4: Number of borrowers with income 0 who therefore did not repay their loan:

In the above screen you see an example of the information for 5 periods. The information is provided for each current period (1-20) and for all prior periods (1-20).

Information about the decisions in your group of 12*(only in observer treatments)*

At the end of each period, you will receive a summary of information about the decisions in your group of 12. You will be informed about how many borrowers have paid their loan debt in your group of 12, as well as how many borrowers tin your group could not settle their debt because they had an income of 0 points, and how many borrowers in your group did not pay their loan debt in your group although they had an income of 200 points.
You'll also learn how many points, on average, the observers have deducted from a borrower that repaid her loan debt and how many points were on average deducted of a borrower who did not repay her loan debt DESPITE OF HAVING AN INCOME OF 200 AND HOW MANY POINTS AN OBSERVER DEDUCTED ON AVERAGE FROM A BORROWER THAT DID NOT REPAY HER DEBT BECAUSE SHE HAD AN INCOME OF 0. You will see the following screen:

Example: Decision of all borrowers and avarage reduction ob points by the observers in your group for 5 (Observer Partial Info Treatment)


Periode

5 von 20

Übersicht über die Entscheidungen aller Kreditnehmer und über den durchnittlich getätigten Punktabzug der Beobachter in Ihrer Gruppe:

Periode:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld nicht beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 0, und somit die Kreditschuld nicht beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern, die die Kreditschuld beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern, die die Kreditschuld nicht beglichen haben:
1	4	3	1	0	250
2	5	3	0	68	283
3	3	4	1	167	152
4	6	1	1	0	200
5	3	5	0	0	280

Translation:
Title: Overview over the decisions of all borrowers and average deduction of points by the observers in your group:
First row:
Column 1: Period:
Column 2: Number of borrowers with income 200 who repaid their loan debt:
Column 3: Number of borrowers with income 200 who did not repay their loan:
Column 4: Number of borrowers with income 0 who therefore did not repay their loan:
Column 5: Average deduction of points from borrowers who repaid their loan debt:

Column 6: Average deduction of points from borrowers who did not repay their loan debt:

Example: Decision of all borrowers and avarage reduction ob points by the observers in your group for 5 (OBSERVER FULL INFORMATION TREATMENT)

Periode

5 von 20

Verbleibende Zeit [sec]: 16

Übersicht über die Entscheidungen aller Kreditnehmer und über den durchnittlich getätigten Punktabzug der Beobachter in Ihrer Gruppe:

Periode:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld nicht beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 0, und somit die Kreditschuld nicht beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern, die die Kreditschuld beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern mit Einkommen 200, die die Kreditschuld nicht beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern mit Einkommen 0, und somit die Kreditschuld nicht beglichen haben:
1	3	2	3	33	200	67
2	2	0	6	0	0	0
3	5	1	2	0	300	0
4	3	2	3	0	100	0
5	2	4	2	0	45	0

TRANSLATION.
COLUMN 6: AVERAGE DEDUCTION OF POINTS FROM BORROWERS WITH AN INCOME OF 200 WHO DID NOT REPAY THEIR LOAN DEBT
COLUMN 7: AVERAGE DEDUCTION OF POINTS FROM BORROWERS WITH AN INCOME OF 0 WHO DID NOT REPAY THEIR LOAN DEBT

In the above screen you see an example of the information for 5 periods. The information is provided for each current period (1-20) and for all prior periods (1-20).

Payment

After the 20 periods a participant is selected at random to come to the experimenter and draw 2 distinct numbers between 1 and 20 from a deck of numbered cards. The numbers will be publicly announced and determine the payment periods for all participants. Therefore 2 different periods will be randomly selected for payment. The selected periods will be entered into the computer program by the experimenter. Your earnings will then be reported on the screen.

Your payoff is computed as follows:

Your payoff for pay period 1 in points
+ Your payoff for pay period 2 in points
= Your overall payoff in points

Your final payoff in Euro (100 points = 2.50 Euro)
+ The show up fee = 5 Euro
= Your payoff in Euro

After completion of the experiment and before we start with the payouts, please fill in the questionnaire that follows the experiment. When you have completed the questionnaire, please remain seated at your place before we start paying out the participants. Please wait in your cabin until you are called by us to collect your payment. Please bring all documents you have received from us when you receive your payment.

The experiment begins when all participants are fully familiar with the procedure of the experiment and understand the consequences of their decisions and the decisions of others for their earnings. To ensure this, we ask you to solve some control questions. Your solutions to the control questions have no effect on the income you can earn in the experiment.

You receive the control questions below in paper form and on the computer screen. Please solve them on paper first. In order to verify the accuracy of your answers you are asked to answer the questions again on the computer screen.

The experiment begins, once you correctly solved all the control questions. After completion of the experiment, please fill in a questionnaire on the screen. Then, the payout commences.

If you have any questions, please raise your hand. An experimenter comes to you and will answer your question.

Overview over the calculation of payoffs for borrowers

Your payout as a borrower is calculated as follows:

Your payoff is calculated as follows:

Your payoff=		Your endowment (200)
	+	Your income (200 or 0)
	-	The cost of repaying the outstanding loan debt (100 or 0)
	-	Reduction of your income due to a not repaid loan of the other borrower (150 or 0)

1. You receive an income of 200 points in addition to your endowment of 200 points.

Table: Example for possible payoffs depending on your decisions and the decision of the other borrower if you receive an income of 200 points

Your endowmnet	**Your income**	**Cost for repaying the loan debt**	**Reduction of points due to non repayment of the other borrower**	**Your payoff**
200	+200	0	0	400
200	+200	-100	0	300
200	+200	0	-150	250
200	+200	-100	-150	150

2. You receive an income of 0 points in addition to your endowment of 200 points.

Table: Example for possible payoffs depending on your decisions and the decision of the other borrower if you receive an income of 0 points

Your endowment	**Your income**	**Cost for repaying the loan debt**	**Reduction of points due to non repayment of the other borrower**	**Your payoff**
200	0	0	0	200
200	0	0	-150	50

Overview over the calculation of payoffs for borrowers and observers

Your payout *as a borrower is calculated as follows:*

Your payoff is calculated as follows:

Your payoff =		*Your endowment (200)*
	+	*Your income (200 or 0)*
	-	*The cost of repaying the outstanding loan debt (100 or 0)*
	-	*Reduction of your income due to a not repaid loan of the other borrower (150 or 0)*
	-	*Point reduction by the observer (between 0 and 400)*

Below, some examples are highlighted:

1. You receive an income of 200 points in addition to your endowment of 200 points.

Table: Example for possible payoffs depending on your decisions and the decision of the other borrower and the observer if you receive an income of 200 points.

Your endwoment	***Your income***	***Cost for repaying the loan debt***	***Reduction of points due to non repayment of the other borrower***	***Point deduction by the observer***	***Your payoff***
200	*+200*	*0*	*0*	*0*	*400*
200	*+200*	*-100*	*0*	*0*	*300*
200	*+200*	*0*	*-150*	*0*	*250*
200	*+200*	*-100*	*-150*	*0*	*150*
200	*+200*	*0*	*0*	*-400*	*0*
200	*+200*	*0*	*0*	*-300*	*100*
200	*+200*	*0*	*-150*	*-400*	*0*
200	*+200*	*0*	*-150*	*-100*	*150*
200	*+200*	*-100*	*0*	*-200*	*100*
200	*+200*	*-100*	*0*	*-50*	*250*
200	*+200*	*-100*	*-150*	*-100*	*50*
200	*+200*	*-100*	*-150*	*-50*	*100*

2. You receive an income of 0 points in addition to your endowment of 200 points.

Table: Example for possible payoffs depending on your decisions and the decision of the other borrower and the observer if you receive an income of 0 points

Your endowment	***Your income***	***Cost for repaying the loan debt***	***Reduction of points due to non repayment of the other borrower***	***Point deduction by the observer***	***Your payoff***
200	*0*	*0*	*0*	*0*	*200*
200	*0*	*0*	*-150*	*0*	*50*
200	*0*	*0*	*0*	*-400*	*0*
200	*0*	*0*	*-150*	*-200*	*0*
200	*0*	*0*	*-150*	*-10*	*40*

The payoff of the observer is calculated as follows:

Payoff observer =	*Endowment (300)*
-	*Cost for deducting pints from borrower A (between 0 and 40)*
-	*Cost for deducting pints from borrower B (between 0 and 40)*

Control Questions

Question:

a) What is your endowment at the beginning of each period?

Answer:

b) What is the probability that your income in one period is 200 points?

Answer:

c) Are you able to repay the outstanding loan debt if your income is 0 points?

Answer:

d) By how many points will your payoff be reduced if you repay your loan debt?

Answer:

e) By how many points will your payoff be reduced if you do not repay your loan debt?

Answer:

f) By how many points will the payoff of the other borrower be reduced if you do not repay your loan debt?

Answer:

g) By how many points will your payoff be reduced if the other borrower does not repay her loan debt?

Answer:

h) By how many points is the payoff of the observer reduced if the observer decides to deduct 100 points from one borrower?

Answer:

i) By how many points ist he payoff of the observer reduced if the observer deducts 400 points from one borrower?

Answer:

Enforcer Instructions

Instructions translated from German. Note that we present the instructions for observers in the weak economy. In the strong economy, instructions are similar, yet the probability of a borrower's income of 200 points is 90% and the probability of an borrower's income of 0 points is 10%. In the experiment, the relevant passages in the instructions as well as the computer screens are adjusted accordingly. For reasons of simplicity we only present one document here. Changes in instructions in the Enforcer Full Information treatment compared to the Enforcer Partial Information treatment are highlighted in *italic.*

General Explanations for Observers

Welcome to the experimental laboratory!

Today, you are participating in an economics experiment. By participating, you can earn money. How much money you make depends on your own decisions and the decisions of other participants. Therefore it is important that you carefully read the following instructions.

The instructions you have received from us are for your private information. During the experiment, communication is absolutely prohibited. If you have any questions, please contact us by raising your hands. An experimenter will come to you and answer your questions. Failure to comply with the rules will result in exclusion from the experiment and all payments. The decisions you make during the experiment are anonymous. Only the experimenter learns your identity but your decisions can not be assigned to your identity.

For the participation in the experiment, you will receive a show up fee of 5 Euros. The additional payment depends on your decisions and the decisions of other participants. Your payment during the experiment will be calculated in points.

The experiment is divided into different periods. In each period, you have to make decisions that you enter in the computer. In total there are 20 periods. At the end of the experiment, 2 periods are randomly selected for your payment. The total number of points obtained in the

two selected periods will be converted into Euro and then paid to you in cash. For the conversion the following exchange rate applies:

100 Points = 2.50 Euro.

In total, you receive your earnings from the 2 payment periods plus the show up fee of 5 Euro in cash.

Please wait in your cabin during the payout phase until you are summoned by us to collect your payment. Please bring all documents you have received from us when you receive your payment.

Before the experiment, all 24 participants were divided into two groups of 12 who independently participate in the experiment. In each group, there are 8 borrowers and 4 observers.

Throughout the experiment you are an observer in your group of 12.

Brief overview about the experimental procedure

Throughout the experiment, your group consists of the same 12 persons: you (as an observer), 3 other observers and 9 borrowers.

In each period, you observe the decision of two randomly paired borrowers from your group of 12.

At the beginning of each period, the two borrowers have an outstanding loan debt of 100 points.

In each period, the borrowers earns an income. With a probability of 50% the income is 200 points. With a probability of 50%, the income is 0.
Borrowers with an income of 200 points can decide whether they want to settle their outstanding loan debt of 100 points or not. Borrowers with an income of 0 points cannot repay the outstanding loan debt of 100 points.

In addition to the income, the borrowers have an initial endowment of 200 points in each period. This initial endowment is included in the final payment but cannot be used to settle the outstanding loan debt.

An unpaid loan debt of one borrower has consequences for the other borrower, with whom she is paired in this period: If one borrower does not repay the loan debt, the payment of the other borrower is reduced by 150 points.

After the income of both borrowers is determined and their decisions are made, you as an observer, make your decision. You receive information for each of the borrowers if the loan debt was repaid or not. You have an endowment of 300 points in each period. You can decide to deduct between 0 and 400 points from each borrower's payout. Reducing the payoff of a borrower is associated with a cost for you. For every 10 points reduction of a borrowers` payoff, you have to pay one point.

Your payoff as an observer in a period will depend on your initial endowment of 300 points minus the costs to deduct points from the borrowers' payoff (between 0 and 80 points).

Overall, the experiment lasts for 20 periods. The procedure for the single periods is organized as follows:

1. At the beginning of a period, each observer is assigned a pair of borrowers from her group of 12 whose behavior she observes.
2. The borrowers learn if their income is 200 points or 0 points in this period.
3. Borrowers with an income of 200 points can decide whether to pay their loan debt or not. Borrowers with an income of 0 cannot settle their loan debt.
4. Each borrower receives information about the calculation of her payoff for this period.
5. The observer learns for each of the two borrowers if the loan debt was repaid or not. The observer decides whether to reduce the payment of the borrowers or not.
6. Each borrower receives information about their period income. The observers are informed about their payoff.
7. At the end of the period borrowers and observers obtain information about the behavior of all borrowers and observers in their group of 12. You get information about how many borrowers have paid their loan debts. How many borrowers did not repay their loan debt, even though they had an income of 200 points. And you get information about how many borrowers could not repay their loan debt because they had an income of 0 points. In addition, borrowers and observers learn for each of the following cases how many points the observers have deducted from the borrowers` payoffs: i) if the borrowers have paid their debt, ii) if the borrowers did not pay their debt *although they had an income of 200 points and iii.) if the borrowers could not repay their debt because their income was 0.*

After completing all 20 periods 2 periods are randomly selected for payment. The points from these 2 periods will be converted in Euros and, additionally to the 5 Euro show up fee, paid in cash.

Detailed information about the experimental procedure

Throughout the experiment you are in a group of 12 people. The 11 others in your group are the same people during the whole experiment. Your group of 12 consists of 8 borrowers and 4 observers. You are an observer during the entire experiment.

In every period, you observe the behavior of two randomly paired borrowers from your group of 12. The paired borrowers are allocated at random to the observers. In each period, new pairs of borrowers are build randomly and then allocated to an observer. Thus, you observe the decisions of different borrowers from your group of 12 during the course of the experiment.

At the beginning of each period, the two borrowers whose decisions you observe each have an outstanding loan debt 100 points. In each period, the borrowers each have an initial endowment of 200 points. This initial endowment cannot be used to settle the loan debt.

At the beginning of each period you, as an observer, have an initial endowment of 300 points.

During the experiment, all participants enter their decisions on the computer. The following explanation describes in detail how you can make your decisions in each period:

Income of borrowers

In each period, the income of the borrowers is re-determined at random. With a probability of 50%, the income of a borrower is 200 points. With the counter probability of 50% a borrower's income is 0 points.

The income of a borrower is determined by the outcome of a 10 - sided die role by the experimenter. The die number is publicly announced by the experimenter and then entered into the computer program.

The assignment of the die numbers to possible incomes is made independently for all borrowers. Thus, if a borrower receives a certain income; she cannot infer the income of other borrower from this.

Repayment of the loan debt and payoff of borrowers

If a borrowers' income in a period is 0 points, she cannot repay her debt.
If a borrower's income is 200 points, she can choose to settle her loan debt of 100 points. If she repays the debt her payoff is reduced by 100 points. 100 points because this is the outstanding loan debt of every borrower. If the borrower chooses not to settle her loan debt, her payoff is not reduced by 100 points. If a loan debt is not repaid, the payoff of the other borrower is reduced to 150 points. This is the case regardless of whether a borrower has an income of 0 and cannot repay the loan debt, or if a borrower has an income of 200 points and decided not to settle her loan debt.

Thus, at this point of an experimental period, a borrowers' income is determined as follows:

Borrowers` payoff=		Endowment (200)
	+	Income (200 or 0)
	-	The cost of repaying the outstanding loan debt (100 or 0)
	-	Reduction of the income due to a not repaid loan of the other borrower (150 or 0)

Example 1: Borrower A has an income of 200 points and decides to repay the outstanding loan debt. Borrower B also has an income of 200 points and also settles her debt.

- Payoff borrower A: 200 + 200 – 100 – 0 = 300 points
- Payoff borrower B: 200 + 200 – 100 – 0 = 300 points

Example 2: Borrower A has an income of 200 points and decides to repay the outstanding loan debt. Borrower B also has an income of 0 points and therefore cannot settle her debt.

- Payoff borrower A: 200 + 200 – 100 – 150= 150 points
- Payoff borrower B: 200 + 0 – 0 – 0 = 200 points

Example 3: Borrower A has an income of 200 points and decides not to repay the outstanding loan debt. Borrower B has an income of 0 points and therefore cannot settle her debt.

- Payoff borrower A: 200 + 200 – 0 – 150= 250 points
- Payoff borrower B: 200 + 0 – 0 – 150= 50 points

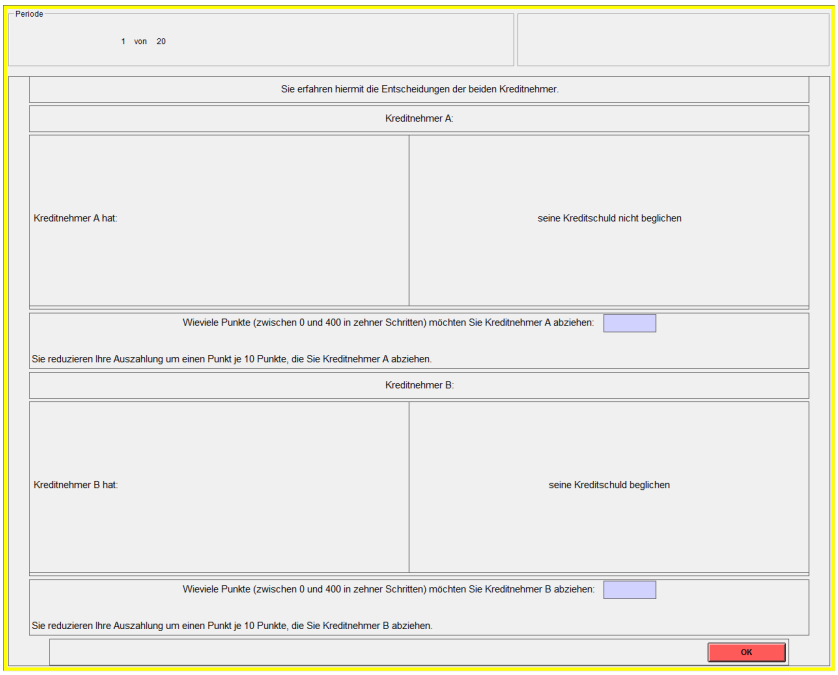
Example 4: Borrower A has an income of 0 points. Borrower B also has an income of 0 points. Thus, both borrowers cannot settle their debts.

- Payoff borrower A: 200 + 0 – 0 –150= 50 points
- Payoff borrower B: 200 + 0 – 0 –150= 50 points

Information and decision of observers

Once the income of the borrowers is determined and both borrowers made their decision, you receive information about the outcome of the borrowers' actions.

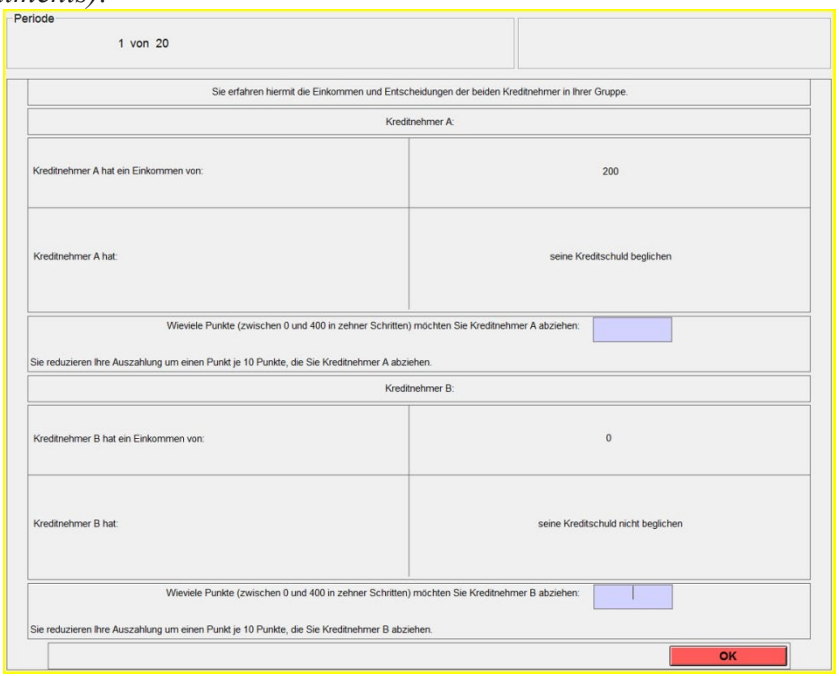
You see the following screen: (Partial Info Treatments):



Translation:
Top half:
Line 1: You receive information about the decision of borrower A
Line 2: Borrower A:
Line 3: Borrower A did: not repay the loan debt.
Line 4: How many points would you like to deduct from borrower A (between 0 and 400 in increments of 10)

Line 5: Your payoff is reduced by one point for every ten points you deduct from borrower A.
Bottom half:
Similar to the top except decisions for borrower B are displayed plus:
Line 3: Borrower B did: repay the loan debt.

(Full Info Treatments):



Translation:
Compared to the Partial Info Treatment a line is added between line 2 and line 3 (top half):
New line 2: Borrower A has an income of: 200.
Bottom half: Borrower B has an income of: 0.

You can now decide whether you want to deduct points from the borrowers' payoff.

You can deduct between 0 and 400 points from each borrower's payoff. A deduction can only be made in increments of 10 points. You can choose do deduct points from one borrower independent from how many points you decide to deduct from the other borrower.

If you decide to deduct points from a borrowers' payoff this deduction is associated with some cost. A deduction of 10 points cost one point. Thus the cost you potentially have to bear are between 0 and 80 points (if you decide to deduct 400 points from each borrower).

The final payoff of a borrower is calculated as follows:

Borrowers‘ payoff =		Endowment of a borrower (200)
	+	Income of a borrower (200 or 0)
	-	The cost of repaying the outstanding loan debt (100 or 0)
	-	Reduction of the income due to a not repaid loan of the other borrower (150 or 0)
	-	Point reduction by the observer (between 0 and 400)

A point deduction cannot reduce a borrower’s income below 0. I. e., when an observer deducts more points than a borrower has, the payoff is only reduced to 0 but not further. However, you have to bear the full cost for all points you deduct even though the points that you would deduct would make a borrowers’ income negative.

Information about your final payoff

Your final payoff for a period is your endowment of 300 points minus the cost that occur for deducting points from the borrowers' payoffs:

Your payoff =		Your endowment (300)
	-	Cost of deducting points from borrowers' payoff (between 0 and 80)

Example 5: Borrower A has an income of 200 points and decides to repay the outstanding loan debt. Borrower B also has an income of 200 points and also settles her debt. You decide not to deduct points from either borrower.

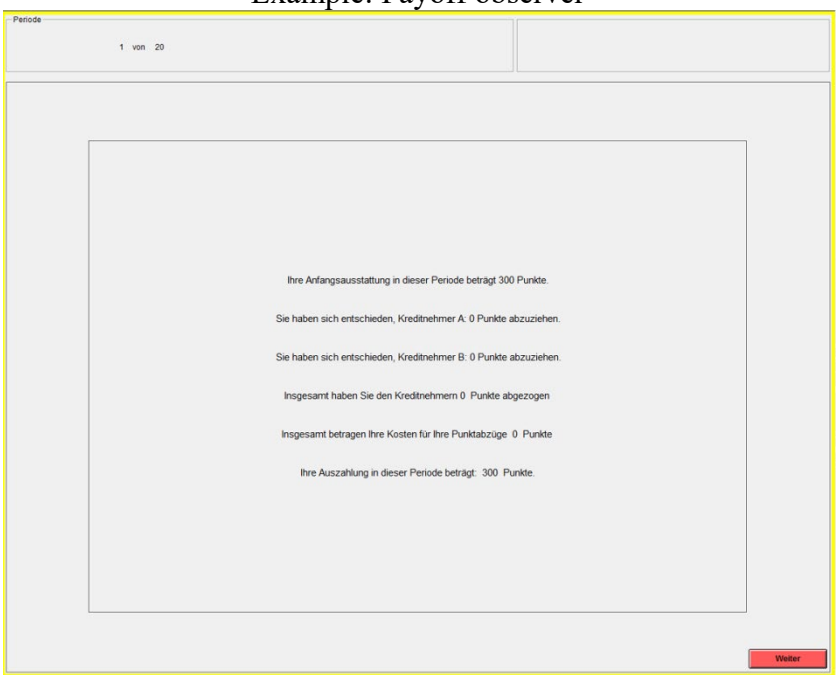
- Payoff borrower A: 200 + 200 – 100 – 0 – 0 = 300 points
- Payoff borrower B: 200 + 200 – 100 – 0 – 0 = 300 points
- Your payoff as an observer: 300 points

Beispiel 6: Borrower A has an income of 200 points and decides not to repay the outstanding loan debt. Borrower B has an income of 0 points and therefore cannot settle her debt. You decide to deduct 100 points from the payoff of borrower A and also 100 points from the payoff of borrower B.

- Payoff borrower A: 200 + 200 – 0 – 150 – 100 = 150 points
- Payoff borrower B: 200 + 0 – 0 – 150 – 100 = 0 points (The payoff cannot be negative)
- Your payoff as an observer: 350 – 10 – 10 = 330 points (Because every deduction of 10 points is associated with a cost of 1point)

An example of your choices as observer and your payment for one period are highlighted on the following screen. If this period would be chosen as one of the two relevant payment periods, you would receive this payment converted in Euros.

Example: Payoff observer



Translation:
Line 1: Your endowment in this period is 300 points.
Line 2: You decided to deduct 0 points from borrower A.
Line 3: You decided to deduct 0 points from borrower B.
Line 4: In total, you deducted 0 points.
Line 5: The cost for the sum of points that you deducted are 0 points.
Line 6: Your payoff in this period is: 300 points.

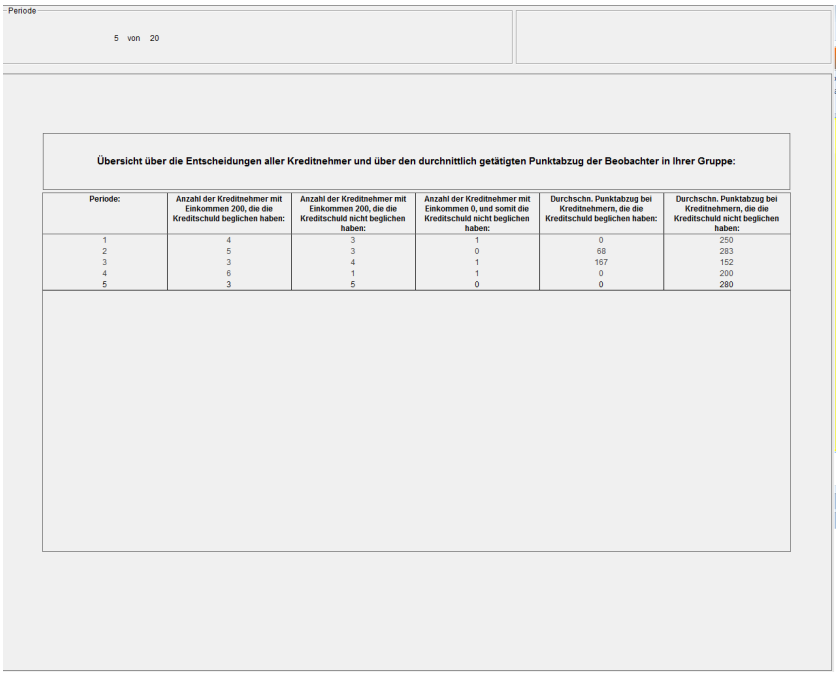
Information about the decisions in your group of 12

At the end of each period, you will receive a summary of information about the decisions in your group of 12. You will be informed about how many borrowers have paid their loan debt in your group of 12, as well as how many borrowers in your group could not settle their debt because they had an income of 0 points, and how many borrowers in your group did not pay their loan debt in your group although they had an income of 200 points.

You'll also learn how many points, on average, the observers have deducted from a borrower that repaid her loan debt and how many points were on average deducted of a borrower who did not repay her loan debt *despite of having an income of 200 and how many points an observer deducted on average from a borrower who did not repay her debt because she had an income of 0.*

You will see the following screen:

Example: Decision of all borrowers and avarage reduction ob points by the observers in your group for 5 periods (Partial Information Treatment)



Periode

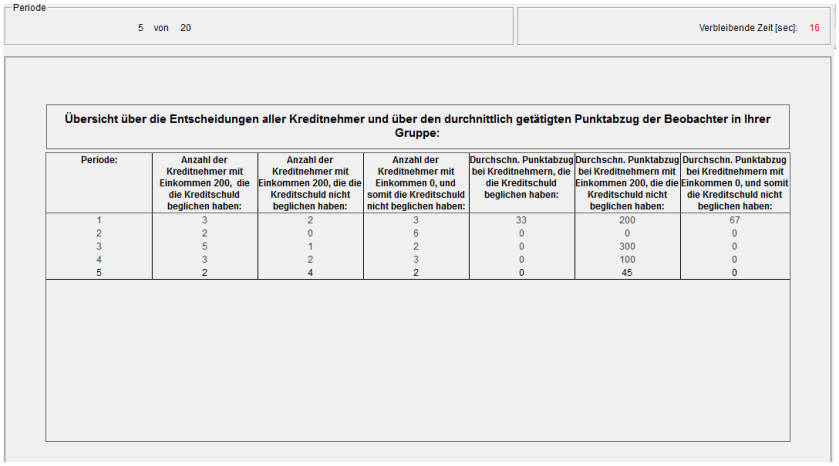
5 von 20

Übersicht über die Entscheidungen aller Kreditnehmer und über den durchnittlich getätigten Punktabzug der Beobachter in Ihrer Gruppe:

Periode:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld nicht beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 0, und somit die Kreditschuld nicht beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern, die die Kreditschuld beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern, die die Kreditschuld nicht beglichen haben:
1	4	3	1	0	250
2	5	3	0	68	283
3	3	4	1	167	152
4	6	1	1	0	200
5	3	5	0	0	280

Translation:
Title: Overview over the decisions of all borrowers and average deduction of points by the observers in your group:
First row:
Column 1: Period:
Column 2: Number of borrowers with income 200 who repaid their loan debt:
Column 3: Number of borrowers with income 200 who did not repay their loan:
Column 4: Number of borrowers with income 0 who therefore did not repay their loan:
Column 5: Average deduction of points from borrowers who repaid their loan debt:
Column 6: Average deduction of points from borrowers who did not repay their loan debt:

Example: Decision of all borrowers and avarage reduction ob points by the observers in your group for 5 periods (Full Information Treatment)



Periode

5 von 20

Verbleibende Zeit [sec]: 16

Übersicht über die Entscheidungen aller Kreditnehmer und über den durchnittlich getätigten Punktabzug der Beobachter in Ihrer Gruppe:

Periode:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 200, die die Kreditschuld nicht beglichen haben:	Anzahl der Kreditnehmer mit Einkommen 0, und somit die Kreditschuld nicht beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern, die die Kreditschuld beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern mit Einkommen 200, die die Kreditschuld nicht beglichen haben:	Durchschn. Punktabzug bei Kreditnehmern mit Einkommen 0, und somit die Kreditschuld nicht beglichen haben:
1	3	2	3	33	200	67
2	2	0	6	0	0	0
3	5	1	2	0	300	0
4	3	2	3	0	100	0
5	2	4	2	0	45	0

Translation:
Column 6: Average deduction of points from borrowers with an income of 200 who did not repay their loan debt
Column 7: Average deduction of points from borrowers with an income of 0 who did not repay their loan debt

In the above screen you see an example of the information for 5 periods. The information is provided for each current period (1-20) and for all prior periods (1-20).

Payment

After the 20 periods a participant is selected at random to come to the experimenter and draw 2 distinct numbers between 1 and 20 from a deck of numbered cards. The numbers will be publicly announced and determine the payment periods for all participants. Therefore 2 different periods will be randomly selected for payment. The selected periods will be entered into the computer program by the experimenter. Your earnings will then be reported on the screen.

Your payoff is computed as follows:

Your payoff for pay period 1 in points
+ Your payoff for pay period 2 in points
= Your overall payoff in points

Your final payoff in Euro (100 points = 2.50 Euro)
+ The show up fee = 5 Euro
= Your payoff in Euro

After completion of the experiment and before we start with the payouts, please fill in the questionnaire that follows the experiment. When you have completed the questionnaire, please remain seated at your place before we start paying out the participants. Please wait in your cabin until you are called by us to collect your payment. Please bring all documents you have received from us when you receive your payment.

The experiment begins when all participants are fully familiar with the procedure of the experiment and understand the consequences of their decisions and the decisions of others for their earnings. To ensure this, we ask you to solve some control questions. Your solutions to the control questions have no effect on the income you can earn in the experiment.

You receive the control questions below in paper form and on the computer screen. Please solve them on paper first. In order to verify the accuracy of your answers you are asked to answer the questions again on the computer screen.

The experiment begins, once you correctly solved all the control questions. After completion of the experiment, please fill in a questionnaire on the screen. Then, the payout commences.

If you have any questions, please raise your hand. An experimenter comes to you and will answer your question.

Overview over the calculation of payoffs for borrowers and observers

Your payout as an observer is calculated as follows:

Your payoff =		Endowment (300)
	-	Cost for deducting pints from borrower A (between 0 and 40)
	-	Cost for deducting pints from borrower B (between 0 and 40)

The payoff of a borrower is calculated as follows:

Borrowers' payoff =		Your endowment (200)
	+	Your income (200 or 0)
	-	The cost of repaying the outstanding loan debt (100 or 0)
	-	Reduction of your income due to a not repaid loan of the other borrower (150 or 0)
	-	Point reduction by the observer (between 0 and 400)

Control Questions

Question:

a) What is the endowment of a borrower at the beginning of each period?

Answer:

b) What is the probability that the income of a borrower in one period is 200 points?

Answer:

c) Can a borrower repay the outstanding loan debt if the income is 0 points?

Answer:

d) By how many points will the payoff of a borrower be reduced if she repays her loan debt?

Answer:

e) By how many points will the payoff of a borrower be reduced if she does not repay her loan debt?

Answer:

f) By how many points will the payoff of the other borrower be reduced if you do not repay your loan debt?

Answer:

g) By how many points will the payoff of one borrower be reduced if the other borrower does not repay her loan debt?

Answer:

h) By how many points is your payoff reduced if you decide to deduct 100 points from one borrower?

Answer:

i) By how many points is your payoff reduced if you deduct 400 points from one borrower?

Answer: