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Social Norms and Strategic Default^{*}

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Abstract

This paper studies the behavioral mechanisms underlying the increase in strategic defaults during an economic crisis. We report data from a laboratory experiment in which we exogenously vary the state of the economy. Our data reveal two main reasons for why an economic contraction adversely affects repayments. First, weak economic conditions seem to soften debtors' moral constraints. When surrounded by insolvency, solvent debtors become less hesitant to default strategically. Second, an economic downturn also undermines the enforcement of social repayment norms by peers. However, we find that the decrease in norm enforcement is not caused by a break-down of the repayment norm itself, but rather is a consequence of the additional informational uncertainty that weak economic conditions create. In a crisis peers are reluctant to sanction defaulters, because the risk of harming innocent debtors is higher.

Keywords: Strategic Default, Moral Constraints, Social Norms

JEL codes: G01, G02, C91

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1 Introduction

Consumers and entrepreneurs regularly face decisions to settle their financial obligations or to default on due payments; e.g. installments on bank loans, credit card bills, 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 can be problematic from an efficiency point of view, because they often not only impose a loss on the creditor, but also create negative pecuniary externalities for other economic agents. Negative externalities of strategic default were, for example, highlighted in the recent U.S. mortgage crisis when high delinquency rates led to a substantial increase in foreclosures.¹ Recent evidence suggests that high foreclosure rates are 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). Another example of negative externalities is related to joint-liability contracts in microfinance: When one borrower fails to make a loan installment, other borrowers are called upon to make up for the payment. Moreover, delinquencies within a lending group may limit future access to credit for the whole group of borrowers (Besley and Coate, 1995). Beyond the credit market, 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 decisions imply that strategic defaults may trigger moral constraints. Indeed, evidence indicates that many people feel that solvent debtors have a moral obligation to repay their debt. For example, 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.² These findings are in line with evidence from the behavioral literature suggesting 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 motivate households to repay even if a strategic default would be in their narrow economic interest. Moreover, when 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

¹The annual number of homes subject to a foreclosure sale increased from less than 100'000 in 2005-2006 to nearly 1 million in 2008-2011.

²The 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>

social costs and stigma associated with defying the norm that debts should be paid (Fay et al., 2002; Gross and Souleles, 2002). 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).

The preventive force of moral constraints and social norms may, however, crucially depend on underlying economic conditions. Guiso et al. (2013) argue that during the 2007-2009 crisis a change in household or societal attitudes may have led to a contagious propagation of defaults in the mortgage market.³ Empirical evidence by Towe and Lawley (2013), Bradley et al. (2015) and Gupta (2016) shows that the contagion of defaults in local mortgage markets goes well beyond what one could expect due to immediate price effects. These findings are consistent with the conjecture that strategic default rates increase strongly under weak economic conditions, because households feel less obliged to repay their mortgage (weaker moral constraints) and 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 different behavioral channels underlying the increase in strategic defaults in an economic crisis. 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 fundamental 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 sanctioning technology in our game allows us to directly measure the extent to which social norms are enforced by 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 a negative economic shock on repayment behavior and norm enforcement.

We implement a stochastic prisoner’s dilemma game that mirrors a debtor’s repayment decision 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 society). In our experiment the ability of the borrowers to cooperate is stochastic: with a probability γ they have a sufficiently high 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 (fun-

³Their data shows, for example, that during the crisis the individual propensity to engage in strategic default was amplified if the respondent was acquainted to someone else who defaulted strategically.

damentally) 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 cost).

To study the behavioral determinants of strategic default across economic conditions, we exogenously manipulate the frequency of fundamental defaults in the economy across treatments. In addition, we not only study treatments with and without third-party enforcers, but also vary the information that enforcers have about borrowers’ personal economic situation. Specifically, we vary whether or not enforcers can distinguish strategic from fundamental 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 a negative shock on individual moral constraints from that on social norm enforcement, and iii) to separate the different channels through which a crisis may weaken the enforcement of social norms by peers.

Our data confirm that in the absence of norm enforcement by peers an economic downturn substantially increases borrowers’ disposition to engage in strategic default. Whereas roughly half of all solvent borrowers repay when the state of the economy is strong, the repayment rate drops by nearly 25 percent when the economy turns weak. These findings are in line with the hypothesis that moral concerns are less likely to mitigate strategic default once bad economic conditions force others around them to default as well. In addition, the results of our experiment also back up the claim that the state of the economy has a substantial impact on the effectiveness of norm enforcement by peers. If enforcers cannot cleanly distinguish between fundamental and strategic defaults 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 fundamental defaults makes it harder to distinguish strategic from fundamental defaults. On the other hand, it is also possible that the negative economic shock weakens the repayment norm itself, 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. The results indicate that the latter effect is weak at best. Our findings suggest that an economic downturn does not lead to a break-down of the repayment norms per se, but rather creates informational uncertainty that makes it more difficult to enforce the norm. This finding qualifies Guiso et al. (2013)’s conjecture that an economic crisis weakens social

norms to repay.

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. (2015) and Karlan et al. (2015) show that interventions at the individual level can further strengthen the role of moral constraints. They apply moral suasion tactics (text-messages with either religious or relationship-enhancing content) in a field experiment and show that this increases real-life debt repayment. 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.⁴ However, 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 a negative economic shock impacts on the efficacy of moral constraints and social norm enforcement in deterring strategic defaults.⁵

The findings in our paper 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; Dwenger et al., 2016; Fellner et al., 2013; Kirchgaessner, 2010; Tyler, 2006).⁶ While most of the existing literature studies tax evasion in static economic environments (see e.g. Slemrod, 2016, for a review) our experiment focuses on the propensity to evade under adverse economic conditions. Our results indicate that downward economic shocks 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, our enforcer treatments emphasize the importance of information about incomes of tax-

⁴Some 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.

⁵We 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-García, 2016).

⁶According 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).

payers for sanctioning third parties such as tax authorities. In this vein, our results reinforce the findings by Bø et al. (2015), who emphasize that public disclosure of taxable income has deterring effects on evasion. In particular, our evidence suggests that transparency with regard to taxpayers' income may substantially mitigate the negative impact of an economic crisis 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, 2015) 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 the information available to potential enforcers, 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.

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 strategic loan default and the enforcement of social norms of repayment are affected by adverse economic conditions. To do this we implement an experimental design with 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.⁷

Table 1: Prisoner’s Dilemma Payoffs

		Borrower 1			
		Income=200		Income=0	
		Repay	Strategic Default	Fundamental Default	
Borrower 2	Inc.=200	Repay	300,300	150,400	150,200
		Strat. Default	400,150	250,250	250,50
	Inc.=0	Fund. 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 fundamentally default. Repayment if the other borrower defaults fundamentally yields 150 points. Fundamental default if the other borrower repays yields a profit of 200. If one borrower strategically defaults and the other borrower defaults fundamentally the strategically defaulting borrower secures 250 points and the fundamentally defaulting borrower earns 50 points. If both borrowers fundamentally default, each one of them receives 50 points.

Borrowers with an income of zero cannot repay their debt: this constitutes a “fundamental 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.

⁷To 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.

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 fundamental 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. 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).⁸

Table 1 summarizes 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).

In some of our treatments we add a third player—an enforcer—to the game. Enforcers’ 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.⁹ 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.¹⁰ We vary whether enforcers can observe borrowers’ incomes or not across treatments. The presence of enforcers allows us to explore the role of norm enforcement by peers and to study how the information situation affects the efficacy of such a mechanism.

2.2 Treatments

To identify the impact of an economic shock 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.

For expositional simplicity, we begin by describing the three information conditions that we implement in the experiment:

⁸Our 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.

⁹An 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.

¹⁰Punishment 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.

No Enforcer Conditions

In our no enforcer conditions, third parties are absent and social norm enforcement can therefore not play any role. The only force that can prevent borrowers from engaging in strategic default in these conditions are individual moral constraints. Moral constraints hereby 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 fundamental default and a strategic default.

Enforcer with Full 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 fundamental 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, are illiquid and are forced to fundamentally 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%. Accordingly, the probability that a borrower is forced to fundamentally 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 fundamental default $(1 - \gamma) = 0.5$. Strong economy: probability of fundamental 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 (fundamental or strategic) of the default. Enforcer with full information: Enforcers observe defaults and incomes of borrowers and can distinguish strategic from fundamental 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 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. 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 were illiquid. 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 fundamental defaulters in their matching group.¹¹

The experiment was programmed in z-Tree (Fischbacher, 2007) and conducted at the University of Hamburg Experimental Laboratory between April and July 2014. The University of Hamburg uses the HROOT software by Bock et al. (2014) to recruit subjects. 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 consequences of each possible choice in the experiment in detail.¹² At the end of the instructions there was a set of exercises in 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 solved all exercises.

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 15.78.¹³

Between the end of the experiment and the payment phase, subjects had to complete a post-experimental questionnaire in which we elicited demographics and some information on how participants evaluated their own behavior and the behavior of others.

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 household may impose two types of social costs: First, the lender suffers a financial loss proportionate to the private benefit of the not repaying borrower. The lender's loss will depend on the outstanding loan amount and the amount potentially recovered through bankruptcy or foreclosure proceedings.¹⁴

¹¹In 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 fundamental 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.

¹²An English translation of the originally German instructions is available from the authors upon request.

¹³The average hourly wage of a student subject in Germany is about EUR 10.

¹⁴In 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 resolvment of the claim through a bankruptcy process takes on average 1.7 years. See <http://www.doingbusiness.org/data/exploretopics/resolving-insolvency> for details.

Second, a default may also impose costs on outsiders to the contract. 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 higher costs of credit as lenders raise interest spreads to account for increased local credit risk (Gupta, 2016). 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). Moreover, deliberately defaulting on tax obligations increases the tax burden for others and imposes cost on societies at large. In this context, the decision to strategically default by under-reporting taxable income undermines public good provision (Slemrod, 2007).

The social costs suffered by the lender and/or other households 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 sanctions by peers who see it as their duty to enforce the norm.

In this experiment we focus on the negative externalities of strategic defaults on parties outside of the contract and we consciously abstract from the negative impact of defaults on the creditor profits.¹⁵ The rationale for this design choice is that the nature of the social relation between the borrower and the creditor heavily depends on the specific context. In some situations the creditor might be a large bank (mortgage market), or even the state (taxes), while in others the lender might correspond to an individual (peer-to-peer lending). In the former cases it seems inappropriate to study the relation between the borrower and the institutionalized lender by observing two individual participants interacting in an experiment. The negative externalities of strategic default, in contrast, are typically imposed on individuals who are comparable to the defaulter (other homeowners, borrowers, tax payers). We argue that this situation is well captured in the experimental setting (albeit in a stylized manner). The prisoner’s dilemma underlying our experiment captures the negative externality of strategic defaults on peers in a simple and parsimonious way: the social cost of a default is imposed directly on the other player and reduces his income by 150 points. In reality the negative externality of a strategic default by one borrower is likely to spread out over a larger number of other

¹⁵Brown and Zehnder (2007) provide an experimental analysis of reciprocity in trust-games which capture the pure interaction between a lender and borrower. Fehr and Rockenbach (2003) and Charness et al. (2008) study the role of social norms (as captured by 2nd party or 3rd party punishment) in such a setting.

consumers. Evidence from public goods experiments however 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 important feature of our design is that we add uncertainty to the standard prisoner’s dilemma game. In our game borrowers are unable to repay with an exogenous probability $(1 - \gamma)$. Importantly, the ability to repay is private information so that fundamental and strategic defaults cannot be distinguished by the other borrower. While we are not the first to study stochastic prisoner’s dilemmas, our design differs in important ways from these previous experiments. Bereby-Meyer and Roth (2006) focus on learning and use a game that provides players with perfect information about each others’ strategies but yields stochastic payoffs. This game lacks the asymmetric information structure which is central to our setup. Kunreuther et al. (2009) and Xiao and Kunreuther (2015) use games where defection sometimes benefits the defecting player without hurting the other player, so that observed own payoffs do not necessarily reveal whether the other player has defected or not. However, in their game, cooperation (repayment) is always possible and their setup does therefore not include the possibility of fundamental default.¹⁶ In the design of Fudenberg et al. (2012) each strategy is implemented with noise so that there is also a possibility that borrowers who intend to defect (default) are forced to cooperate (repay). This feature makes little sense in the context of interest in our paper. Moreover, all of the above experiments are mainly concerned with the identification of strategy selection and learning procedures in repeated two-player games, while our study 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 straightforward and transparent manner and introduces the realistic feature that borrowers can hide their opportunistic actions behind potential economic hardship. This feature substantially distinguishes our design from the existing literature on stochastic prisoner’s dilemmas.

To explore under which informational conditions the social norms to repay are more or less likely to collapse in economic downturns, we vary the information the enforcer receives about borrower’s actions in our design. In the partial information conditions enforcers can only infer from the underlying probability of fundamental 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

¹⁶Ambrus and Greiner (2012) and Grechenig et al. (2010) follow a similar approach and implement noisy information about contributions in repeated multi-person public goods games with punishment. Also these papers do not model exogenous economic shocks which prevent players from making contributions to the public good.

conditions, in contrast, enforcers are fully aware of the intentions of defaulting borrowers and can take this 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 will be able to see whether adverse economic conditions affects the social norm itself or only the intensity with which the norm is enforced.

3 Predictions and Hypotheses

In this section we provide predictions based on a formal analysis of the game underlying our experiment. As a benchmark, we first analyze the self-interest model assuming that all borrowers and enforcers maximize their monetary payoff. We then explore the implications of a richer model in which borrowers are characterized by heterogeneous moral concerns and enforcers exhibit heterogeneous aversion against norm violations.

Consider a game in which a borrower i interacts with another randomly drawn borrower j . Table 3 displays the symbols that we use to describe the payoffs associated with all possible strategy combinations in the simultaneous game that the borrowers play:

Table 3: Notation

		Borrower j		
		Repay (r)	Strat. Default (s)	Fund. Default (f)
Borrower i	Repay (r)	R, R	L, W	L, w
	Strat. Default (s)	W, L	D, D	D, d
	Fund. 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 fundamentally). L (150) is the payoff from repayment if the other borrower defaults (strategically or fundamentally). w (200) and d (50) are the payoffs from fundamental default depending on whether the other borrower repays or defaults (strategically or fundamentally).

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 γ . Weak economic conditions are represented by a lower γ , which corresponds to a higher

fundamental default rate $(1 - \gamma)$. We use γ_{SE} and γ_{WE} to distinguish between the strong (SE) and the weak economy (WE).

When analyzing the partial information and full information conditions we also consider a third-party enforcer h . The enforcer receives a fixed endowment E and his or her 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.

3.1 The self-interest model

If all borrowers and enforcers are pure payoff-maximizers, the predictions for our experiment are straightforward: In the absence of enforcers, borrowers never repay, because conditional on having a positive income repaying is a dominated strategy for both players ($W > R$ and $D > L$). The presence of enforcers does not alter this prediction. Self-interested enforcers never engage in costly punishment in one-shot encounters. Thus, borrowers have no incentive to repay even if enforcers are present. This yields the following prediction:

Self-interest hypothesis: *All borrowers always default in all treatments. In treatments with enforcers, punishment never occurs.*

3.2 Moral constraints

We now incorporate the fact that many borrowers consider strategic default to be morally wrong (Guiso et al., 2013). Whereas such moral constraints do not necessarily prevent a decision maker from engaging in strategic default, it seems plausible that doing something immoral is associated with a psychological cost. To capture this non-pecuniary dimension of borrowers' decisions, we assume that their utility function has the following form:

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

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 fundamentally, 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 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 incorporate the fact that there may be considerable 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, however, that the proportional impact of borrower j 's choice on borrower i 's moral cost is constant so that we can write: $k_i(s, r) = (1 + \lambda)k_i(s, c_j \in \{s, f\}) \equiv (1 + \lambda)k_i$, where $\lambda > 0$. The cost k_i is characterized by a continuously differentiable distribution function $F(\cdot)$ with support $[k_{min}, k_{max}]$, where $0 < k_{min} < \frac{\Omega}{1+\lambda}$ 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:¹⁷

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

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

Proof. See Appendix. □

The behavior of borrowers with either weak or strong moral concerns is independent of the state of the economy. Borrowers with strong moral concerns (type 1 behavior) repay whenever their income allows them to do so and borrowers with weak moral

¹⁷We 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.

concerns (type 3 behavior) never repay even if they have the income to do so. For the behavior of borrowers with intermediate moral concerns (type 2 behavior), in contrast, the state of the economy is of relevance. These borrowers are conditional cooperators (Fischbacher et al., 2001), in the sense that they only repay if sufficiently many other borrowers repay as well. Because an economic downturn corresponds to an increase in the fundamental default rate, the negative shock has a direct, first-order effect on how many other borrowers repay. A smaller number of repaying other borrowers reduces the motivation of conditional cooperators to repay their loans. Borrowers who repay conditionally are willing to repay only as long as the expected utility from repaying is at least as large as the expected utility from strategically defaulting. Suppose that borrowers believe that all borrowers with $k_i > \bar{k}$ repay their loan whenever they can. Given this belief borrower i repays if the following condition is satisfied:

$$U_i(r) = L + \gamma(1 - F(\bar{k}))\Delta \geq D + \gamma(1 - F(\bar{k}))\Delta - (1 + \gamma\lambda(1 - F(\bar{k})))k_i = U_i(s).$$

This simplifies to:

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

The condition is intuitive: The stronger the borrower's moral concerns (i.e., the higher k_i), the more likely it is that she is willing to cooperate for a given repayment propensity among the population of fellow borrowers ($1 - F(\bar{k})$).

We now turn to the analysis of equilibrium repayment behavior. To ensure uniqueness of equilibrium we need to impose some restrictions on the distribution $F(k)$. Multiplicity of equilibria emerges if much of the probability weight of $F(k)$ is concentrated on one (or several) narrow interval(s) within the support of the distribution.¹⁸ For expositional simplicity we discuss the technical details in the Appendix (see Assumption 1). 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 the fraction of repaying borrowers is strictly higher in the strong economy than in the weak economy: $k_N^*(\gamma_{SE}) < k_N^*(\gamma_{WE})$.*

¹⁸Existing evidence shows that there is wide variety in the degree to which people care about moral and social concerns (see e.g., Fischbacher et al., 2001). Distributions that put a lot of probability weight on narrow intervals of k are therefore unlikely to be realistic description of the borrower population.

Proof. See Appendix. □

Proposition 1 formalizes the following intuition: In an economic downturn fundamental 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 consider the role of third-party enforcers. In a community in which most people perceive strategic default as immoral repaying becomes a social norm. Violators of the norm risk to get stigmatized and face social costs (see, e.g., Fay et al., 2002; Gross and Souleles, 2002; Guiso et al., 2013, for a discussion). We formalize social costs as direct punishment inflicted on strategically defaulting borrowers by unaffected third-parties in their social environment. 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 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 enforcer's 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 ($0 < q_{hi}(s, 0, \gamma) < q_{hi}(f, 1, \gamma) < q_{hi}(r, 1, \gamma) \rightarrow \infty$). The psychological cost function captures the intuition that enforcers may feel unhappy (i.e., 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). We include this feature in the model, because Guiso et al. (2013) 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 unjustified

punishment.¹⁹ For expositional simplicity, we use the following functional form to model the enforcer's psychological cost: $q_{hi}(f, 1, \gamma) \equiv q_h$ and $q_{hi}(s, 0, \gamma) \geq \beta(\gamma)q_h$, where $\beta(\gamma) \geq 1, \forall \gamma$ 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 $0 < q_{min} < \frac{\kappa}{\beta(\gamma_{SE})} < \frac{\kappa}{\beta(\gamma_{WE})} < q_{max}$.

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:*

$$b_{hi} = \frac{\gamma F(\bar{k})}{\gamma F(\bar{k}) + (1 - \gamma)} \geq \frac{q_{hi}(f, 1, \gamma) + \kappa}{q_{hi}(s, 0, \gamma) + q_{hi}(f, 1, \gamma)} = \frac{q_h + \kappa}{(1 + \beta(\gamma)) q_h}.$$

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

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

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

Proof. See Appendix. □

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 fundamental default rate on punishment decisions of enforcers:

Proposition 2 (Impact of economic shock on norm enforcement). *A negative economic shock (i.e., an exogenous decrease in γ) weakens 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, a negative economic shock decreases the probability with which a partially informed enforcer believes

¹⁹Without this assumption enforcers would never punish in the weak economy ($\gamma = 0.5$). The reason is that in this state partially informed enforcer's belief that a non-repaying borrower engaged in strategic default is always strictly lower than 0.5. If unsanctioned violations and unjustified punishments were equally costly, such a belief would never be sufficient to trigger punishment. See Lemma 2.

that a non-repaying borrower engaged in strategic default:

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

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 b_{hi} that a non-repaying borrower i engaged in strategic default, a negative economic shock potentially decreases the probability $\rho(b_{hi})$ with which the borrower is punished, because the enforcer's psychological cost may depend on the state of the economy γ :

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

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

Proof. See Appendix. □

Proposition 2 establishes that if third-parties are only partially informed a negative economic shock potentially affects norm enforcement through two distinct channels. On the one hand, an increase in the strategic 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 unjustified punishments). On the other hand, the negative economic shock may also change the norm itself, so that sanctions are reduced, because enforcers perceive strategic default as more acceptable.

Fully informed observers who can cleanly distinguish between fundamental and strategic defaults 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, in 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 social sanctions of fully informed enforcers are not powerful enough to motivate completely self-interested borrowers ($k = 0$) to always repay in the good state of the economy. This assumption makes sure that the problem remains interesting in all conditions that we are interested in and excludes the rather unrealistic case in which norm enforcement ensures the first best. Second, we again need to restrict the set of admissible distributions so that uniqueness of equilibrium is guaranteed. Please see the detailed discussion of Assumptions 2 and 3 in the Appendix for technical details.

Proposition 3 characterizes equilibrium repayments in the presence of informers 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. □

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 fundamental 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 fundamental 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 a number of directly testable hypotheses that will guide the presentation of our results.

Hypothesis 1 (Effect of an economic downturn on moral constraints). *A negative economic shock weakens 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. An increase in the fundamental default rate decreases the expected moral cost of a strategic default. The reason is that the presence of fewer repaying borrowers makes it less likely that the negative externalities of a strategic default 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, when the economic conditions are unfavorable (i.e., relatively few borrowers have the necessary income to repay), we expect that only borrowers with strong moral constraints are willing to repay.

Hypothesis 2 (Effect of an economic downturn on social norm enforcement). *A negative economic shock undermines 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.*

Lemma 2 implies that enforcers are willing to punish defaulting borrowers if the expected disutility from observing an unpunished norm violation outweighs both the monetary cost of punishing the wrongdoer and the risk of harming an innocent borrower. Proposition 2 reveals that an adverse development of the economy reduces enforcers' motivation to engage in punishment of defaulters for two reasons: First, there is the information channel capturing the fact that an economic downturn makes it difficult for enforcers to infer the underlying reason behind an observed default. Under strong economic conditions most borrowers have sufficient income to repay their debt. Partially informed enforcers can therefore be reasonably sure that an observed default is the result of a

strategic decision not to repay. However, when economic conditions begin to weaken and the frequency of fundamental defaults starts to increase, punishing an observed default entails a higher risk of sanctioning a borrower whose default was not strategic in nature. The risk of accidentally hitting an innocent borrower lowers the expected utility of norm enforcement through punishment. Everything else equal, the increased uncertainty about the nature of observed defaults therefore makes enforcers more reluctant to sanction not repaying borrowers. Second, adverse economic conditions may also have a direct effect on the psychological benefit of punishing a strategic defaulter. The intuition behind this effect—which we termed the norm channel—is that enforcers may be more sympathetic to strategic default in hard times, because it is easier to understand why borrowers decide not to repay if many other borrowers around them default as well. In combination, the information channel and the norm channel imply that partially informed third-party enforcers are less likely to sanction defaulting borrowers in weak economy than in the strong economy.

Hypothesis 3 (Effect of an economic downturn on the repayment norm). *A negative economic shock weakens the repayment norm. 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.*

When observing the total effect of a negative economic shock on norm enforcement in the partial information conditions, it is impossible to determine the relative importance of the information channel and the norm channel. The full information conditions, in contrast, allow us to separate these two effects. In these conditions, third-party enforcers can always perfectly distinguish strategic defaults from fundamental defaults irrespective of the state of the economy. By definition, the information channel can therefore not be present in this setup. Any change in sanctioning behavior across economic conditions must therefore be caused by the norm effect. As detailed in section 3 we follow Guiso et al. (2013) and assume that weak economic conditions render strategic default more acceptable. We therefore hypothesize that an economic downturn leads to weaker norm enforcement (i.e., less harsh punishment of strategic defaulter) even if the information available to enforcers remains constant across states of the economy.

Hypothesis 4 (Effect of norm enforcement on repayment). *Third-party norm enforcement motivates borrowers to repay and 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 presence of sanctioning third-parties lowers the expected benefit of strategic default for borrowers. Lemma 2 implies that norm enforcement will be strongest in the

full information conditions, where third-parties can cleanly distinguish between fundamental and strategic defaults (the enforcers' belief is $b_{ti} = 1$). Accordingly, borrowers incentive to repay is maximized under full information. We also expect to see a positive effect of norm enforcement on repayments under partial information, but enforcers will be more reluctant to sanction, because of the risk of accidentally punishing fundamental defaulters. In the no enforcer conditions the strategic default rate will be highest, because borrowers do not need to fear sanctions and are motivated to repay only by their internal moral constraints.

It is important to notice, 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 reason is that the size of the effect 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 is not much probability weight in the relevant part of the distribution. Thus, the fact that the punishment threat created by partially informed enforcers is expected to be smaller in the weak economy, does not necessarily imply a smaller impact on the strategic default rate. 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 an economic downturn on the strategic default rate. Such a study would need to be carried out in the field-setting of interest, because only there the distribution of moral constraints and the punishment technology would be 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 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. The number of actual borrower decisions varies across treatments, because the probability of fundamental defaults varies across treatments. In the partial and full information conditions we observe 160 punishment decisions by enforcers within each matching group.

Table 4: Summary Statistics by Treatment

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

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 unique matching group 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 fundamental and strategic defaults. *Punishment if Fundamental* and *Punishment if Strategic* reveals average punishment of fundamentally defaulting or strategically defaulting borrowers. *Punishment if Repay* shows average punishment attributed to repaying borrowers.

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.²⁰ Third-party sanctions are reported differently for the partial and the full information conditions. As enforcers in the partial information condition cannot distinguish between fundamental 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 fundamental (*Punishment if Fundamental*)

²⁰The Fundamental 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 bit of variation in these rates, because fundamental defaults were randomly determined at the individual level in the experiment, see also Footnote 7.

and strategic defaults (*Punishment if Strategic*) 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 an adverse economic shock on repayment behavior in the absence of third-party norm enforcement (section 4.1). In the second part we analyze the effect of an economic downturn on norm enforcement (section 4.2).

4.1 Moral Constraints

In this section we analyze the data of our no enforcer treatments. In this environment borrowers have no financial incentive to repay and personal moral constraints alone may prevent them from engaging in strategic default. The negative economic shock is implemented by increasing the fundamental default rate from 10% in the strong economy (SE no enforcer) to 50% in the weak economy (WE no enforcer). Table 4 reveals that this change in the fundamental default is associated with a substantial increase in the strategic default rate. In the strong economy—where the vast majority 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 fundamentally default—the strategic default rate augments to 67.5%. This corresponds to an increase of 23.2% (12.7 percentage points). One-sided ranksum tests at the matching group level indicate that this difference is significant ($N=20$, $p=0.06$).²¹

We summarize this finding as our first result:

Result 1 (Effect of an economic shock on the strategic default rate). *An exogenous increase in the fundamental 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.*

Result 1 is consistent with Hypothesis 1 and our predictions presented in section 3.2. Our theory argues that morally constrained borrowers face a trade-off between the monetary benefit of not repaying and the psychological burden of being a socially harmful strategic defaulter. An economic downturn changes this trade-off, because the presence of more defaulters in the borrower population lowers the expected moral cost of a strategic default. The intuition is that borrowers feel less bad about imposing a social cost on society if their strategic default most likely hurts others who defaulted themselves. This effect leads to a downward spiral towards a newly emerging equilibrium

²¹We report one sided non-parametric tests using matching group averages i.e., all decisions of 8 individuals as just one observation. We use one sided test because we have specific directional hypotheses.

in which more borrowers act opportunistically and only borrowers with very strong moral concerns are willing to repay their loans.

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 do not yet 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.1 in the Appendix 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 condition the strategic default rate amounts to 33.8%. In the first period of the WE no enforcer condition, in comparison, 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: $N=116$, $p=0.014$).²²

An analysis of the dynamics of the strategic default rate reveals that Result 1 persists over time. Figure A.3 in the Appendix 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.²³ Second, the difference in the strategic default rates across economic conditions remains stable. In each five-period interval the strategic default rate is higher in the weak economy than in the strong economy.²⁴

Finally, the impact of the economic downturn on repayment behavior can also be demonstrated by comparing the distribution of individual borrower behavior, i.e. the frequency of strategic default per borrower over all 20 periods. Figure 1 displays the distribution of borrower-specific default rates 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 Kolmogorov Smirnov (KS)

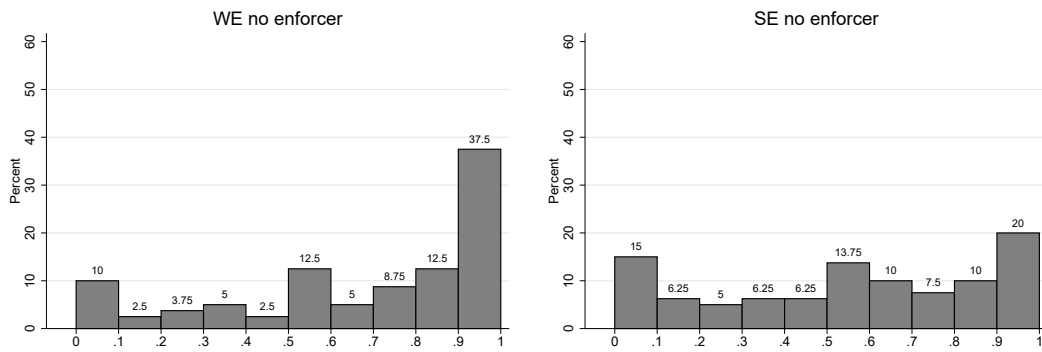
²²Because subjects have not yet been rematched in period one, we report tests using individual borrowers as independent observations when analyzing period one results.

²³Individual fixed effects OLS regressions using per-period strategic default rates as observations 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 $N = 824$; $\beta = 0.014$; $p < 0.01$. Standard errors clustered at the matching-group level.

²⁴Obviously the data basis become weaker when we split up our observations into different time intervals. 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% ($N = 20$, $p = 0.32$).

test: $N=160$, $p=0.013$). The difference in borrower strategic default rates 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 bound 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. 26.25% do so in the SE no enforcer condition, default less than 30% of the time compared to only 16.25% in the WE no enforcer condition.

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



Notes: The figure shows the percentage of borrowers who strategic default with different frequencies (in 10% bins) in the WE no enforcer treatment (left hand figure) and the SE no enforcer treatment (right hand figure).

4.2 Norm Enforcement

In this section, we discuss the effect of an economic shock on social norm enforcement by third party peers. We first analyse norm enforcement in the partial information treatments in section 4.2.1. Second, we present the effect of an economic shock on norm enforcement of fully informed enforcers in section 4.2.2. Finally, in section 4.2.3, we examine the effect of norm enforcement on borrower behavior in the two enforcer conditions.

4.2.1 Partially informed enforcers

Enforcers in the partial information conditions cannot distinguish between fundamental and strategic defaults. In this condition we therefore analyze sanctions in response to default in general. Table 4 shows that partially informed enforcers punish defaulters significantly more harshly in the strong economy than in the weak economy (average punishment of 58.96 points in the SE compared to an average punishment of 36.59

points in the WE; one sided ranksum tests: $N=20$, $p=0.06$).²⁵ These data indicate that an economic downturn substantially weakens 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 an economic downturn on social norm enforcement). *When enforcers cannot distinguish fundamental from strategic defaults, an exogenous increase in the fundamental default rate 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.*

Result 2 provides support for our Hypothesis 2. Our model in section 3 points out that there are two potential reasons for why we should expect an economic downturn to have a negative effect on social norm enforcement: First, a negative economic shock may undermine the social norm itself. 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. Second, the increase in surrounding fundamental defaults in the weak economic condition leads to a loss in information about borrowers intentions behind a 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.

To get a more detailed understanding of the observed data pattern regarding sanctioning decisions under partial information we now zoom in on 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 of 25.76 points between the two economic conditions ($N=89$; $p=0.033$).²⁶ However, when comparing the punishment level in period 1 to

²⁵Evidence 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 ($N=10$; $p<0.01$).

²⁶Also in Period 1 punishment is anything but random (see also Table A.1 in the Appendix). 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 ($N=18$; $p=0.021$). 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 ($N=23$; $p=0.025$).

the overall punishment level, it seems evident that punishment is lower early on in the experiment. Figure A.4 in the Appendix 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.²⁷ 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 negative economic shock is a robust finding that persists irrespective of the development of the punishment levels over time.²⁸

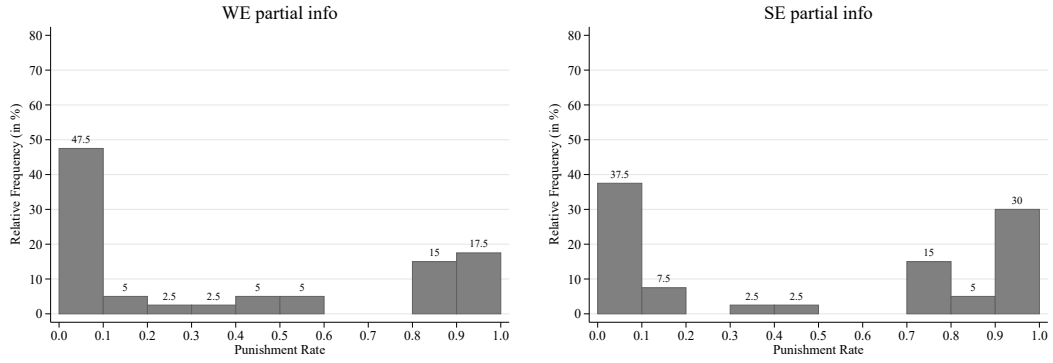
The downturn's effect on sanctioning behavior is also evident when considering enforcers' individual punishment behavior. Figure 2 shows the distribution of individual, enforcer-specific punishment rates (i.e. the frequency with which an individual enforcer imposes a positive number of punishment points 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 somewhat 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, in contrast, 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 fundamental default rate makes third-parties more reluctant to enforce the repayment norm.

²⁷Fixed 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: $N = 639$; $\beta = 1.19$; $p = 0.061$; WE partial information: $N = 761$; $\beta = 1.37$; $p = 0.048$. Standard errors clustered at the matching-group level.

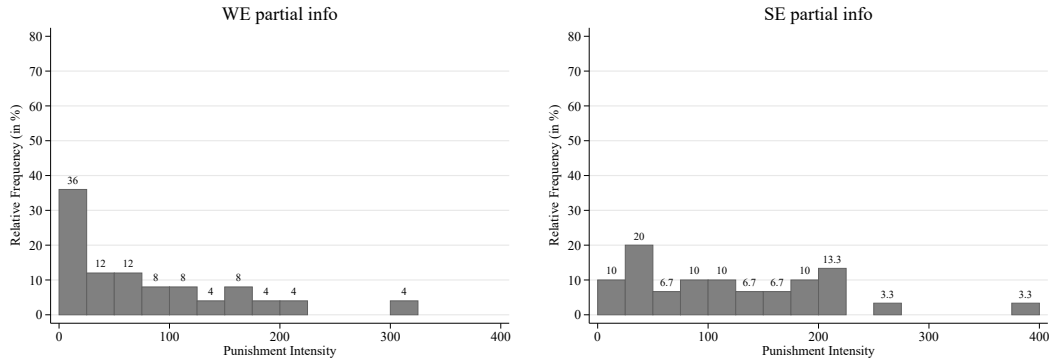
²⁸One sided ranksum test at the matching group level show that differences in all but one five-period intervals are statistically significant: Periods 1-5: WE 22.6 points vs. SE 41.7 points ($N = 20$, $p = 0.01$), Periods 6-10: WE 35.7 points vs. SE 64 points ($N = 20$, $p = 0.05$), Periods 11-15: WE 53 points vs. SE 67.4 points ($N = 20$, $p = 0.2$), 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

Panel A: Punishment Rate



Panel B: Punishment Intensity



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).

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 fundamental and strategic defaults irrespective of the state of the economy. This implies that in these treatments a negative economic shock 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 relatively modest (about 13%) and not statistically significant ($N=20$, $p=0.24$).²⁹

We summarize this finding as our third result:

Result 3 (Effect of an economic downturn on the repayment norm). *When enforcers can unambiguously identify strategic defaults, an exogenous increase in the strategic default rate has only a small, not statistically significant impact on norm enforcement.*

Result 3 contradicts Hypothesis 3. It seems that an economic downturn leaves the repayment norm largely intact. Contrary to our assumption put forward in section 3, most third-party enforcers do not deem strategic default more acceptable when borrowers are surrounded by others who are forced to default fundamentally. This finding has important implications for the interpretation of Result 2. It seems that the substantial decrease in the intensity of norm enforcement under partial information is predominantly a consequence of the informational uncertainty that an economic downturn creates.

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.³⁰ 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 significance difference between these two punishment levels ($N=20$; $p=0.24$). If the economic condition is weak, in contrast, the high rate of fundamental defaults implies that partially informed enforcers face strong uncertainty about the nature of an observed default. In fact, under realistic beliefs en-

²⁹As 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 repayers with 15.58 points and fundamental 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. fundamental 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 repayers, and 3.2 points to fundamental defaulters. Again both differences are significant (one sided signrank tests: strategic defaults vs. repayments: $N=10$, $p<0.01$ / strategic vs. fundamental defaults: $N=10$, $p<0.01$).

³⁰If 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%.

enforcers will think that an observed default is most likely not strategic in nature.³¹ As a consequence, sanctions include a high risk that innocent borrowers are punished. Our data are in line with these arguments and confirm that information quality makes a large difference for 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 ($N=20$; $p=0.06$).

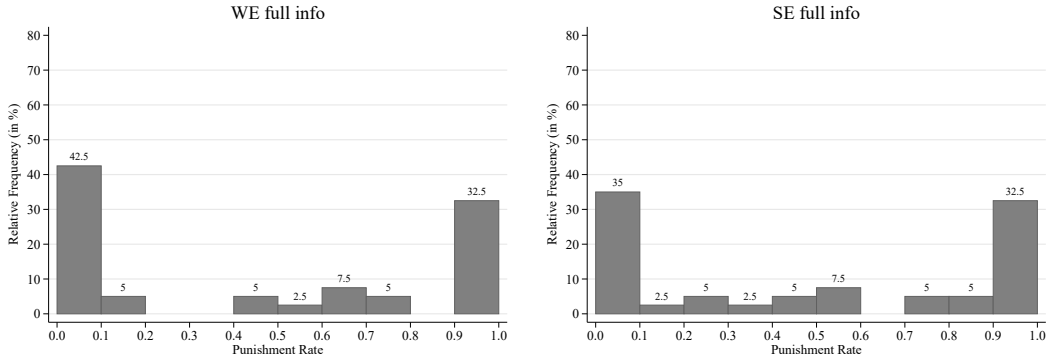
When only considering first period results there seems to be a bit more support for the change in the repayment norm put forward in Hypothesis 3 than in the full data set. In the first period fully informed enforcers in the strong economy punish strategic defaulters on average with 48.2 punishment points, while fully informed enforcers in the weak economy only assign 24.3 points. This difference seems large, but there is considerable variance so that the effect is not statistically significant ($N=29$; $p=0.2$). 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 the Appendix (the development of punishment over time in intervals of five periods) shows that this difference in punishment levels rapidly disappears over time.³² The limited impact of the negative economic shock 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 test detect no difference (Kolmogorov Smirnov (KS) tests: Punishment rate: $N=80$, $p=0.99$; Punishment intensity: $N=50$, $p=0.98$).

³¹If 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%.

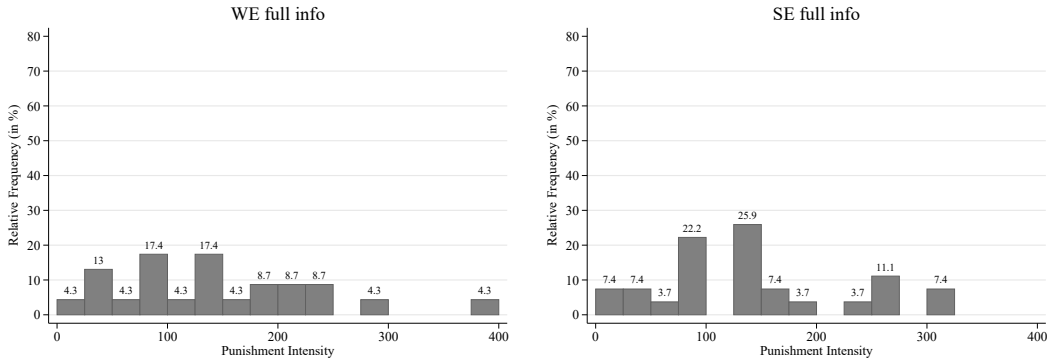
³²Ranksum test at the matching group level show that the difference is only significant in the first few periods of the experiment: Periods 1-5: WE 51.30 points vs. SE 73.57 points ($N=20$, $p=0.09$), Periods 6-10: WE 62.97 points vs. SE 69.92 points ($N=20$, $p=0.41$), Periods 11-15: WE 72.85 points 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.

Figure 3: Punishment Rate and Punishment Intensity under Full Information

Panel A: Punishment Rate



Panel B: Punishment Intensity



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).

4.2.3 Implications of Norm Enforcement

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. Table 4 reveals that the presence of enforcers reduces the strategic default rate in both economic conditions. In the strong economy 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. One sided ranksum tests show, however, that these effects are not significant (no enforcers vs. partial information: $N=20$, $p=0.46$ / partial information vs. full information: $N=20$, $p=0.3$ / 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: $N=20$, $p=0.085$ / no enforcers vs. full information: $N=20$, $p=0.012$).

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 strong 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%).*

Result 4 lends support to Hypothesis 4. The presence of third-party enforcers implies that strategic defaulters face the risk of being sanctioned. This punishment threat reduces the benefit of a strategic default. Average punishment levels are not high enough to fully overcome the monetary incentive to strategically default, but they are sufficient to change the behavior of borrowers who are torn between their moral concerns and their financial interests.

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.

A look at results in the first period confirms that this finding is present from the outset. In line with the increasing time trend reported in section 4.1 average strategic default rates are, in general, lower than later in the experiment, but Table A.1 in the appendix 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 analysis of 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.³³ Figure A.3 reveals that roughly the same ordering of strategic default rates persists over the full duration of the experiment.

5 Conclusion

Strategic defaults occur in a variety of important economic settings. Typical examples include consumers who walk away from underwater mortgages, or entrepreneurs who refrain to pay supplier bills, or evade taxes. Debtors' decisions to deliberately not make due payments not only harm the creditor, but also have negative externalities. Recent evidence from the mortgage market suggests that a negative shift in the surrounding economic conditions can trigger 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 change in economic conditions 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 economic shocks and to separate the different channels that are intermingled in the field data.

The results of our experiment confirm that the increase in the strategic default rate in an economic crisis is driven by two distinct behavioral forces: First, a negative shock in the economic environments weakens individual moral constraints that prevent strategic defaults in times when economic conditions are good. When liquidity problems lead to an increasing rate of fundamental defaults in the surrounding environment, debtors seem to feel less obliged to repay their loans. It seems that the 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.

Second, an economic contraction also weakens peer enforcement of social repayment

³³The 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: $I: N=146$, $p=0.34$).

norms. When exogenous reasons let many debtors suffer from solvency problems, third-party observers 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 are always fully aware of 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 creates informational uncertainty. In realistic settings, peers cannot perfectly identify whether an observed default is strategic or fundamental. If a shock drives the fundamental default rate up, 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 withhold their repayment, but were forced to do so by an exogenous negative shock. It seems that many enforcers are not willing to take this risk and prefer to give defaulters the benefit of the doubt and not to punish them.

Our findings imply that the impact of a negative economic shock on the strategic default rate also depends crucially on the information situation in a particular environment. The more transparency there is, the less severely a 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 will experience a smaller increase in strategic defaults than large and very anonymous environments. This has implications for business and policy. For example, banks active in mortgage lending should consider that an economic downturn might have very heterogeneous effects on their loans. In particular, the risk in portfolios predominantly consisting of mortgages in urban areas may increase over-proportionally, because social norms to prevent strategic default are less likely to be enforced in those environments. Similarly, tax authorities should take into account that evaluating the effectiveness of transparency initiatives under strong economic conditions may considerably underestimate their positive impact, because the full extent of the benefit may only be revealed during a crisis.

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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 can be rewritten as: $k_i(1 + \gamma\alpha\lambda) = \Omega$. Rearranging and solving for α yields the following condition for the minimally necessary repayment rate of solvent other borrowers: $\alpha \geq \frac{\Omega - k_i}{\gamma\lambda k_i}$. $\square$

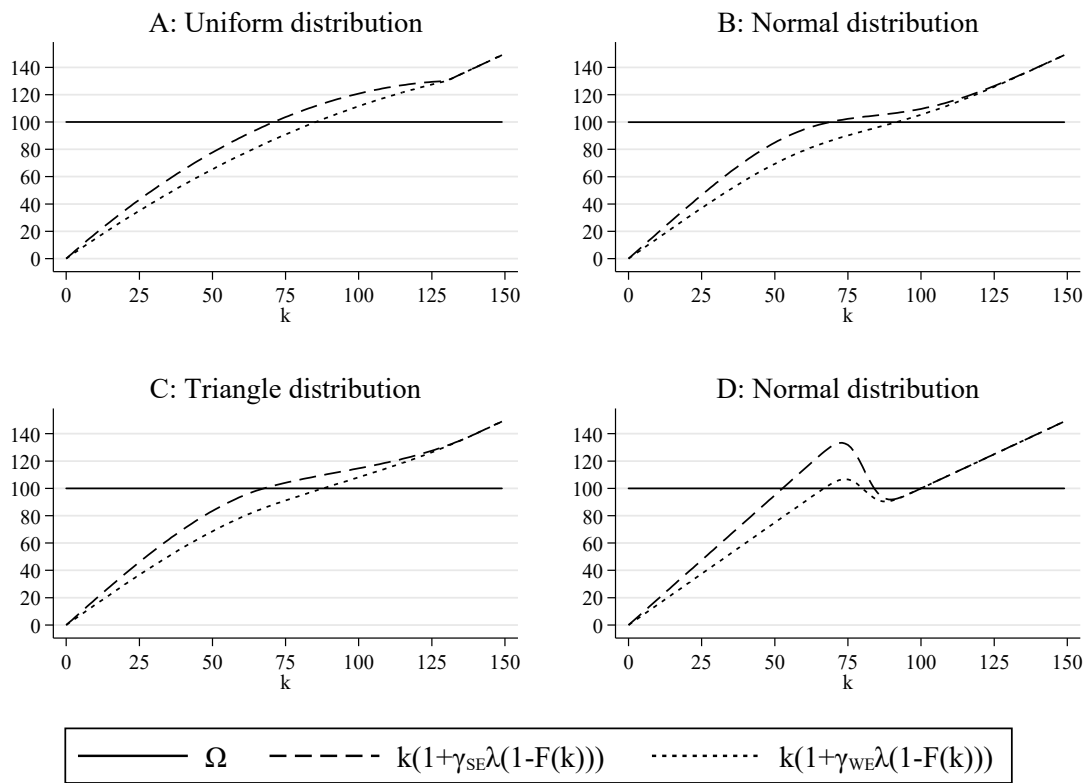
Assumption 1 (Distribution of borrowers' moral concerns). *The distribution $F(k)$ fulfills the following property:*

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

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 is not necessarily monotonically increasing in k : the derivative of the left-hand side with respect to k is equal to $1 + \gamma\lambda(1 - F(k)) - k\gamma\lambda f(k)$ and can be positive or negative depending on the characteristics of the distribution $F(k)$. The non-monotonicity can give rise to multiple equilibria. 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 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 the distribution of k puts a lot of probability weight on a narrow range of values. This would, for example, be the case if a big part of the borrower population were very homogeneous with regard to their moral concerns (unimodal distribution with a very small variance) or if there were only a very small number of clearly distinct borrowers types (multimodal distribution with little within-type variation). Existing evidence in the social preference literature indicates that there 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 plausible distributions.

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”: $F(k) = \mathcal{N}(80, 5)$. 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.

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). $\square$

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: $U_k(p_{hi} = 0) = E - b_{hi}q_{hi}(s, 0, \gamma) = E - b_{hi}\beta(\gamma)q_h$. 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: $q_h = \frac{\kappa}{(1+\beta(\gamma))b_{hi}-1}$. $\square$

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: $\frac{\partial b_{ti}}{\partial \gamma} = \frac{F(\bar{k})}{(\gamma F(\bar{k}) + (1-\gamma))^2} > 0$.

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: $\frac{\partial \rho(b_{hi})}{\partial \gamma} = g\left(\frac{\kappa}{(1+\beta(\gamma))b_{hi}-1}\right) \frac{\kappa}{((1+\beta(\gamma))b_{hi}-1)^2} \frac{\partial \beta(\gamma)}{\partial \gamma} b_{hi}$. $\square$

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 even completely self-interested borrowers who do not face any moral constraints would always repay when enforcers are perfectly informed and the economy is strong. Assumption 2 guarantees that the repayment problem remains interesting for all information conditions and states of the world.

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

$$1. k_{min}(1 + \gamma\lambda(1 - F(k_{min})) < \Omega - \rho P,$$

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

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

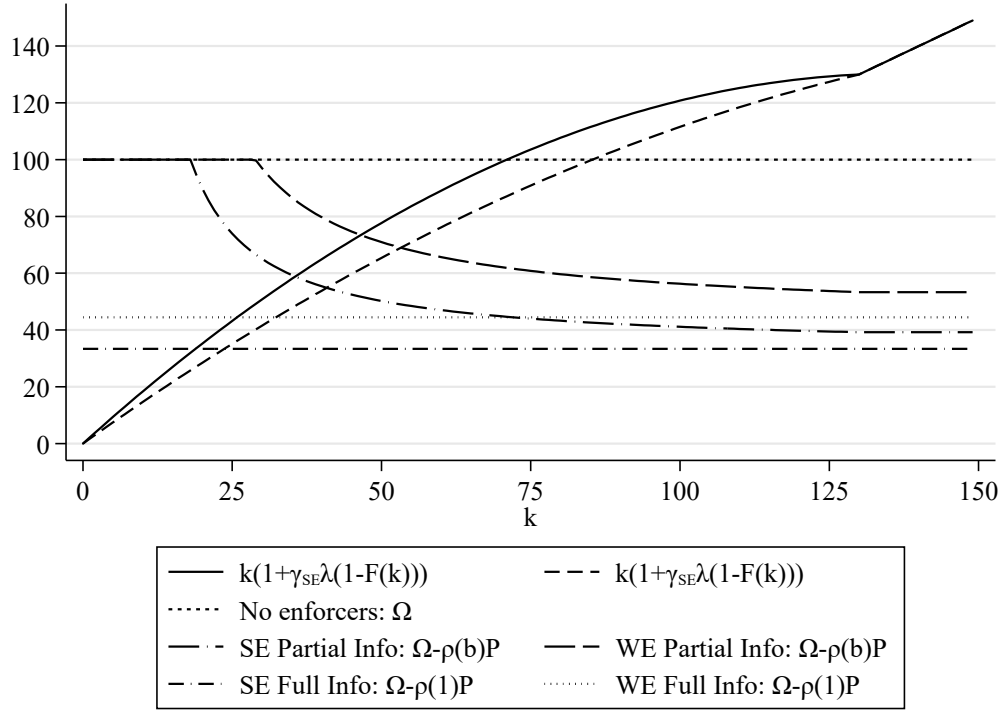
$$\text{a) } b_{hi} = \frac{\gamma F(\bar{k})}{\gamma F(k) + (1-\gamma)} \text{ under partial information.}$$

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

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 figure 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. The rationale is very similar to the one outlined above for Assumption 1. The assumption ensures that there is at most one repayment threshold at which expected costs and benefits of a strategic default are equal.

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). $\square$

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 $\mathcal{U}(0, 15)$.

Appendix: Period one results

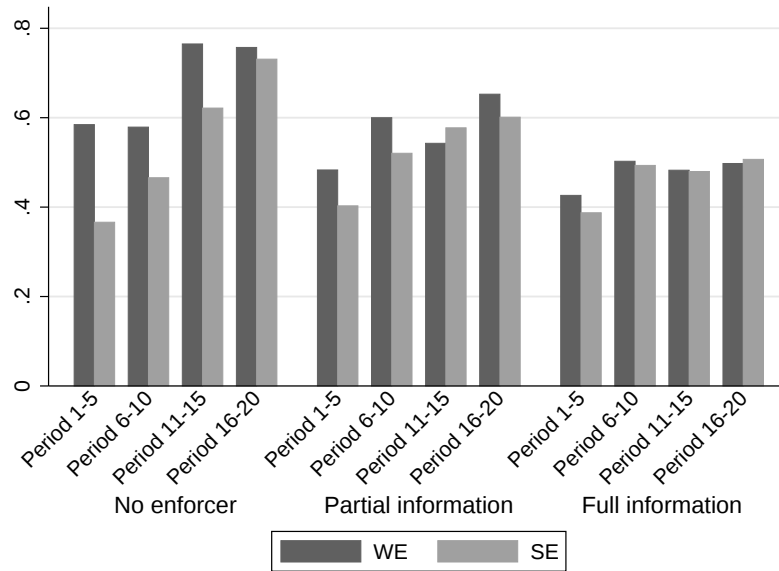
Table A.1: Summary Statistics by Treatment for Period One

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

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 fundamental and strategic defaults. *Punishment if Fundamental* and *Punishment if Strategic* reveals average punishment of fundamentally defaulting or strategically defaulting borrowers. *Punishment if Repay* shows average punishment attributed to repaying borrowers.

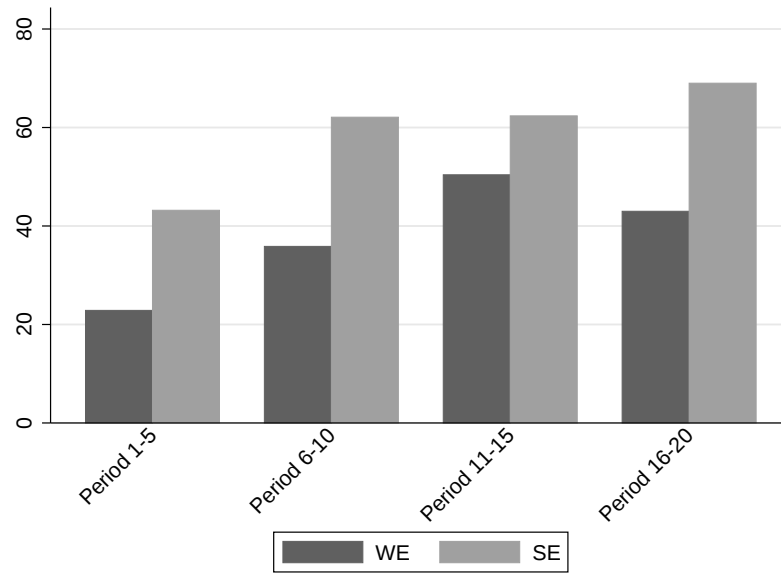
Appendix: Treatment outcomes over time

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



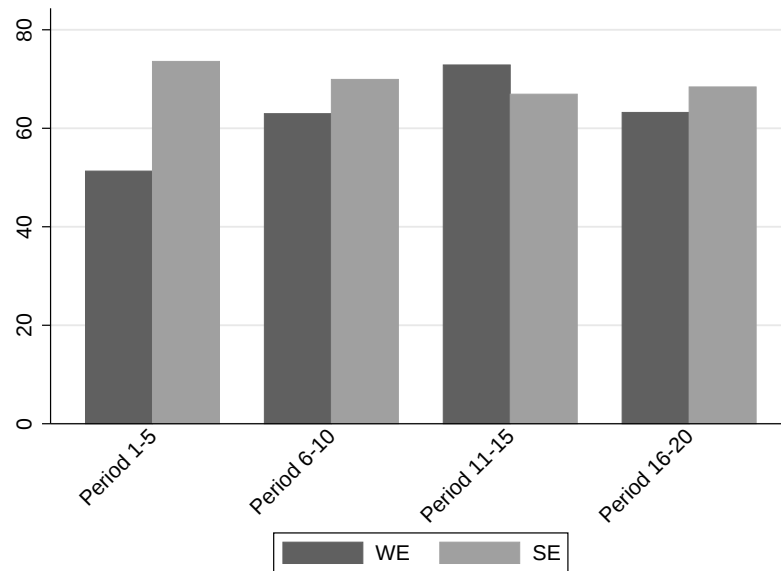
Notes: The figure displays strategic default rates for five-period intervals for our weak and strong economy treatments in each of the three information conditions (no enforcers, partial information, full information).

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



Notes: The figure displays average punishment of defaults in the WE and SE partial information conditions. Punishment of defaults is higher in the strong economy. In both conditions, punishment increases from period 1–5 to period 6–10 and stays constant in period 6–20.

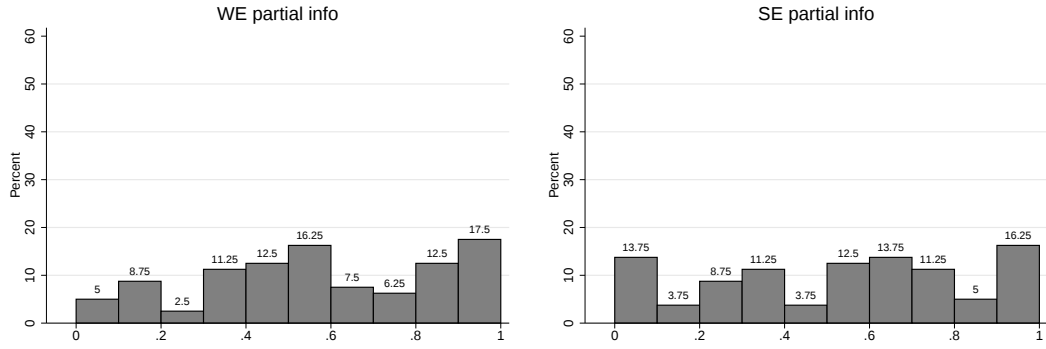
Figure A.5: Punishment of Strategic Default in Full Information Conditions over Time



Notes: The figure displays average punishment of strategic defaults in the WE and SE full information conditions. In the SE condition punishment of strategic default is higher in period 1–5 and levels with punishment of strategic default in the WE in period 6–20.

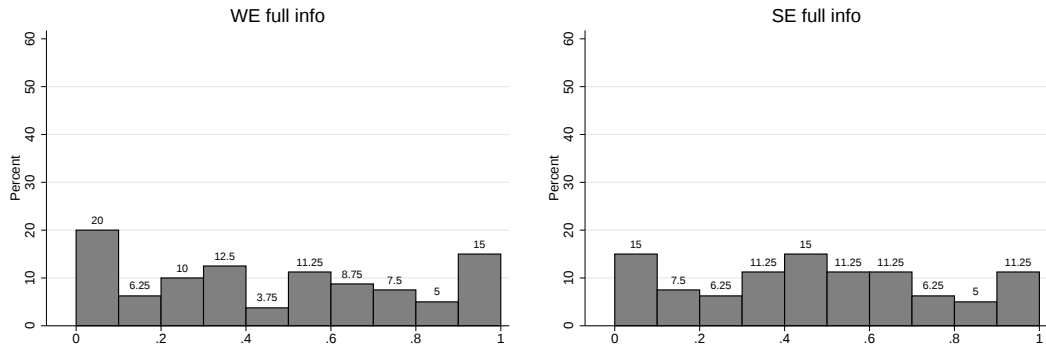
Appendix: Social norm enforcement and strategic default rates

Figure A.6: Borrower 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 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).