Trust and Lending: An Experimental Study

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Abstract

This paper investigates the importance and the determinants of trust in a lending situation using an online controlled experiment. We find that communication can facilitate collaboration between lenders and borrowers through three channels of trust: 1) an information channel, 2) a preference channel, and 3) a guilt-aversion channel. Our results highlight the advantages of relationship-based lending that may not be substituted by FinTech solutions.

Keywords: Behavioral finance, Trust, Lending, Financial risks, Banking, Credit Markets, Experimental Economics

JEL codes: C90, G21, G32, G41

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1 Introduction

Trust has long been considered a vital factor in financial transactions, even in environments where formal institutions are well established. For example, there has been extensive evidence that trust is associated with stock market participation (Guiso et al., 2004, 2008), willingness to take out mortgages (D'Acunto et al., 2018), and using investment advisers (Gurun et al., 2017). Trust is also crucial for credit markets, where lending is often hindered by asymmetric information between borrowers and lenders (Stiglitz and Weiss, 1981). Modern technologies on data gathering and credit risk modeling overcome adverse selection to a large extent, if not completely. However, moral hazard, whereby borrowers undermine lenders' interests ex post by taking excessive risk after lending (Jensen and Meckling, 1976), remains due to frictions such as incomplete contracts. Trust potentially plays in important role in mitigating moral hazard in lending relationships.

As Sapienza et al. (2013) argue, the act of trusting is the outcome of two components: beliefs in other people's trustworthiness and one's preference to trust, which may be influenced by risk aversion, inequality aversion, and altruism, among others. The behavioral economics literature, such as Baumeister et al. (1994), Charness and Dufwenberg (2006, 2011) and Battigalli and Dufwenberg (2007), suggests another effect of trusting through guilt aversion.[1] That is, the act of trusting conveys a positive expectation on the other party's trustworthiness. Because people are concerned about what others expect of them, and are reluctant to fall short of these expectations to avoid the feeling of guilt, the act of trusting can causally induce trustworthy behaviors that meet the conveyed expectation. In sum, a framework of trust consists of three potential channels through which the act of trusting is facilitated: 1) an informational channel, 2) a preference channel, and 3) a guilt aversion channel.

We believe this framework can potentially explain some observations in the credit markets, particularly those that heavily rely on interpersonal relationships. For example, Fisman et al. (2017) use data from a large state-owned bank in India to show that loan officer-borrower pairs that share

[1] The theoretical model of guilt aversion is developed in the framework of psychological game theory pioneered by Geanakoplos et al. (1989), which is further advanced by Battigalli and Dufwenberg (2009).

the same religion or caste are associated with greater amount of lending, more favorable loan terms on average, and higher loan size dispersion. Importantly, they also find that in-group lending has a better loan repayment rate. Their proposed explanation is the informational channel: a loan officer is more likely to trust a borrower that share the same religion or caste because she has more information about the borrower due to cultural proximity. In addition, the preference and the guilt aversion channel may also contribute to the observed phenomenon. On the one hand, people that are culturally close may have an innate preference to trust one another. On the other hand, the act of trusting by an in-group loan officer may also causally enhance the repayment likelihood due to the borrower's aversion to breaking the trust by an in-group peer through the guilt-aversion channel.

While it is plausible that all the three channels may jointly explain the lending decisions and outcomes in interpersonal lending relationships, such as those in Fisman et al. (2017), it is difficult to tease them out separately in observational data. To overcome this empirical challenge, we gauge the effect of the three channels using an online controlled experiment in this paper. In the experiment, we employ a two-player sequential game, called the "lender-borrower" game. Each game consists of two randomly paired online participants, with one playing the role of a lender and the other playing the role of a borrower. The lender first decides whether to lend to the borrower, then the borrower chooses between a safe bet with a certain payoff and a risky bet with an uncertain payoff if the lender decides to lend to her. The risky bet has a higher expected payoff for the borrower relative to the safe bet, but is welfare-reducing considering the lender's payoff. Our experiment thus incorporates a risk-shifting incentive for the borrower, an incentive that has been extensively studied in the corporate finance literature (e.g. Jensen and Meckling, 1976; Gavish and Kalay, 1983; Green, 1984; Green and Talmor, 1986; Hernández-Lagos et al., 2016).

We incorporate two different treatment variations in the game, which gives us a 2×2 between-subject design. On the one hand, we either allow or do not allow communication before the start of the game. Specifically, when communication is allowed, the borrower can send a free-form message to the lender before the lender makes a decision. On the other hand, we either allow

or do not allow the borrower to observe the lender's decision. Specifically, when the borrower cannot observe the lender's decision, she always makes a decision, but her decision is only payoff-relevant when the lender chooses to lend. We called this the strategy method setting.[2] When the borrower can observe the lender's decision, she only makes a decision when the lender chooses to lend. Hence, the game proceeds in its natural sequential form. We call this the dynamic setting. Allowing communication can have two potential effects. One is that the message could reduce information frictions if the borrower truthfully conveys her planned action. Another effect is that, any promise made by the borrower would shape the lender's expectation about the borrower's action, which in turn disciplines borrower's action due to guilt aversion. The dynamic setting further strengthens the effect of guilt aversion – letting the borrower know the lender's decision explicitly shapes the borrower's belief about the lender's expectation.

We find that lenders are willing to lend to borrowers 72% of the time, and the likelihood of lending does not vary significantly across treatments. This result shows that the subjects generally have the preference to trust the borrowers. When allowing borrowers to type a text message, only a small proportion of borrowers (11%) explicitly promise to take the safe bet. However, among those who make explicit promises, almost all of them keep the promise by actually taking the safe bet. Therefore, the subjects generally refrain from lying and the communication is highly effective in conveying truthful information about borrowers' actions. Communication may not by itself causally induce more trustworthy behavior, but merely acts as a sideshow that reflects borrowers' actions. Consistent with this idea, in the strategy method setting, allowing communication does not reduce the likelihood of borrower risk taking in general, even if we confine to cases where lenders decide to lend.

The effect of the dynamic treatment is striking. When allowing communication *and* letting borrowers observe lenders' actions before choosing their bets, borrowers are significantly less likely to take risk. Therefore, communication appears to causally induce more collaborative behavior

[2]The strategy method has been widely adopted in the experimental economics literature, which enables the researcher to collect more data from the players at the later stages of a sequential game. It effectively transforms a sequential game into a simultaneous one. See Brandts and Charness (2011) for a survey on the pros and cons of the method.

when the act of trusting from lenders explicitly shapes borrowers' beliefs about the lenders' expectations. This is consistent with the guilt aversion channel, whereby borrowers are reluctant to fall short of lenders' positive expectation once they know it.

Our experimental results tease out the three channels of trust underlying collaborative behaviors. First, the subjects have the innate preference to trust since they are unconditionally willing to lend even when the counterparties are anonymous. Second, non-binding communication is generally truthful which makes information-based trust effective. Third, after communication, the act of trusting causally induces more trustworthy behaviors by setting a positive expectation and inducing guilt aversion on the counterparty. We thus believe that all three channels are likely at work to bring about successful interpersonal lending relationships in real-world credit markets.

2 Literature Review

Our study contributes to the line of research that study on the role of lending relationships (e.g. Rajan, 1992; Petersen and Rajan, 1994; Berger and Udell, 1995; Berger et al., 2005; Schenone, 2009; Bharath et al., 2009; Karolyi, 2018). With consolidations in the banking industry and the development of information technologies, consumer and small business credits have increasingly been offered in a more arm's length form through standardized products such as credit card and peer-to-peer lending (see Thakor (2019) and Philippon (2016) for surveys on the recent development of FinTech lending). However, technologies cannot fully resolve the information asymmetry in the credit markets, particularly the moral hazard problem whereby borrowers can behave in a way that undermines lenders' interests ex post. Our study, based on experimental evidence, suggests that interpersonal trust could mitigate the moral hazard problem by: (1) conveying truthful soft information through in-person communication; and (2) causally inducing trustworthy behavior through the act of trusting. Hence, relationship-based lending still adds value to credit markets in the era of FinTech.

Our study also contributes to the experimental economics literature. Many experimental studies reveal that people have a tendency to tell the truth even when communication is not verifiable

and lying is profitable (He et al., 2017; Belot et al., 2010; van den Assem et al., 2012). A direct implication is that people may keep their promises when they make one. Charness and Dufwenberg (2006) show that promises can significantly increase the rate of cooperation in a trust game that is similar to ours and they argue that promise can be crucial for fostering partnerships in a wide range of economic applications.[3] Different motives have been discussed to support the experimental finding on truth-telling. Charness and Dufwenberg (2006) propose that people keep their promises because they are guilt-averse and they feel guilty if they fail to live up to others' expectations. Vanberg (2008), on the other hand, shows in an experiment that people have a preference for truth-telling or dislike the act of lying per se.[4] Our study contributes to this literature by using a lender-borrower game, which shares a similar game form to the trust game adopted in Charness and Dufwenberg (2006), but generates a different incentive structure that is more in line with a lender-borrower relationship in credit markets. Moreover, our study provides further supportive evidence to the real effect of guilt aversion. Our paper also contributes to the growing literature that utilizes laboratory and field experiments to research questions in finance (e.g., Gillette et al., 2003; Cadsby et al., 1990; Kale and Noe, 1997; Pikulina et al., 2017; Du et al., 2019; Hernández-Lagos et al., 2016; Biais et al., 2013; Gneezy et al., 2003; Haigh and List, 2005; Kirchler et al., 2012; Smith et al., 1988; Frydman et al., 2014; Frydman and Camerer, 2016; Frydman and Nave, 2016; D'Acunto, 2015; Cole et al., 2017, among others.).

Finally, our study contributes to the literature on trust. Trust is regarded as important social capital that influences a wide range of socio-economic phenomena (See Putnam, 1993; Fukuyama, 1995; Knack and Keefer, 1997; La Porta et al., 1997; Guiso et al., 2004, 2006, 2008, 2009). Ac-

[3] Berg et al. (1995) propose an influential experimental game, called the "trust game", to measure trust and trustworthiness, which inspires a large literature that follows. See for example, Glaeser et al. (2000), Karlan (2005), Sapienza et al. (2013), among others. In the original two-person trust game, the investor can send an amount of dollars to the allocator. The transfer will be multiplied. After receiving the transfer, the allocator may return some money to the investor. The amount sent by the investor measures trust and controlling for the amount sent, the amount returned by the allocator is a measure of trustworthiness. The lender-borrower game in this paper and Charness and Dufwenberg (2006)'s game can be considered as variations of the original version, which we will explain in detail in Section 2.

[4] See Ederer and Stremitzer (2017) for a recent experiment that supports the guilt-aversion argument of Charness and Dufwenberg (2006). See Ellingsen and Johannesson (2004), Gneezy (2005), Mazar et al. (2008), Fischbacher and Franziska Follmi-Heusi (2013) and Abeler et al. (2019) for related studies on lying aversion. Recently, Di Bartolomeo et al. (2019) provides a design based on Vanberg (2008) to distinguish between guilt-aversion and lying-aversion.

cording to the definition of Coleman (1994), trust is an act involving voluntary placement of resources at the disposal of a trustee, with no enforceable commitment from the trustee, and trustworthiness of a trustee plays a key role in determining trust from a trustor. Karlan (2005) links individuals' behavior in experimental games and their financial decision as a borrower, and finds that those who are identified as trustworthy in a trust game are less likely to default on their loans. Consistent with Karlan (2005), our experimental evidence suggests that multiple mechanisms of trust might be at work that strengthen the efficacy of real-world interpersonal lending relationships.

3 Experimental Design, Procedures, and Hypotheses

3.1 Treatment design

In the experiment, we implement the lender-borrower game shown in Figure 1, where the payoffs are presented in an experimental currency.

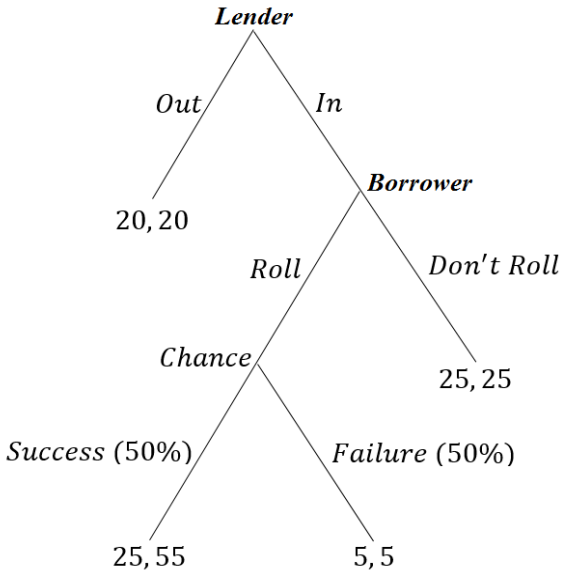

Figure 1: The lender-borrower game.

In the experiment, we refer to the lender as Player A and the borrower as the Player B so that subjects would not naturally regard themselves as in a lending situation. The Lender has two choices: `Out` and `In`. The lender can choose either `Out` to end the game, which gives both players 20, or `In` to let the borrower to make a choice. The borrower in turn has two choices: `Roll` and

Don't Roll, if the lender chooses In. If the borrower chooses Don't Roll, the game ends and each player gets 25. If the borrower instead chooses Roll, there is a 50% chance that the lender gets 25 and the borrower gets 55, and another 50% chance that both players get only 5.[5] Note that the total expected payoff of both players is maximized if the lender chooses In and the borrower chooses Don't Roll. However, the unique subgame perfect equilibrium for self-interested and risk-neutral players is (Out, Don't Roll), which is inefficient. Therefore, the lender-borrower game has the "dilemma" flavor shared by many of the trust games studied in the literature.

The closest study to ours is Charness and Dufwenberg (2006). Hence, it is of importance to point out the similarities and differences between ours and theirs in terms of the game used and the experimental design.

The lender-borrower game we propose shares a similar game form with the trust game proposed by Charness and Dufwenberg (2006). However, the incentive structure is different. In our game, Don't Roll is considered as a "kind" action of the borrower because it never hurts the lender. Following In, a self-interested borrower may or may not choose Roll, depending on her degree of risk aversion. In the Charness and Dufwenberg (2006)'s game, Don't Roll is the "unkind" choice that benefits the borrower the most but hurts the lender the most. Hence, following In, a self-interested borrower always prefer Don't Roll.

The differences in the incentive structure between our game and Charness and Dufwenberg (2006)'s may affect how subjects would potentially behave and respond to communication in the experiment. First, we expect that the lender is more likely to choose In in our game even in the absence of communication because the lender may believe that the borrower is sufficiently risk-averse to choose Don't Roll. Second, when the borrower is allowed to communicate her intention

[5] We can interpret the game as a lending situation. For example, both the lender and the borrower initially have a payoff of 20. The lender first decides between lending 15 (with an interest of 5) to the borrower (In) or not (Out). If the lender chooses not to lend the money, the game ends. If the lender chooses to lend the money, the borrower has 35 (20 plus the 15 borrowed) for investment. She can choose between a safe bet (Don't Roll) and a risky bet (Roll). The safe bet results in a sure return of 45 for the borrower. After repaying the lender 20 (principle plus interest), each player has a payoff of 25 (we assume that the borrower automatically pays her debt whenever she is able to do). Hence, the safe bet benefits both players for sure. The risky bet, on the other hand, yields a high return of 75 with 50% chance and a low return of 5 with 50% chance. If the high return is realized, the borrower is able to pay back the lender 20 and gives herself a final payoff of 55. If the low return is realized, she is not able to pay back the lender and she has to default. In this case, both players get a low payoff of 5.

to the lender, she is able to make a statement like "please go in, I won't roll because I don't like risk," which simply conveys the information that she is risk-averse to the lender. However, in Charness and Dufwenberg (2006)'s game, such a statement is implausible.

In addition, our game naturally applies to the credit markets where a lender faces a moral hazard problem due to the potential risky investments made by a borrower; Charness and Dufwenberg (2006)'s game, on the other hand, is more suitable for describing a principal-agent contract problem where the principal needs to decide whether to delegate a project to the agent (by paying the agent a fixed wage) and the agent chooses to either exert an high effort (`Roll`), which may result in the success of the project or a low effort (`Don't Roll`) which hurts the principle's interest.

To investigate the effect of communication, we first vary the game that the subjects play in the experiment. Subjects are presented with either the game in Figure 1 or a variation of the game in which the borrower is allowed to send a free-form message to the lender at the begining of the game.[6] We further vary the game setting: either a strategy method setting or a dynamic setting. In the strategy method setting, the borrower does not observe the lender's choice before choosing between `Roll` and `Don't Roll`. In the dynamic setting, the borrower observe the lender's choice as in a standard extensive form game. The comparison between the two settings enables us to observe if the act of trusting (choosing `In`) by the lender is able to convey the lender's expectation for the borrower to honor her promise and choose `Don't Roll` if she makes such a promise when communication is allowed. Considering both the strategy method setting and the dynamic setting also differentiates us from Charness and Dufwenberg (2006), who only consider the strategy method. The payoffs in Figure 1 are denoted in experimental currency units (ECU). In order to introduce the possibility of high stakes, subjects were told that the exchange rate would be \$1 = 10 ECU with 90% chance but with 10% chance the exchange rate would be \$1 = 1 ECU. The purpose of this design choice was to increase the stakes of the game and strengthen the external validity of our

[6] A rich literature in experimental economics has devoted attention to communication in strategic interactions. See Cooper et al. (1989, 1992), Charness (2000), Clark et al. (2001), Duffy and Feltovich (2002, 2006), Brosig et al. (2003), Ellingsen and Johannesson (2004), Blume and Ortmann (2007), Brandts and Cooper (2007), Charness and Dufwenberg (2006, 2011), Belot et al. (2010), van den Assem et al. (2012), Cason and Mui (2015), Brandts et al. (2016), He et al. (2017), Palfrey et al. (2017), Dufwenberg et al. (2018), Wu (2018), He et al. (2019), Wang and Houser (2019), among many others.

experiment.

The subjects are randomly matched to form a pair. Once two subjects are matched, they are informed about their role. One of them is selected as the lender, and the other is chosen as the borrower. The role of each subject is kept fixed throughout the experiment.

Each subject participates in only one of the treatments: the lender-borrower game or the one adding a communication stage, under either the strategy method setting or the dynamic setting. This gives us a 2×2 between-subject design. Table 1 summarizes the treatments.

	Strategy	Dynamic
No communication	S-N	D-N
Communication	S-C	D-C

Notes: Each cell displays the abbreviation of each treatment.

Table 1: Treatments overview

At the end of the experiment, we elicit subjects' risk attitudes using a simple task. The details of the risk-elicitation task are provided in the Appendix.

3.2 Procedures

The main experiment was conducted on the Amazon Mechanical Turk (MTurk). The experiment was computerized using Software Platform for Human Interaction Experiments (SoPHIE). Subjects were recruited from the registered MTurk worker pool, with the additional restriction that they must be in the United States.[7] We ran 21 sessions in total, with between 4 and 7 sessions per treatment. We obtained 373 independently matched pairs. In total, 746 subjects from various backgrounds were recruited. Table 2 presents the number of subjects, and number of sessions in each treatment.

A consent form was presented for the subjects to agree to their participation prior to the start of the experiment. All instructions were displayed on their computer screens. Control questions were

[7]The MTurk platform is a desirable platform for experiments such as this because it allows for a large amount of data collection in a relatively short time. Additionally, the subject pool is more diverse than a typical lab experiment with university students as subjects. For example, we had participants from 49 of 50 US states and the average age was 35.9 years, with ages ranging from 19 to 72. Several recent papers in behavioral finance have used the MTurk platform and reported similar behavior as in lab studies (see e.g., Lian et al., 2018; Kumar et al., 2015; D'Acunto, 2018, among others).

Treatments	No. of subjects	No. of sessions
S-N	182	4
S-C	240	5
D-N	136	5
D-C	188	7
Total	746	21

Table 2: Summary of subjects

conducted to check their understanding of the instructions. See the Appendix for the instructions and the control questions.

After finishing the experiment, subjects received their earnings, which were automatically sent to their MTurk account privately. The average earnings were USD $5.42 (including a participation fee of $0.50), and it took approximately 15-20 minutes for a pair of subjects to complete the session.[8] Hence, the implied hourly rate is between $16.26 and $21.68, which is substantially higher than typical earnings for economic experiments on MTurk (Hara et al., 2018).

We also analyze the contents of the messages sent by the borrowers in the treatments with communication. An independent coder was hired to read through all borrower messages and to categorize whether each message is a "promise" or not. A promise is a message that explicitly conveys that the borrower will choose `Don't Roll` if the lender chooses `In`. Only 24 out of 214 subjects in the treatments with communication make promises to the lenders. In Table 3, we show some of the messages that the coder categorizes as promises and non-promises for illustration.

3.3 Hypotheses

We expect that the borrowers will utilize communication to convey truthfully their intention to the lenders if they decide to choose `Don't Roll`. As a result, communication can result in more lenders choosing `In` and more borrowers choosing `Don't Roll`, and both the lenders' and the borrowers' expected payoffs can increase given communication. We believe that communication works through two channels to affect game play as we predict: 1) the information channel, and 2)

[8]The exact process through which subjects flowed through the experiment was as follows: subjects would (1) accept the HIT, (2) read and agree to the consent form, (3) read the instructions and answer control questions, (4) enter a virtual waiting room until there is another participant with which they can be matched, (5) make decisions and receive game feedback, (6) answer a short survey and (7) receive payment feedback.

the guilt-aversion channel.

The information channel works as follows. Communication provides an opportunity for the borrower to convey information about her type to the lender. For example, the lender may initially believe that the borrower is not sufficiently risk-averse to choose `Don't Roll`. Without communication, the lender will choose `Out` to protect herself. When communication is allowed, the borrower can inform the lender that she is actually risk-averse and prefers to choose `Don't Roll`. After observing the message from the borrower, the lender may update her belief about the borrower's risk attitude and instead choose `In`. Therefore, communication can result in more lenders choosing `In`. Under the strategy method, all borrowers' decisions (including those whose lenders choose `Out`) are observable. The overall proportion of `Don't Roll` in the observed actions may not increase with communication if communication merely acts as a sideshow that reflects borrowers' actions. Conditioning on lenders choosing `In`, the relative proportion of `Don't Roll` in the strategy-method game should increase with communication to the extent that lenders respond to information contained in the messages. Under the dynamic setting, more lenders choosing `In` implies that more of the borrowers (those who convince the lender that they are sufficiently risk-averse) have the opportunity to make choices, which also likely results in an increase in the frequency of `Don't Roll`.

Note that the information channel works only if the subjects are sufficiently averse to lying. Otherwise, all the borrowers would claim that they prefer to choose `Don't Roll` and the lenders are thus unable to update their beliefs.[9] If the subjects indeed have lying-aversion, one should expect that those borrowers who prefer to choose `Don't Roll` would inform their lenders about their type and those borrowers who prefer to choose `Roll` would instead choose not to send a message or send an uninformative message to their lenders. We will empirically verify if this is true in the data.

The above arguments suggest that the information channel alone is sufficient to enable com-

[9]The extant evidence on the informativeness of non-binding communication is mixed. Bracht and Feltovich (2009), for example, consider cheap talk in trust games and find that it has no effect in inducing cooperation. Servatka et al. (2011) and Schniter et al. (2013), on the other hand, find evidence that supports the opposite conclusion.

munication to facilitate more `In` & `Don't Roll` pairs and to enhance the welfare of both players. We formalize the following hypothesis for empirical testing:

Hypothesis 1. In both the strategy-method and the dynamic settings, communication leads to a higher frequency of `In` and `Don't Roll`. In addition, communication leads to higher average earnings of the subjects.

Besides the informational channel, a guilt-aversion channel can also increase the frequency of `In` and `Don't Roll`. A comparison between the strategy method setting and the dynamic setting allows us to tease out the guilt-aversion channel from the informational channel. More specifically, we expect that when communication is allowed, the borrower is more likely to choose `Don't Roll` under the dynamic setting than the strategy method setting because of the borrower's guilt-aversion.

The guilt-aversion channel works as follows. We adopt the model from Charness and Dufwenberg (2006), which is based on a more general formulation by Battigalli and Dufwenberg (2007). For simplicity, assume both the lender and borrower are risk-neutral. Let τ_B denote the borrower's probability of choosing `Don't Roll`, τ_{LB} denote the lender's belief of τ_B, and τ_{BLB} denote the borrower's belief of the lender's belief τ_{LB}. Suppose the lender is self-interested, she chooses `In` if the expected payoff of choosing `In`, $\tau_{LB} \times 25 + (1 - \tau_{LB})(25 \times 0.5 + 5 \times 0.5)$, is at least as high as the payoff of choosing `Out`, 20. This gives us $\tau_{LB} \geq 0.5$.

If the borrower is guilt-averse, her utility of choosing `Don't Roll` is 25 and her utility of choosing `Roll` is

$$\begin{aligned} U_B(\texttt{Roll}) &= \big(55 \times 0.5 + 5 \times 0.5\big) - \theta\big((\tau_{BLB} \times 25 + (1 - \tau_{BLB})15) - 15\big) \\ &= 30 - \theta\tau_{BLB}10. \end{aligned}$$

The borrower's utility function equals to the sum of her expected monetary payoff of choosing `Roll` and a disutility from guilt aversion. The parameter $\theta > 0$ denotes the borrower's degree of guilt aversion. $\tau_{BLB} \times 25 + (1 - \tau_{BLB}) \times 15$ is what the borrower believes that the lender expects to

get by choosing `In` and 15 is what the lender would eventually get (in expectation) if the borrower choose `Roll`. The difference between the two denote the amount that the borrower "let down" the lender by choosing `Roll` and the borrower would feel guilty of failing the lender's expectation. By comparing the utilities of the two choices of the borrower, we conclude that the borrower chooses `Don't Roll` if $\tau_{BLB} \geq \frac{1}{2\theta}$.

Communication allows the borrower to promise the lender that she will choose `Don't Roll`, which increases τ_{LB} and leads to a higher chance for the lender to choose `In`. At the same time, it also increases τ_{BLB}, which leads to a higher chance for the borrower to choose `Don't Roll` to avoid feeling guilty. Therefore, if the guilt-aversion channel is at work, the borrowers who would have chosen `Roll` without communication may choose to promise their lenders that they will choose `Don't Roll` when communication is allowed and eventually keep their promises. Hence, the guilt aversion channel can lead to a higher frequency of `Don't Roll` even under the strategy method, implying that communication has a treatment effect on the borrowers' choices.

In the dynamic setting, if the borrower observes that the lender chooses `In` after communication, she will believe that the lender indeed expects her to choose `Don't Roll`. In other words, the act of trusting (choosing `In`) by the lender conveys her expectation to the borrower, resulting in a further increase in τ_{BLB}.

In order to compare the dynamic setting with the strategy method setting properly, we restrict our attention to the sample in which the lenders choose `In`. If we indeed find that the frequency of the borrower choosing `Don't Roll` is higher under the dynamic setting in this sample, we can conclude that the guilt-aversion channel is at work because the effect of the information channel is the same across the two settings in this sample. We formalize the second hypothesis as follows:

Hypothesis 2. Conditioning on lenders choosing `In`, communication increases the frequency of `Don't Roll` more in the dynamic setting than in the strategy-method setting.

4 Experimental Results

4.1 Lenders' decisions

We first present the summary statistics of lenders' decisions. In Table 4, we present the proportion of lenders choosing `In` in different treatments. Overall, lenders are willing to lend to borrowers 72% of the time. There is no noticeable variation in the likelihood of lending across treatments: the range of the proportion is 69.1%-78.6%. Promises also do not appear to increase lenders' propensity to lend. Among lender-borrower pairs in the communication treatments, the proportion of lenders choosing `In` in the strategy method setting (the dynamic setting) is 74.5% (72.6%) when the borrowers do not make promises, and 78.6% (70.0%) when borrowers make promises.

We then perform regression analysis to more formally examine the effect of communication and promise on lenders' decisions. In Table 5, we present regression estimates from linear probability models in which the dependent variable is a binary variable that equals one if the lender chooses `In`.[10] *Communication* is a binary variable that equals one if the treatment allows communication. *Promise* is a binary variable that equals one if the borrower message includes explicit promise that she will choose `Don't Roll`. In columns 1, 2, and 3, we examine the effect of communication on lenders' propensity to choose `In` in both the strategy method and the dynamic settings, in the strategy method setting only, and in the dynamic setting only, respectively. Across both types of settings, there is no significant effect of communication on the likelihood of lenders choosing `In`. In columns 4 to 6, we narrow the sample down to the treatments with communication and explore the variation across borrowers that make or do not make a promise. Again, we find no significant effect of promises on the likelihood of lenders choosing `In`. Overall, the results suggest that the subjects generally have the preference to trust the borrowers and their decisions to trust do not seem sensitive to the information revealed through the communication.

[10] We use linear probability models throughout the paper. However, all our results remain similar if we use probit models instead.

4.2 Borrowers' decisions

Next, we examine borrowers' decisions. In Table 6, where we report the proportion of borrowers choosing `Roll`, we break the sample down to different treatments. Within treatments with communication, we also break the sample further into those with borrower promise and those without borrower promise. The sample in Panel B of Table 6 is smaller than that of Table 4 because we only keep observations where the lenders have chosen `In`. Overall, the dynamic setting alone does not appear to reduce the likelihood of borrowers choosing `Roll`. The proportion of borrowers choosing `Don't Roll` in the strategy-method setting (the dynamic setting) is 62.1% (61.7%). However, the dynamic setting seems related to a lower likelihood of rolling when communication is allowed. The proportion of borrowers choosing `Roll` in the strategy-method setting (the dynamic setting) with communication is 62.5% (54.4%).

As we note earlier, only 24 out of 214 subjects in treatments with communication make promises to the lenders. Interestingly, borrowers who promise to choose `Don't Roll` are indeed substantially less likely to roll. Table 6 shows that the proportion of borrowers choosing `Roll` in the strategy method setting (the dynamic setting) with communication is 67.9% (59.0%) when the borrowers do not make promises, and 21.4% (14.3%) when the borrowers make promises.

We examine the truthfulness of promises using regression analysis. In Table 7, we estimate linear probability models in a sample of treatments with communication. The dependent variable is a binary variable that equals one if the borrower chooses `Roll`. The independent variable is *Promise*, a binary variable that equals one if the borrower message includes an explicit promise that she will choose `Don't Roll`. The estimates show that, both in the strategy-method and the dynamic settings, borrower promises strongly predicts one's decision to choose `Don't Roll`. In the strategy-method setting (the dynamic setting), the likelihood of borrowers choosing `Roll` decreases by 46.5 (32.9) percentage points if the borrower has explicitly promised not to roll. Therefore, borrowers appear quite truthful in their communication, despite the fact that communication was non-binding and there is a conceivable benefit of lying.

Our results thus far suggest that the information channel is at work because the borrowers

make truthful promises which makes communication informative. If lenders are discerning in making their decisions based on the information conveyed from borrowers' messages, they could potentially enhance the joint payoff. In that case, the observed proportion of borrowers choosing `Roll` should decrease with communication and the effect should be observed both in the strategy-method and dynamic settings (**Hypothesis 1**). As we discussed above, we also hypothesize that communication could increase lender-borrower joint payoff through the guilt aversion channel. If the guilt aversion effect exists, we would expect communication to have a stronger effect in reducing the likelihood of borrowers choosing `Roll` in the dynamic setting because lenders' act of trusting through the decision to lend would explicitly shape borrowers' beliefs about the lenders' expectations (**Hypothesis 2**).

Next, we test the two hypotheses by examining the effect of communication treatment on the likelihood of borrowers choosing `Roll`. In Table 8, we estimate linear probability models where the dependent variable is a binary variable that equals one if the borrower chooses `Roll`, and the independent variable is *Communication*. In columns 1 and 2, sample include treatments with the strategy-method setting. While column 1 includes observations where borrowers make a choice but lenders choose `Out`, column 2 only includes observations where lenders choose `In`. In column 1, we do not see a significant effect of communication on the likelihood of borrowers choosing `Roll`. This suggests that communication does not causally improve the joint payoff in the strategy-method setting where borrowers make decision without knowing lenders' actions. It is still possible to see a reduction in the likelihood of borrowers choosing `Roll` in the lender-selected sample if lenders make their lending decisions based on (truthful) information revealed by the borrowers. However, in column 2, where we restrict the sample to cases in which the lenders choose `In`, we still do not find the effect of communication significant. A plausible explanation is that, as we show in Table 5, lenders in our experiment are generally quite willing to lend and their lending decisions are not sensitive to the content of the messages. Therefore, the subsample where lenders choose `In` does not exhibit a strong selection effect as reflected by borrowers average propensity to choose `Roll`. Because the sample in column 2 is conditional on lenders' selection, this estimate

provides a benchmark for the effect of communication in the dynamic setting.

In column 3, we estimate the effect of communication on borrowers' decisions in treatments with the dynamic setting. In the dynamic setting, communication reduces the likelihood of borrowers choosing `Roll` by 17.9 percentage points and this effect is significant at the 5% level. This result is in sharp contrast with the strategy-method setting, where we find no significant effect of communication. This result is supportive of the effect of the guilt-aversion channel. With only the information channel, we would expect communication to reduce borrowers' risk-taking behavior in both the strategy-method and dynamic settings. The fact that communication helps only in the dynamic setting suggests that letting the borrowers know about lenders' actions can causally shape borrowers action by shaping their belief about lenders' expectations.

4.3 Potential improvement in lender payoff if choosing based on borrower promise.

Many lenders decide to lend even when borrowers do not promise to avoid the risky bet. These decisions result in suboptimal outcomes as many of these non-promising borrowers eventually make risky choices and undermine the lenders' payoff. As we show in Table 7, borrowers tend to be trustworthy if they promise to choose `Don't Roll`. Thus, lenders could be better off on average if their decisions were more sensitive to borrowers' promises. We estimate the potential improvement in lenders' *expected* payoff in a hypothetical scenario if they had chosen *In* only when the borrowers promise not to roll. We perform this estimation only in the strategy method setting with communication in which we observe all the borrowers' actions regardless of the lenders' actual choices. In the first row of Table 9, we show that the lenders on average obtain an expected payoff of 18.83 ECUs based on their actual decisions. In the second row, we show that the average expected payoff of the lenders under the hypothetical scenario is 20.33 ECUs. Therefore, the lenders could potentially increase their expected payoffs by 1.5 ECUs (8.0%) had they lent only to borrowers who promise not to roll and this payoff improvement is statistically significant at 1% level. This estimation further demonstrates the informational value of nonbinding communication.

4.4 Robustness: additional controls for subject characteristics

We test the robustness of our results in several ways. First, we control for several borrower characteristics, including age, gender, and their self-reported risk aversion when examining the effect of promise and communication on borrowers' risk taking behavior. One caveat of our design is that we ask about subjects' risk aversion *after* they play the lender-borrower game. As a result, the reported risk aversion is likely endogenous to the choice they just made. For example, if, as we have seen, subjects are less likely to choose `Roll` in the dynamic game with communication, they could rationalize this ex post by reporting a higher risk aversion. As such, this variable is potentially a "bad control" which we do not include in our analysis (Angrist and Pischke, 2008).

In Panel A of Table 10, we re-estimated the regressions in Table 7 with the additional control variables. Panel A shows that the effect of promise on borrowers' decision to `Roll` remains significantly negative after controlling for subject's age, gender, and self-reported risk aversion. In Panel B, we re-estimates the regressions of Table 8. When controlling for subjects' age and gender, the effect of communication on borrowers' decision to `Roll` in the dynamic setting remains significantly negative. However, after further controlling for subjects' self-reported risk aversion, the effect of communication becomes insignificant. We conjecture that this is likely driven by the endogenous nature of self-reported risk aversion. In an unreported test, we find that borrowers in the dynamic setting with communication tend to report higher risk aversion on average. Given by the randomized nature of our experimental design, it is likely that they report higher risk aversion because of their previous low-risk choices which are shaped by lenders' acts of trusting.

5 Conclusion

We design and implement a lender-borrower game in a controlled experiment, and find evidence from lenders' and borrowers' behaviors that are consistent with the three channels of trust: (1) people have the innate preference to trust; (2) non-binding communication is generally truthful and informative which facilitates decision making; and (3) the act of trusting causally induces trustworthy behavior because of guilt aversion. Our findings shed light on the various mechanisms

that shape interpersonal trust and highlight the advantages of relationship-based lending that may not be substituted by FinTech solutions.

As suggested by the extensive literature on trust, the strength of trust may be highly heterogeneous across cultures. Existing studies gauge the level of trust in different countries based on responses to survey questions (e.g., the World Value Survey) or experiments such as the trust game (Glaeser et al., 2000). Future studies could utilize our experimental design to measure the relative strength of various mechanisms of trust in different cultural environments. It may also be of interest to examine these questions in a traditional lab environment with a more homogeneous subject pool and less social distance between the subjects.

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Examples of promises
“i will not be rolling”
“I don’t plan to roll.”
“I can choose don’t roll if you choose In, maximizing our odds.”
“Lets not risk it and don’t roll”
Examples of non-promises
“Hi. I hope you try to create a fair outcome.”
“Good luck!”
“Hello”
“Hi there, hope you are having a nice Monday.I am excited to participate in this with you”

Table 3: Illustration of messages.

Panel A

	N	Mean
Communication	120	0.750
Communication with promise	14	0.786
Communication without promise	106	0.745
No communication	91	0.703
Total	211	0.730

Panel B

	N	Mean
Communication	94	0.723
Communication with promise	10	0.700
Communication without promise	84	0.726
No communication	68	0.691
Total	162	0.710

Panel A (B) presents the proportion of lenders that choose `In` in the strategy-method setting (the dynamic setting).

Table 4: Summary Statistics: Lender decision to choose `In`.

Dependent Variable:	Lender chooses `In`					
Communication:	Both	Both	Both	Yes	Yes	Yes
Dynamic:	Both	No	Yes	Both	No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Communication	0.040	0.047	0.032			
	(0.85)	(0.75)	(0.44)			
Promise				0.013	0.040	-0.026
				(0.14)	(0.34)	(-0.17)
N	373	211	162	214	120	94
R-sq	0.002	0.003	0.001	0.000	0.001	0.000

This table presents regression estimates from linear probability models in which the dependent variable is a binary variable that equals one if the lender chooses `In`. *Communication* is a binary variable that equals one if the game allows communication. *Promise* is a binary variable that equals one if the borrower message includes an explicit promise that she will choose `Don't Roll`. *t*-statistics using robust standard errors are in brackets. *, ** and *** indicate significance better than 10%, 5%, and 1% respectively.

Table 5: Regressions: Lender decision to choose `In`.

Panel A

	N	Mean
Communication	120	0.625
Communication with promise	14	0.214
Communication without promise	106	0.679
No communication	91	0.615
Total	211	0.621

Panel B

	N	Mean
Communication	68	0.544
Communication with promise	7	0.143
Communication without promise	61	0.590
No communication	47	0.723
Total	115	0.617

Panel A (B) presents the proportion of borrowers that choose `Roll` in strategy-method games (dynamic games).

Table 6: Summary Statistics: Borrower decision to choose `Roll`.

Dependent Variable:	Borrower chooses `Roll`		
Communication:	Yes	Yes	Yes
Dynamic:	Both	No	Yes
	(1)	(2)	(3)
Promise	-0.402***	-0.465***	-0.329***
	(-4.75)	(-3.89)	(-2.98)
N	214	120	94
R-sq	0.064	0.095	0.043

This table presents regression estimates from linear probability models in a sample of communication games. The dependent variable is a binary variable that equals one if the borrower chooses `Roll`. *Promise* is a binary variable that equals one if the borrower message includes an explicit promise that she will choose `Don't Roll`. *t*-statistics using robust standard errors are in brackets. *, ** and *** indicate significance better than 10%, 5%, and 1% respectively.

Table 7: Regressions: Borrower promise and decision to choose `Roll`.

Dependent Variable:	Borrower chooses `Roll`		
Dynamic:	No	No	Yes
Lender chooses `In`:	Both	Yes	Yes
	(1)	(2)	(3)
Communication	0.010	0.031	-0.179**
	(0.14)	(0.39)	(-2.00)
N	211	154	115
R-sq	0.000	0.001	0.033

This table presents regression estimates from linear probability models in a sample of communication games. The dependent variable is a binary variable that equals one if the borrower chooses `Roll`. *Promise* is a binary variable that equals one if the borrower message includes an explicit promise that she will choose `Don't Roll`. *t*-statistics using robust standard errors are in brackets. *, ** and *** indicate significance better than 10%, 5%, and 1% respectively.

Table 8: Regressions: Communication and borrower decision to choose `Roll`.

	Average expected payoff	Standard error
Actual lender decision	18.83	0.38
Hypothetical lender decision	20.33	0.15
Difference	1.5***	0.35

This table presents the average expected payoff for the lenders in the strategy method setting with communication based on their actual decisions and hypothetically decisions in which they choose *In* only if the borrowers to choose *Don′tRoll*. The lender's expected payoff is 20 if she chooses *Out*, 25 if she chooses *In* and borrower chooses *Don′tRoll*, and 15 if she chooses *In* and borrower chooses *Roll*. *, ** and *** indicate significance better than 10%, 5%, and 1% respectively.

Table 9: Expected improvement of lender payoff if choosing based on borrower promise.

Panel A: Borrower promise and decision to choose `Roll`.

Dependent Variable:	Borrower chooses `Roll`					
Communication:	Yes	Yes	Yes	Yes	Yes	Yes
Dynamic:	Both	No	Yes	Both	No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Promise	-0.369***	-0.454***	-0.299**	-0.313***	-0.411***	-0.225**
	(-4.20)	(-3.72)	(-2.59)	(-3.65)	(-3.31)	(-2.17)
Age	0.009***	0.006*	0.007	0.009***	0.007*	0.009
	(2.88)	(1.94)	(1.22)	(3.00)	(1.95)	(1.48)
Male	-0.064	0.006	-0.076	-0.088	-0.026	-0.087
	(-0.97)	(0.08)	(-0.71)	(-1.38)	(-0.31)	(-0.83)
RiskAversion				-0.109***	-0.098**	-0.104**
				(-3.45)	(-2.14)	(-2.35)
N	214	120	94	214	120	94
R-sq	0.103	0.116	0.071	0.155	0.153	0.130

Panel B: Communication and borrower decision to choose `Roll`.

Dependent Variable:	Borrower chooses `Roll`					
Dynamic:	No	No	Yes	No	No	Yes
Lender chooses `In`:	Both	Yes	Yes	Both	Yes	Yes
	(1)	(2)	(3)	(4)	(5)	(6)
Communication	0.009	0.033	-0.166*	-0.015	0.005	-0.071
	(0.13)	(0.42)	(-1.84)	(-0.23)	(0.07)	(-0.80)
Age	0.007**	0.007**	-0.000	0.008***	0.008**	0.004
	(2.36)	(2.46)	(-0.09)	(2.67)	(2.54)	(0.90)
Male	-0.009	0.016	-0.096	-0.034	-0.026	-0.115
	(-0.13)	(0.20)	(-1.01)	(-0.53)	(-0.34)	(-1.31)
RiskAversion				-0.137***	-0.115***	-0.173***
				(-4.33)	(-3.11)	(-4.62)
N	211	154	115	211	154	115
R-sq	0.023	0.034	0.042	0.100	0.089	0.179

Panels A, B replicate Tables 7, and 8 with additional control variables on borrower characteristics, respectively.

Table 10: Robustness: Control for borrower characteristics.

Appendix: Sample Instructions

Remark 1. *The instructions below are for the dynamic treatment with communication. The instructions for the dynamic treatment without communication are obtained by removing the paragraph with a box around it. Footnotes 11 and 12 highlight differences between high and normal-stakes versions of the experiment and between strategy method and dynamic versions of the experiment, respectively.*

You are about to participate in a session on interactive decision-making. Thank you for agreeing to take part. You will earn money based on your decisions, the decisions of another participant and possibly chance.

Please read these instructions carefully as there will be some control questions that you must answer correctly in order to be able to participate.

All payments are denoted in **experimental currency units (ECU)**. The will be converted to US dollars ($) at the exchange rate of **10ECU** = $**1**.[11]

At the beginning of the experiment, you will be randomly assigned as either a type A or a type B participant.

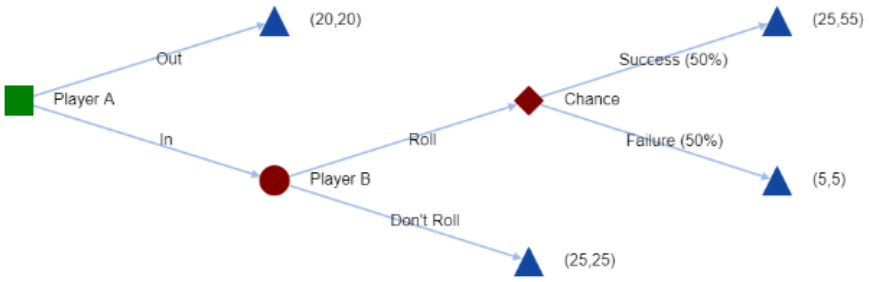
You will be randomly paired with another participant of a different type. That is, if you were assigned as type A, you will be randomly paired with a participant that was assigned as type B; if you were assigned as type B, you will be randomly paired with a participant assigned as type A.

You will interact only with the participant you have been paired with for that period. We refer to this participant as your match.

If you are assigned as type B player, you are first asked to type a message to type A player. If you do not wish to send a message, do not enter any text and simply press "Submit". If you wish to send a message, you can type anything in a message box except for contents that reveal identity, contain threatening or abusive languages, or propose side deals outside the experiment. After clicking the button "Submit", your message will be automatically shown on the type A player's screen.

[11] In high-stakes versions of the experiment, this sentence read, "**With 10% chance the exchange rate will be 1ECU = $1. With 90% chance the exchange rate will be 10ECU = $1.**"

You will then enter a decision making phase. The decision problem that you will face is:



The tree structure denotes the order in which decisions will be made. The nodes (square, circle or diamond) indicate which player makes a decision and the labels on each branch represent the actions that are available to the decision maker.

The numbers in each cell $(\mathbf{x}, \mathbf{y})$ represent the payoff to each player should that outcome occur. Specifically, the type A player receives the first number, **x**, while the type B player receives the second number, **y**.

The type A player must initially decide between two actions, **In** and **Out**. If the type A player chooses **Out**, then the game ends and both player types will receive 20.

If the type A player chooses **In**, then the type B player will make a choice between **Roll** and **Don't Roll**.[12] If the type B player chooses **Don't Roll**, then the game ends and both player types will receive 25.

If the type B player chooses **Roll**, then the payoffs of each player will be determined by a chance outcome. Specifically, for the type A player, there is a 50% chance of receiving 25 and a 50% chance of receiving 5. Similarly, for the type B player, there is a 50% chance of receiving 55 and a 50% chance of receiving 5.

After both you and your match have made your decisions, you will learn the actions taken by both player and, if applicable, you will learn whether the chance outcome was a success or failure. Your payoff that of your match will be determined and displayed.

[12] In the strategy method versions of the experiment, this sentence continued, "*before learning whether the type A player chose In or Out.*"

Control Questions Answered by Subjects Following Instructions

Remark 2. *Note that in all cases, subjects saw an illustration of the game tree. For brevity, we do not repeat it here. All questions were multiple choice, with a single correct answer and one or two incorrect answers from which to choose.*

1. Suppose that the Type A player chose **In**, the Type B player chose **Roll** and the chance outcome was a **Success**. What is the payoff (in ECU) for the Type A player?

2. Suppose that the Type A player chose **In** and the Type B player chose **Don't Roll**. What is the payoff (in US dollars) for the Type B player if the exchange rate is determined to be 10ECU = 1USD?

3. Suppose that the Type A player chose **In** and the Type B player chose **Roll** and the chance outcome is **Failure**. What is the payoff for the Type A player in US dollars if the exchange rate is 1ECU = 1USD?

4. Suppose that the Type A player chose **In** and the Type B player chose **Roll** and the chance outcome is **Success**. What is the payoff for the Type B player in US dollars if the exchange rate is 1ECU = 1USD?

Risk Elicitation Question

Remark 3. *This question was asked after receiving feedback about the game but before subjects learned their final payoff and could submit the HIT back to the MTurk system. The question was formatted as an 11-point Likert scale.*

How do you see yourself: are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? (0: not at all willing to take risks; 10: very willing to take risks.)