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Measuring trust in institutions and its causal effect

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We propose a novel way of measuring trust in institutions, which draws on the experimental method used to elicit time preferences. Our measure is provided in the meaningful metric of the subjective probability of trustworthiness of the trustee. In a lab-in-the-field setting in the Philippines, we measure trust in two different financial institutions. Additionally, we exploit exogenous variation in the eligibility for a future payment to examine whether a promise fulfilled by the institution increases trust and changes individual financial behavior. We find that eligible individuals significantly increase savings held with the institution.

Keywords. Trust, institutions, experiment, time preference, risk preference, savings.

JEL classification. C91, D81, D90, O10.

1. Introduction

While *trust in institutions* is an important economic factor,[1] neither a behavioral measure nor a method of exogenously varying trust have been established so far. Our study introduces methods to fill these gaps. We propose an experimental measure of trust in

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[1] Generally, trust has been shown to be positively related to GDP (Putnam, Leonardi, and Nonetti (1993), Porta, Lopez-De-Silane, Shleifer, and Vishny (1997), Knack and Keefer (1997), Zak and Knack (2001), Algan and Cahuc (2010), Tabellini (2010)), trade (Guiso, Sapienza, and Zingales (2009)), stock purchases (Guiso, Sapienza, and Zingales (2004, 2008)), and financial behavior in developing countries (Karlan (2005), Cole, Gine, Tobacman, Topalova, Townsend, and Vickery (2013), Karlan, Lakshmi Ratan, and Zinman (2014)).

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institutions based on the behavioral definition of trust put forward by Coleman (1990). "An individual trusts if she voluntarily places resources at the disposal of another party without any legal commitment from the latter. In addition, the act of trust is associated with an expectation that the act will pay off in terms of [this individual]'s goals." (Fehr (2009, p. 238))

The most commonly used measures of trust in institutions are hypothetical questions in surveys.[2] However, behavioral measures capture trust more accurately than reported measures (Fehr (2009), Algan and Cahuc (2014)). After all, it is not clear whether individuals that verbally declare trusting an institution would actually behave in a cooperative way or be willing to transact with the institution.

Our trust measure is inspired by the time preference elicitation methods that use choices between smaller, sooner and larger, later payments. Instead of the experimenter, an institution is responsible for the future payment. We identify trust by providing a payment guarantee in form of a post-dated check and by examining the behavioral difference to the setting without such check. The uncertainty of future payment delivery by the institution in our trust elicitation is analogous to the situation described in the definition of trust. An additional risk elicitation informs us about individual risk preferences. We measure trust in two different financial institutions that invoke different levels of reported trust. Our results confirm the direction of the difference, yet with small magnitudes.

The second contribution of our paper follows from the fact that the experiment payment itself can provide exogenous, random variation of the level of trust in an institution. Specifically, a future payment that eventually is fulfilled as promised can affect trust positively, and hence can change individual financial behavior. Our experiment features trust elicitation decisions, which give rise to a future payment but also risk preference elicitation decisions that do not. A random draw determines the type of decision to be remunerated, and thus whether a future payment potentially occurs. Using administrative data, we find that being paid a trust decision rather than a risk decision from an institution increases personal savings held at this institution by approximately 25% above baseline levels. Overall, we see this as first indicative evidence that the kept promise of the later payment causally increases savings via a higher level of trust in the institution.

To our knowledge, this is the first instance of exogenously impacting trust in the field and using this random variation to show the effects of trust on economic outcomes. The laboratory study by Bartling, Fehr, Huffman, and Netzer (2022) is the only other study known to us that exogenously varies trust. Their study and our paper contribute different methods and insights. While they use different examples of game play histories to induce a trust variation, we use variation in the subjects' experience with the institution. They illuminate the mechanisms of how institutional arrangements interact with trust in the laboratory while we observe the effect of trust reflected in economic outcomes in the field.

[2]Important relevant surveys are the World Value Survey (WVS), the General Social Survey (GSS), and the Financial Trust Index Survey (FTIS). Further data is regularly collected by Gallup, the Pew Research Center, Edelman Trust Barometer and others.

The literature on trust measurement using laboratory experiments typically measures *general* trust, mostly using the trust game (Berg, Dickhaut, and McCabe (1995)) and the gift exchange game (Fehr, Kirchsteiger, and Riedl (1993)). We aim to measure directed trust, which features less prominently in the literature. Using the trust game, a number of studies investigate directed trust by installing as trustees either known members of a person's social network (Leider, Möbius, Rosenblat, and Do (2009), Ligon and Schechter (2012), Binzel and Fehr (2013)) or employees of various institutions for a measure of trust in institutions (Carlsson, Demeke, Martinsson, and Tesemma (2019)). Adding to this literature, we implement an experimental method with an institution as the clearly defined trustee that is responsible for the future payment. In contrast to both survey and common experimental measures, our data allows us to objectively quantify the trust in an institution in terms of the subjective probability of keeping a promise. For example, an estimated probability of payment completion of 0.5 would imply that in one out of two cases, the institution is expected to indeed complete the payment.

We implement our trust elicitation method alongside a trust game and survey questions on trust in a lab-in-the-field experiment in the Philippines. The two institutions that are responsible for the future payment are a formal and named microfinance institution called Negros Women for Tomorrow Foundation (NWTF) and local Money Lenders (ML), a well-known, informal group of anonymous individual lenders that has a long history in the Philippines.

Our three estimation methods estimate the trust in NWTF to be higher than in ML, albeit not significantly. They suggest a much less pronounced difference than the levels of trust reported in the survey. For example, one specification quantifies the subjective probability of payment completion to be 0.573 for NWTF and 0.524 for the ML, relative to payments with guarantee by check. Further analyses suggest that the hypothetical question for trust invokes additional elements beyond trust, particularly for those experienced with the institution.

Since we employ methods of time preference elicitation, our study is related to the wide area of experimental work that measures intertemporal discounting. The survey by Frederick, Loewenstein, and O'Donoghue (2002) emphasizes that delayed rewards are subject to uncertainty, which could be a confounding factor in the measurement of time preferences. Since the delay of a payment comes with inherent uncertainty about its future enjoyment, the literature has always aimed to establish subjects' trust in the experimenter's full commitment to realize the payment. For that purpose, it is common practice to use notarized certificates, post-dated checks or equivalent financial instruments to assure the future payment (e.g., Coller and Williams (1999), Benjamin, Choi, and Joshua Strickland (2010)). By varying the use of checks, we contribute to the understanding of the role of such guarantees and observe that a post-dated check indeed influences subjects' decisions, and hence the inferred time preferences.

The literature on experimental time preference elicitation features various elicitation methods. In order to account appropriately for utility function curvature, Andersen, Harrison, Lau, and Rutström (2008) use double multiple price lists (DMPL) of binary choices for the simultaneous elicitation of time and risk preferences. Andreoni and Sprenger (2012a,b) put forward a single elicitation that features a convex time budget

(CTB) to identify both curvature and discounting. The latter method has been the subject of controversial debates (Harrison, Lau, and Rutström (2013), Cheung (2015), Andreoni and Sprenger (2015), Andreoni, Kuhn, and Sprenger (2015)). Harrison, Lau, and Rutström (2013) suggest a latent index type estimation strategy as in Andersen et al. (2008) to be implemented on the CTB task data. Our experimental setup generates convex and binary budget data for both time and risk preference elicitations. This allows for the implementation of both the CTB and DPML estimation methods and for extending the DPML joint estimation approach to convex budget data. Our results are robust across approaches, including the latter hybrid one. However, advances and convergence in the literature of time preference elicitation would improve and facilitate trust measurements of the kind we propose.

2. Experimental design

In our experiment, we measure trust in institutions with a method that is similar to time preference elicitation. To identify trust, we vary within-subject whether the later payment is guaranteed by a post-dated check (*C*) or not (*NC*). Furthermore, we vary between-subject (i) the institution that carries responsibility for the implementation of the later payment and (ii) the order of *C* and *NC*.[3]

The main elements of the experimental design are the trust elicitation task (TE, 36 decisions), the risk preference elicitation task (RPE, 18 decisions) as well as the trust game. In this order, these elements are parts of each experimental session. Each element is introduced by verbal instructions to the plenary of all session participants. From TE and RPE, one out of 54 decisions is chosen randomly for payment via a ball draw by the subject. Additionally, all subjects are paid according to the outcome of the trust game.

2.1 *Trust elicitation task*

The main idea behind the trust elicitation task is that a subject places more resources in the hands of an institution the higher is her belief of getting back these resources, *absent any contractual commitment*, from the institution in the future. Adding a payment guarantee in the form of a check to the aforementioned procedure and observing resulting changes in behavior allow us to estimate the subjects' beliefs P of compliance by the institution. We call P the level of trust in institution I. The intertemporal utility of consumption at two points in time, depends on the probability P of obtaining the chosen future earnings c_{t+d} as follows:

$$DU(c_t, c_{t+d}) = u(c_t) + \delta^d \big[P \cdot u(c_{t+d}) + (1-P) \cdot u_0\big], \tag{1}$$

where u_0 refers to the utility of not receiving any payment.

[3]In the NC/C treatment, subjects first make 18 *NC* decisions and then 18 *C* decisions. Vice versa in the C/NC treatment.

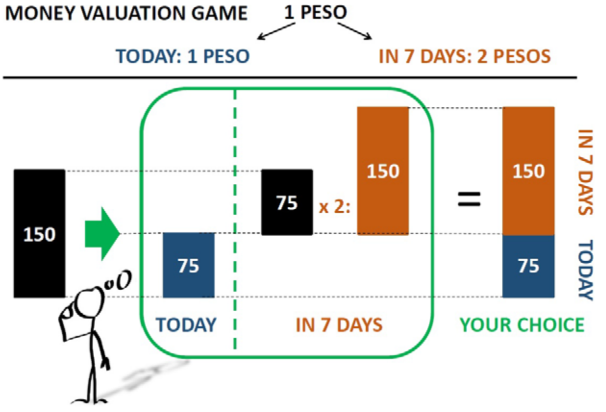


FIGURE 1. Instructional poster for the trust elicitation task (English translation).

2.1.1 *Decision* Subjects are presented 36 decisions, which feature two delay lengths until the later payment, $d \in \{7, 28\}$ in days, and two payment guarantees $G \in \{NC, C\}$. For each combination of d and G, subjects are presented with nine different interest rates $1+r$ ranging from 1 to 40. The variations in d, $1+r$, and G will allow us to estimate time preferences, the curvature of the utility function and the trust in the institution, respectively.

Drawing on the CTB approach of Andreoni and Sprenger (2012a), in each of the decisions subjects choose a current amount $c_t \in [a, 150]$ in Philippine Pesos (PHP). The interest rate $1+r$ determines the future earnings to be $c_{t+d} = (150 - c_t) \cdot (1+r)$. For interest rates ranging from 1 to 2.67, the budget set begins at $a = 0$. For $1+r \in \{4, 8, 40\}$, we set $a \in \{50, 100, 140\}$, respectively, and thus cap the future earnings c_{t+d} at a maximum of 400.[4] Figure 1 reprints the instructional poster and Table 1 presents the parameters of the 36 decisions.

2.1.2 *Decision protocol* The decisions are divided into four blocks of nine decisions with different interest rates. In the first and third blocks, subjects make their choices for $d = 7$ and in the second and fourth blocks for $d = 28$. Depending on the order of NC and C, a payment guarantee is offered in the first two or last two blocks. Between the first and last two blocks, the instructor reminds subjects of the upcoming decisions and the change in provision of the payment guarantee.

From the start of the instructions, posters illustrate in detail the decisions. In each block, tablet computers are used for simple and intuitive decision entry.[5] On average, about one research assistant per two subjects is available to explain the decision once more. See Penczynski and Santana (2024) for the experimental instructions.

[4]We include high interest rates to provide incentives for eventual allocations to the future date because these inform our trust measure. The cap on the future amount is introduced due to budgetary reasons. For example, for $1+r = 40$, a subject choosing $c_t = 0$ would otherwise generate future earnings of PHP 16,000, which is approximately 359 USD.

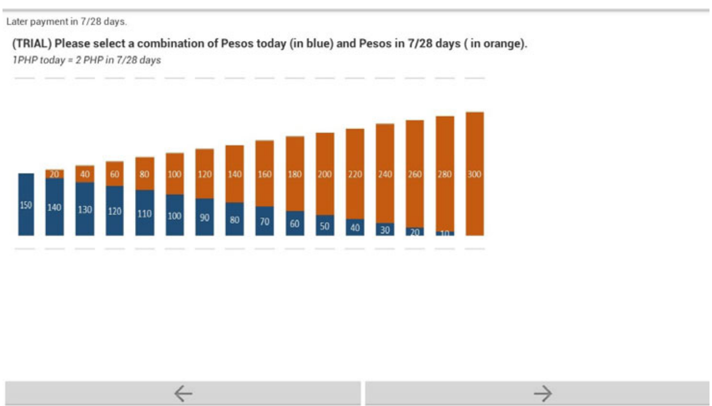
[5]We used Android^{TM} supported tablets and Open Data Kit (ODK), an open source survey program.

Table 1. Choice parameters in the trust elicitation task in the NC/C treatment.

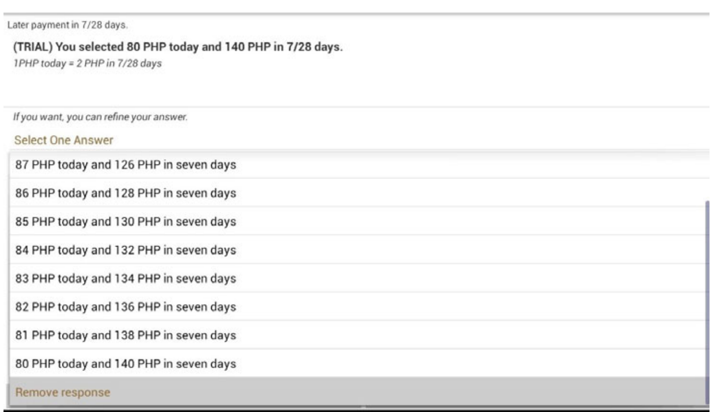
Delay d	Guarantee G	Minimum amount a	Interest rate $1+r$	Daily rate (percent)
7	NC	0	1	0
7	NC	0	1.33	4.20
7	NC	0	1.67	7.57
7	NC	0	2	10.41
7	NC	0	2.33	12.87
7	NC	0	2.67	15.04
7	NC	50	4	21.90
7	NC	100	8	34.59
7	NC	140	40	69.38
28	NC	0	1	0
28	NC	0	1.33	1.03
28	NC	0	1.67	1.84
28	NC	0	2	2.51
28	NC	0	2.33	3.07
28	NC	0	2.67	3.57
28	NC	50	4	5.08
28	NC	100	8	7.71
28	NC	140	40	14.08
7	C	0	1	0
7	C	0	1.33	4.20
7	C	0	1.67	7.57
7	C	0	2	10.41
7	C	0	2.33	12.87
7	C	0	2.67	15.04
7	C	50	4	21.90
7	C	100	8	34.59
7	C	140	40	69.38
28	C	0	1	0
28	C	0	1.33	1.03
28	C	0	1.67	1.84
28	C	0	2	2.51
28	C	0	2.33	3.07
28	C	0	2.67	3.57
28	C	50	4	5.08
28	C	100	8	7.71
28	C	140	40	14.08

Each decision involves three steps. First, subjects make a binary choice between options $c_t = 150$ and $c_t = a$, similar to a multiple price list choice. After getting familiar with the key parameters of the current decision, subjects can choose any amount $c_t \in [a, 150]$ in steps of 10. Both c_t and the remaining amount $c_{t+d} = (150 - c_t) \cdot (1 + r)$ are visualized. Finally, subjects can refine their choice to the unit level in a dropdown menu. Subjects are told that only steps 2 and 3 are payoff relevant. The screenshots of these steps are presented below in Figure 2.

(a) Step 1, binary choice.
"Subong" meaning today and "Sa 7/28 ka adlaw" meaning in 7/28 days.



(b) Step 2, convex time budget choice.



(c) Step 3, refined convex time budget choice.

FIGURE 2. Screenshots of the trust elicitation task in the trial round. *Notes*: The screenshots correspond to the trial round that the subjects do before the decisions. The screenshots read "Later payment in 7/28 days." The expression "7/28" is only for illustrative purposes. Participants are always shown choices to be delivered in either 7 or 28 days.

2.1.3 *Payment procedures* Given our study's goal of measuring trust in institutions, the specific arrangements for the later payment—and the subject's understanding thereof—are important. While payments corresponding to the c_t choice are made at the end of the session, the payments corresponding to c_{t+d} are delivered in cash to the subjects' homes. The subjects are informed that the local institution, NWTF or ML is responsible for storage and delivery of the money. Envelopes containing the money, contact information, and a prepared receipt are handed over to the institution by the experimenters after the session.[6]

Regarding NC decisions, we tell subjects that we cannot provide any written legal note to secure the payment. With the C decisions, we establish a baseline level of trust in the payment by the additional provision of a post-dated check for the future payment. Checks are provided at the end of the session in case delivery of the later payment fails. Upon successful delivery, the checks are collected and voided. Many experiments measuring time preferences use similar procedures to increase the subjects' confidence in the realization of the later payment (Coller and Williams (1999), Andersen et al. (2008), Benjamin, Choi, and Joshua Strickland (2010), Andreoni and Sprenger (2012b)). Although the payment guarantee is independent of the institution, differences between institutions are not ruled out in C decisions.

We instruct subjects that the checks are provided by us to guarantee their payment only for *C* decisions. During instruction, participants are shown a sample check, signed and post-dated with the name of one of the participants as an example (see Supplemental Appendix A.1, Penczynski and Santana (2024)). We place a stamp of the University of Mannheim on the check. This way, we associate ourselves, researchers from a European University, with the check payment and not with the unguaranteed payments. In contrast, subjects know that the nonguaranteed default procedure relies on the treatment institution, a procedure credibly deemed outside of the experimenter's control after the handing over of the money envelopes.

The checks are issued from Banco de Oro (BDO), the largest bank in the Philippines. Subjects are familiar with this form of payment.[7] While BDO branches are common in cities, they are less common in rural areas. To avoid large transportation costs for subjects when cashing the check, they are informed prior to the decisions that we offer a second possibility to locally cash the checks within the community. For this option, NWTF's local offices kindly assisted us and were available to cash checks out of our funds. This procedure is implemented in all sessions, but subjects are only disclosed NWTF's in-

[6] Local research assistants assisted the two institutions in the delivery of the later payments. The instructions were silent on such procedural aspects of the payment and said generally that "this payment will be kept for storage at [the institution] and delivered to you to your house at the according date." 551 subjects were to be paid in the future and only four did not receive their payment due to absence and nontraceability.

[7] All of our subjects are clients of NWTF and have loans with them. Their loans are disbursed through checks. 59 subjects report never cashing a check before. It could be that someone else cashed the check with their loan disbursement for them, but they would know how a check works.

volvement in the local option during the payment procedure after the decisions have been made.[8]

Although our study's goals differ from standard time preferences elicitation studies, our payment procedures are symmetric between treatments. Additionally, delivery to homes is implemented in order to equalize the transaction costs between possible payment dates. This ensures a clean measure of time discounting and avoids any possible interaction of transaction costs with our treatments.

Other studies minimize the procedural difference between the current and the future payment and enable a present bias estimation by implementing a front end delay (Coller and Williams (1999), Andersen et al. (2008), Andreoni and Sprenger (2012a)). Our focus on the uncertain nature of the future payment guides us not to subject the front end payment to such uncertainty and to ensure that front end payment arrangements are always the same: paid at the end of the experiment.

We carefully designed our experiment to pick up differences in trust in institutions. With the random allocation of treatments and the constant parameters across the TE tasks, we make sure that systematic differences in the valuation of later payments can be related to the different institutions and guarantees. It is possible, however, that subjects have preferences over elements of the later payment, such as the delivery mode, the provision of the information necessary to find subjects, the storage at the institution, or the check transaction that might limit this clean attribution.

For instance, regarding the delivery, subjects might not want to have a representative of the institution come to their house, possibly due to pending loans. This could make subjects avoid contact entirely by avoiding any future payment at all ($\bar{c}_t = 150$), depending on the institution. However, there is no difference across treatments on the extensive margin of avoiding future payments in all decisions. 15 out of 560 subjects (2.7%) do this in NWTF, 11 out of 533 (2.1%) in ML. Thus, occurrences of such extremely front-loaded allocations probably result from particular time preferences that are equally present in both treatments, not from preferences regarding the later payment from a particular institution.

In C decisions, the payment guarantee via a check is established in addition to the delivery to the subject's home. Subjects may doubt the delivery of the payment. In this case, whether the check fully substitutes for the delivery depends on beliefs with respect to the funds of the check, the time necessary to cash it, the familiarity with cashing a check, etc. The C decisions consistently generate higher future allocations, which reassures us that the check is perceived as an overall valuable substitute for the delivery.

2.1.4 *Institutions* We chose to work with two financial institutions $I \in \{\text{NWTF}, \text{ML}\}$, which gave rise to distinct reported trust levels in ex ante surveys.

2.1.4.1 *Negros Women For Tomorrow Foundation (NWTF)* The Negros Women for Tomorrow Foundation is a formal, nonprofit microfinance institution (MFI) that operates

[8]Out of 297 distributed checks, 5 were cashed (1 at a BDO branch) and, therefore, the later payment not handed in. Three checks were not returned, 1 of them received the delivery, and 2 could not be reached at home or by phone.

in the Visayas Region of the Philippines. NWTF provides loans at modest rates to poor women from rural communities to start or expand their own small businesses following the Grameen Bank credit methodology of group lending (Besley and Coate (1995)). The loan program has a minimum loan of PHP 1000 and a maximum of PHP 30,000 (between 22 and 673 USD, approximately).

2.1.4.2 *Local Money Lenders (ML)* Local Money Lenders are an informal financial institution in the Philippines also referred to as "5–6" lenders, because commonly for every 5 PHP borrowed, 6 PHP are to be repaid after an agreed period of time of usually 1 or 2 months. They lend money usually to poor people that might not have access to formal lending institutions such as banks or MFIs. Local money lenders do not require collateral or any documents from their borrowers (Kondo (2003)). "5–6" lenders are widely known by the population and usually seen as an expensive and last resort for borrowing money.[9]

We aim to have institutions that are well known to all participants. However, having participants with similar levels of experience toward two different financial institutions was not possible. We thus opted for an institution with which our sample had first-hand experience (NWTF) to guarantee that participants were each equally aware of at least one institution. 100% of our sample (both NWTF and ML treatments) are drawn from NWTF's client base. On the other hand, Money Lenders are a well-known last-resort lending institution throughout the country. Due to security reasons, the exact identity of the ML could not be disclosed as we could only work with them under the condition of anonymity. This is in-line with our aim because people assigned to the ML treatment then draw on their own previous experiences and private information about local money lenders in general when making their choices. A priori and by design, we expect different levels of trust towards the two institutions, with a higher level toward NWTF. One of our aims is to see whether our measure discriminates between the two in the expected direction.

2.2 *Risk preference elicitation task*

In the experiment's second task, subjects allocate money between a safe and a risky lottery in 18 decisions, as illustrated in the instructional poster in Figure 3. The parameters of the risk preference elicitation (RPE) task are chosen analogously to the TE task in that the safe lottery imitates the immediate payment and the risky lottery mimics the later payment's size and risk. Winning the risky lottery multiplies the allocated money by $1 + r \in \{2, 4\}$, losing it reduces the payment to 0. The nine probabilities of winning the lottery are $p_w \in \{0.1, 0.2, \dots, 0.9\}$. The safe lottery pays out for sure the amount allocated to it. Like before, subjects allocate an amount $l \in [a, 150]$ to the safe lottery, and thus obtain a prize of $(1 + r) \cdot (150 - l)$ when winning the lottery. The amount of a is 0 and 50

[9]The lucrative and risky business attracts many Indian nationals and has a long history in the Philippines (Times of India (2013)). While well known, only 7 out of 1093 participants report to have borrowed from money lenders, implying a markedly different level of experience with Money Lenders in the sample compared to NWTF.

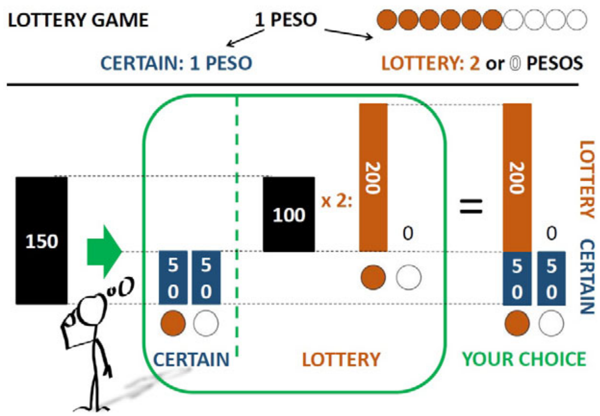


FIGURE 3. Instructional poster for risk preference elicitation task (English translation).

for the two values of $1+r$, respectively, analogous to TE. Each decision again involves three steps. First, subjects make a binary choice between $l_t = 150$ and $l_t = a$. In the second step, subjects can choose any amount $l_t \in [a, 150]$ in steps of 10. Subjects can clearly visualize the amount l_t assigned to the safe lottery and the amounts $(1+r) \cdot 150 - l_t$ or zero, relevant for the risky lottery. In the third step, subjects can refine their l_t choice to the unit level in a dropdown menu. Steps 2 and 3 are analogue to the CTB approach used in TE. Table 2 presents the choice parameters and Supplemental Appendix A.2 presents the screenshots of the task.

TABLE 2. Choice parameters in risk preference elicitation task.

Interest rate $1+r$	Minimum Amount a	Probability p_w	EV of Δl PHP
2	0	0.1	0.2
2	0	0.2	0.4
2	0	0.3	0.6
2	0	0.4	0.8
2	0	0.5	1
2	0	0.6	1.2
2	0	0.7	1.4
2	0	0.8	1.6
2	0	0.9	1.8
4	50	0.1	0.4
4	50	0.2	0.8
4	50	0.3	1.2
4	50	0.4	1.6
4	50	0.5	2
4	50	0.6	2.4
4	50	0.7	2.8
4	50	0.8	3.2
4	50	0.9	3.6

2.3 *Trust game*

In order to have a behavioral measure of general trust, we implement the trust game. This game is played in a similar way to the original game by Berg, Dickhaut, and McCabe (1995) and does not differ across treatments. Participants are randomly assigned to the role of either investor or investee. Investors are given an initial endowment of PHP 50. They then choose an amount ranging from 0 to PHP 50 to send to the investee. This amount is tripled and the investee chooses how much to send back from the tripled amount. Participants do not know which participant has been matched with them in the opposite role.

3. Theoretical background and statistical model

We assume an expected utility framework with exponential discounting, which leads to the discounted utility

$$DU(c_t, c_{t+d}) = u(c_t + \omega) + \delta^d P u(c_{t+d} + \omega) + \delta^d (1 - P) u(0 + \omega), \tag{2}$$

where $u(\cdot)$ is a separable and stationary over time utility function, c_t is the chosen amount at time t, c_{t+d} is the amount d periods into the future of t, ω is other income or average consumption, and δ is the discount factor. Importantly, P is our parameter of interest, namely the probability that the subject attaches to receiving the future payment from institution I. With probability P, the subject receives the future payment c_{t+d}, and with probability $1 - P$ the subject does not receive the future monetary outcome, and in this case she gets 0.[10]

Other than P, we further estimate the discount factor δ and the curvature of the utility function. We implement two statistical specifications. Specification 1 uses only the TE data and is implemented with two different utility functions similar to Andreoni and Sprenger (2012a). Specification 2 makes use of the binary choices from the first decision stage in TE and RPE in an estimation similar to Andersen et al. (2008). Implementing the two specifications allows for comparisons across methods and robustness checks of the estimates. We furthermore implement a third specification, which uses the CTB data for both TE and RPE (see Supplemental Appendix A.5).

3.1 *Specification 1: Theoretical and statistical model*

Thanks to the CTB design, specification 1 delivers estimates of both discounting and curvature on the basis of the TE data alone. Our model follows the setup of Andreoni and Sprenger (2012a), using constant relative risk aversion (CRRA) and constant average risk aversion (CARA) utility functions.

[10]We assume that the institution is believed to deliver either the full promised amount or nothing in period $t + d$. We view the ex ante belief that the institution provides only a fraction of the promised amount as very unlikely.

3.1.1 *CRRA utility* Consider a time separable CRRA utility function for current consumption and future consumption,

$$DU(c_t, c_{t+d}) = \frac{1}{\alpha}(c_t + \omega)^\alpha + \frac{1}{\alpha}\delta^d P(c_{t+d} + \omega)^\alpha + \frac{1}{\alpha}\delta^d(1 - P)(0 + \omega)^\alpha. \tag{3}$$

Maximizing the utility subject to the future-value budget constraint with endowment m,

$$m = c_t(1 + r) + c_{t+d}, \tag{4}$$

the optimal allocation for $\alpha < 1$ is characterized by

$$\frac{c_t + \omega}{c_{t+d} + \omega} = \left[(1 + r)P\delta^d\right]^{\frac{1}{\alpha - 1}}. \tag{5}$$

Taking logs of equation (5), we are able to estimate the equation

$$\ln\left(\frac{c_t + \omega}{c_{t+d} + \omega}\right) = \left(\frac{1}{\alpha - 1}\right) \cdot \ln(1 + r) + \left(\frac{\ln P_{NC}}{\alpha - 1}\right) \cdot \mathbf{1}_{NC} + \left(\frac{\ln \delta}{\alpha - 1}\right) \cdot d, \tag{6}$$

in which $\mathbf{1}_{NC}$ is an indicator function that takes the value of 1 when there is no payment guarantee (NC) and 0 when there is a payment guarantee (C). P_{NC} is the probability of receipt without payment guarantee and P_C is assumed to be 1.

Let there be N experimental subjects and J_1 TE decisions. Assume that each subject i makes her J_1 TE decisions $c_{t_{ij}}$, with $j = 1, 2, \ldots, J_1$, according to the log-linearized equation (6). These decisions are made with some additive mean-zero, potentially correlated error. Specifically,

$$\ln\left(\frac{c_t + \omega}{c_{t+d} + \omega}\right)_{ij} = \left(\frac{1}{\alpha - 1}\right) \cdot \ln(1 + r) + \left(\frac{\ln P_{NC}}{\alpha - 1}\right) \cdot \mathbf{1}_{NC} + \left(\frac{\ln \delta}{\alpha - 1}\right) \cdot d + \varepsilon_{ij}. \tag{7}$$

We assume that the terms ε_{ij} may be correlated within individuals but uncorrelated across individuals. The log consumption ratio is censored by corner solution responses,

$$\ln\left(\frac{c_t + \omega}{c_{t+d} + \omega}\right) \in \left[\ln\left(\frac{0 + \omega}{c_{t+d} + \omega}\right), \ln\left(\frac{c_t + \omega}{0 + \omega}\right)\right], \tag{8}$$

leading us to implement two-limit Tobit maximum likelihood regression techniques, following Andreoni and Sprenger (2012a).

The two-limit Tobit model can be represented as follows:

$$y^*_{ij} = \gamma_1 \ln(1 + r) + \gamma_2 \cdot \mathbf{1}_{NC} + \gamma_3 \cdot d + \varepsilon_{ij}, \tag{9}$$

where y^*_{ij} is the latent variable. If the observed dependent variable is denoted by y_{ij}, the model can be represented by

$$y_{ij} = \begin{cases} \ln\left(\dfrac{0 + \omega}{c_{t+d} + \omega}\right) & \text{if } y^*_{ij} \le \ln\left(\dfrac{0 + \omega}{c_{t+d} + \omega}\right), \\ \ln\left(\dfrac{c_t + \omega}{0 + \omega}\right) & \text{if } y^*_{ij} \ge \ln\left(\dfrac{c_t + \omega}{0 + \omega}\right), \\ y^*_{ij} = \gamma_1 \ln(1 + r) + \gamma_2 \cdot \mathbf{1}_{NC} + \gamma_3 \cdot d + \varepsilon_{ij} & \text{otherwise.} \end{cases} \tag{10}$$

With this specification, the parameters can be estimated by maximizing the corresponding likelihood function, which we implemented with Stata's two-limit Tobit programs.[11] We cluster standard errors at the session level, which is the randomization unit.

The random assignment of treatments allows us to obtain consistent estimates of our parameters by estimating equation (10). Rearrangements of the estimated coefficients $\hat{\gamma}$ allow us to calculate our parameters of interest, the curvature parameter $\hat{\alpha} = \frac{1}{\hat{\gamma}_1} + 1$, the discount rate $\hat{\hat{\delta}} = \exp(\frac{\hat{\gamma}_3}{\hat{\gamma}_1})$, and $\hat{P}_{NC} = \exp(\frac{\hat{\gamma}_2}{\hat{\gamma}_1})$.

3.1.2 *CARA utility* Consider now a time separable constant absolute risk aversion (CARA) utility function, specifically the exponential utility function

$$DU(c_t, c_{t+d}) = -\big[\exp\big(-\rho(c_t+\omega)\big) + \delta^d P \exp\big(-\rho(c_{t+d}+\omega)\big) + \delta^d (1-P)\exp\big(-\rho(0+\omega)\big)\big], \quad (11)$$

where ρ is the coefficient of absolute risk aversion. Under this specification, the optimal consumption allocation is defined by the equation

$$\exp\big(-\rho(c_t - c_{t+d})\big) = (1+r)\big(\delta^k P\big).$$

Taking logs, we are able to estimate the equation independent of ω,

$$c_t - c_{t+d} = \left(\frac{1}{-\rho}\right)\cdot \ln(1+r) + \left(\frac{\ln P_{NC}}{-\rho}\right)\cdot \mathbf{1}_{NC} + \left(\frac{\ln \delta}{-\rho}\right)\cdot d,$$

whose rearrangement allows us to estimate the parameters of interest with a similar statistical model as for CRRA utility.

3.2 *Specification 2: Theoretical model and statistical specification*

Next, we use a simple stochastic specification that translates the discounted utility into choice probabilities, allowing us to specify likelihoods conditional on the model. This is the probabilistic approach based on binary choices used among others by Holt and Laury (2002) and Andersen et al. (2008). We implement a CRRA utility function for choices from both RPE and TE. For the latter, the specification is identical to equation (3).

3.2.1 *Theoretical model for risk preference elicitation* Recall that subjects can allocate an amount $l \in \{a, 150\}$ to the safe lottery. The complementary amount $(150 - l)$ is allocated to the risky lottery, which turns into $(1+r)\cdot(150-l)$ with probability p_w when the lottery is won and 0 otherwise. The expected utility can be written as

$$\text{EU}(l) = \frac{1}{\alpha} p_w\big[(1+r)\cdot(150-l) + l + \omega\big]^\alpha + \frac{1}{\alpha}(1-p_w)\cdot[0+l+\omega]^\alpha. \quad (12)$$

[11] Censor regression techniques are able to address the issue of corner solutions, but have disadvantages acknowledged by both Andreoni and Sprenger (2012a) and Harrison, Lau, and Rutström (2013). We address these in our hybrid specification 3 in Supplemental Appendix A.5, using CTB data with the statistical framework of specification 2.

3.2.2 *Statistical specification* With the choice utilities $DU(c)$ or $EU(l)$, we define the indices

$$\nabla\text{DU} = \frac{\text{DU}(c)^{\frac{1}{\nu}}}{\text{DU}(a)^{\frac{1}{\nu}} + \text{DU}(150)^{\frac{1}{\nu}}}, \quad \text{and} \quad \nabla\text{EU} = \frac{\text{EU}(l)^{\frac{1}{\mu}}}{\text{EU}(a)^{\frac{1}{\mu}} + \text{DU}(150)^{\frac{1}{\mu}}}. \tag{13}$$

These indices are used to specify a likelihood conditional on the model parameters and contain noise parameters ν and μ, respectively, to allow for some errors from the perspective of the deterministic model. The denominator reflects the feasible actions available to the subject, $z \in \{a, 150\}$. The log-likelihood of observing the J_1 decisions c_{ij} of individual i in the TE task is then

$$\ln L_i^{DU}(\alpha, \delta, P_{NC}, \mu, \nu; c, \omega) = \sum_{j=1}^{J_1} \ln \nabla\text{DU}.$$

The log-likelihood of observing the J_2 decisions l_{ij} of individual i in the RPE task is then

$$\ln L_i^{EU}(\alpha, \mu; l, \omega) = \sum_{j=1}^{J_2} \ln \nabla\text{EU}.$$

The joint sample likelihood of the TE and RPE decisions is the sum of these two likelihoods over all individual likelihoods

$$\ln L(\alpha, \delta, P_{NC}, \mu, \nu; c, l, \omega) = \sum_{j=1}^{J_1} \ln \nabla\text{DU} + \sum_{j=1}^{J_2} \ln \nabla\text{EU}. \tag{14}$$

3.3 *Discussion*

The CTB method has been the subject of vivid discussions. On the basis of the Andreoni and Sprenger (2012a) data, Harrison, Lau, and Rutström (2013) expect the estimated utility function to be convex in order to explain the frequently occurring corner allocations (see specification 3 in Supplemental Appendix A.5). They deem such results implausible and a consequence of poor comprehension of subjects. We observe a smaller, but still substantial share of corner allocations. The distribution of choices over the interval [0, 150] is shown in Supplemental Appendix A.6. At the same time, the method has been applied successfully to numerous studies in laboratory experiments, in developing countries and on children and teenagers (see Andreoni and Sprenger (2015), for references). We deliberately implement a decision protocol that generates all the necessary information for estimating trust in various ways. This way we obtain a comprehensive picture of our trust measure from multiple perspectives.

4. Data and sample statistics

The experiments were conducted in the Philippine provinces of Guimaras, Capiz, and Iloilo during the months of March, April, and May 2015 (Penczynski and Santana (2023)). Overall, 1093 subjects took part in the experiment. The experiment session took place during a morning or afternoon and lasted about 3 hours. On average, 22 subjects participated in a session. On average, subjects were paid PHP 290 (ca. 7 USD).

Subjects participating in our study are all clients of NWTF and are randomly selected from the pool of clients in the three provinces. Individuals are randomly assigned to four treatment groups, following the 2×2 between-subject design with two institutions and two orders of the payment guarantee. Subjects are invited to participate in the experiment via an invitation letter delivered to their houses. Details of the randomization procedure are provided in Supplemental Appendix A.3.

An individually administered, two-part questionnaire is implemented, with a first part asked before the experimental elements ("pre-questionnaire") and a second part asked right before payment ("post-questionnaire"). Table 3 reports summary statistics for the full sample and the different treatments, as well as the equality of means t-test between the institution treatments (NWTF and ML) and the order treatments (NC/C and C/NC). Table 3(a) contains pre-questionnaire data and Table 3(b) contains post-questionnaire data.

Given that the treatments are randomly assigned, we expect individuals in the NWTF treatment to be similar to individuals in the ML treatment in terms of the pre-questionnaire responses. The same is expected for individuals in the NC/C and C/NC treatments. The table shows that our expectation holds in general. The number of significant differences are within the bounds of what is expected to occur by chance and joint F-tests are insignificant ($p = 0.422$ and $p = 0.200$, bank distance from post-questionnaire included).

Some differences are worth discussing. The distance to the bank is significantly different between subjects in the NWTF treatment and those in the ML treatment. This difference, however, is driven by remote outliers. When we exclude the top 1 percentile, the difference loses statistical significance. Further, we provide a local cashing option, which makes the distance to the bank less important for us. The fraction of subjects that "Ever cashed a check" turns out higher in ML, which if at all relevant, should make it harder to observe a higher $\hat{P}_{NC}$ for NWTF.

Further, the question that asks whether the subject knows the institutions is answered differently. Our subjects are all clients of NWTF, therefore a large share reports to know the institution. However, only 18% of subjects in the ML treatment report to know the institution. As mentioned earlier, this is due to the fact that the exact identity of the money lender was not disclosed.

As a further balancing check, we implement a multivariate analysis of variance to test for differences between means across the four different treatment groups, on each of the variables presented in the summary statistics. The last column of Table 3 shows the p-values associated with the F-statistic based on Wilks' lambda. We do not reject the null hypothesis that the means across the groups are equal for all variables except being married, having a flush toilet, and electricity in the household, bank distance, and knowing the institution.

Finally, in a hypothetical question after the experimental tasks, we directly elicited participants' subjective probability of payment completion in order to obtain a self-reported measure of their beliefs of the institutions' trustworthiness. A priori, we would expect the informal institution ML to generate lower beliefs. Interestingly, both self-

Table 3. Sample summary statistics.

	(1) Full Sample	(2) ML	(3) NWTF	(4) ML–NWTF	(5) NC/C	(6) C/NC	(7) NC/C–C/NC	(8) Equality of Means (p)
(a) Pre-questionnaire data collected before experimental games.								
Age	42.83	42.61	43.07	0.46	42.68	43.00	0.32	0.518
	(11.60)	(11.28)	(11.92)	(0.70)	(11.61)	(11.59)	(0.70)	
Years of education	8.80	8.81	8.80	−0.01	8.85	8.75	−0.10	0.507
	(2.89)	(3.00)	(2.77)	(0.18)	(2.89)	(2.89)	(0.18)	
Married	0.83	0.82	0.85	0.03	0.86	0.81	−0.05	0.027
	(0.37)	(0.39)	(0.36)	(0.02)	(0.35)	(0.39)	(0.02)	
Household size	5.46	5.59	5.33	−0.26	5.44	5.48	0.04	0.054
	(2.08)	(2.20)	(1.94)	(0.13)	(2.04)	(2.13)	(0.13)	
Employed	0.48	0.46	0.49	0.03	0.48	0.47	−0.00	0.772
	(0.50)	(0.50)	(0.50)	(0.03)	(0.50)	(0.50)	(0.03)	
Has regular income	0.57	0.57	0.57	0.00	0.57	0.57	−0.00	0.756
	(0.50)	(0.50)	(0.50)	(0.03)	(0.50)	(0.50)	(0.03)	
Monthly income (PHP)	1409.6	1329.9	1492.8	162.8	1345.5	1481.1	135.6	0.054
	(3057.1)	(2891.9)	(3223.6)	(246.1)	(2829.9)	(3295.9)	(246.5)	
Average cons. (ω) (PHP, weekly)	350.47	350.05	350.91	0.86	357.22	342.94	−14.29	0.734
	(366.09)	(372.38)	(359.71)	(22.17)	(379.93)	(350.21)	(22.20)	
HH average cons. (PHP, weekly)	1002.7	973.9	1033.0	59.08	973.9	1034.8	60.90	0.182
	(700.3)	(674.3)	(726.2)	(42.36)	(660.7)	(741.3)	(42.41)	
Village official position	0.07	0.06	0.08	0.02	0.08	0.07	−0.01	0.204
	(0.26)	(0.24)	(0.28)	(0.02)	(0.27)	(0.25)	(0.02)	
Dwelling								
Rooms for sleeping	1.81	1.78	1.84	0.05	1.84	1.77	−0.07	0.314
	(0.79)	(0.78)	(0.81)	(0.05)	(0.83)	(0.75)	(0.05)	
Cement floor	0.49	0.48	0.51	0.03	0.50	0.49	−0.01	0.576
	(0.50)	(0.50)	(0.50)	(0.03)	(0.50)	(0.50)	(0.03)	
Flush toilet	0.88	0.87	0.90	0.03	0.88	0.88	0.00	0.000
	(0.32)	(0.34)	(0.30)	(0.02)	(0.33)	(0.32)	(0.02)	
Electricity	0.88	0.87	0.88	0.02	0.87	0.88	0.00	0.001
	(0.33)	(0.34)	(0.32)	(0.02)	(0.33)	(0.33)	(0.02)	
Bottled drinking water	0.37	0.37	0.37	−0.01	0.37	0.37	−0.01	0.988
	(0.48)	(0.48)	(0.48)	(0.03)	(0.48)	(0.48)	(0.03)	
Owned	0.88	0.88	0.88	−0.00	0.88	0.89	0.01	0.981
	(0.32)	(0.32)	(0.32)	(0.02)	(0.33)	(0.32)	(0.02)	
N	1093	533	560	1093	517	576	1093	

(*Continues*)

reported beliefs measures (*Trustworthiness beliefs I* and *II*) indicate very high levels of expected trustworthiness with very small, insignificant differences between NWTF and ML treatments. In contrast, reported measures of trust (*Trust level in NWTF* and *ML*) indicate large differences between the two institutions. Moreover, our estimated $\hat{P}_{NC}$ parameters presented in the Results section, indicate minor differences between NWTF and ML at intermediate levels. In summary, it is possible that—when asked directly by our RAs—subjects are reluctant to reveal their true beliefs.

Table 3. *Continued.*

	(1) Full Sample	(2) ML	(3) NWTF	(4) ML–NWTF	(5) NC/C	(6) C/NC	(7) NC/C–C/NC	(8) Equality of Means (p)
Post-questionnaire data collected after experimental games.								
Am't borrowed MFI/ Banks (PHP)	5780.2	5635.1	5931.5	296.36	5747.1	5817.1	69.97	0.112
	(3169.1)	(2912.9)	(3412.2)	(203.8)	(3179.6)	(3160.4)	(204.32)	
Savings in MFI/rural bank (PHP)	1422.5	1426.2	1418.6	−7.51	1665.1	1159.1	−505.9	0.485
	(4498.9)	(5294.8)	(3442.1)	(381.9)	(6039.0)	(1596.6)	(381.31)	
Trust level in NWTF	6.30	6.49	6.11	−0.38	6.35	6.25	−0.10	0.000
	(1.18)	(0.94)	(1.36)	(0.07)	(1.14)	(1.22)	(0.07)	
Trust in ML[1]	3.81	3.79	3.82	0.03	3.86	3.75	−0.11	0.155
	(2.03)	(2.08)	(1.98)	(0.12)	(2.04)	(2.02)	(0.12)	
Risk preference[2]	3.71	3.68	3.74	0.06	3.78	3.64	−0.14	0.817
	(2.57)	(2.56)	(2.59)	(0.16)	(2.60)	(2.54)	(0.16)	
Betrayal aversion[3]	6.33	6.32	6.33	0.01	6.36	6.30	−0.06	0.653
	(1.50)	(1.53)	(1.48)	(0.09)	(1.48)	(1.53)	(0.09)	
Avoid being taken advantage of[3]	6.16	6.07	6.24	0.17	6.23	6.07	−0.16	0.129
	(1.69)	(1.78)	(1.59)	(0.10)	(1.63)	(1.75)	(0.10)	
Reciprocity[4]	1.57	1.58	1.56	−0.02	1.55	1.60	0.05	0.830
	(1.40)	(1.44)	(1.36)	(0.08)	(1.35)	(1.45)	(0.08)	
Sociability[5]	4.25	4.25	4.24	−0.01	4.29	4.20	−0.09	0.276
	(1.23)	(1.23)	(1.23)	(0.07)	(1.21)	(1.24)	(0.07)	
Bank distance (minutes)	32.55	29.95	35.28	5.33	32.52	32.58	0.05	0.030
	(35.67)	(28.71)	(41.60)	(2.15)	(29.03)	(41.87)	(2.16)	
Ever cashed a check	0.95	0.97	0.92	−0.04	0.94	0.95	0.01	0.009
	(0.23)	(0.18)	(0.27)	(0.01)	(0.24)	(0.21)	(0.01)	
Knows institution	0.54	0.87	0.18	−0.69	0.55	0.51	−0.04	0.000
	(0.50)	(0.33)	(0.38)	(0.02)	(0.50)	(0.50)	(0.03)	
Trustworthiness beliefs I[6]	5.80	5.78	5.83	0.04	5.81	5.80	−0.01	0.447
	(1.62)	(1.62)	(1.61)	(0.10)	(1.65)	(1.58)	(0.10)	
Trustworthiness beliefs II[7]	8.04	8.07	8.02	−0.05	8.04	8.05	0.02	0.529
	(2.59)	(2.51)	(2.68)	(0.16)	(2.61)	(2.58)	(0.16)	
N	1093	533	560	1093	517	576	1093	

Note: Standard deviations and errors in parentheses. Column (8) shows p-values for multivariate equality of means test based on Wilks' lambda test statistics for the four treatment groups.

[1] 1—no trust, 7—complete trust,

[2] Avoid/prepared to take risks: 1—avoid, 7—fully prepared,

[3] Avoid being betrayed/taken advantage of: 1—completely avoid, 7—do not avoid,

[4] If offended, offend back?: 1—offend, 7—not offend,

[5] Meet friends, relatives, neighbor: 1—never, 2—seldom, 3—monthly, 4—weekly, 5—daily,

[6] How certain is payment in 28 days?: 1—surely not reach me, 7—absolutely certain,

[7] Imagine 10 people that are promised a payment in 28 days. Out of 10 people, how many people do you think will get the payment delivered in 28 days?

5. Results

In this section, we report basic patterns in simple statistics of the data, proceed to the trust results from the structural estimations, and show results from the trust game and survey questions.

TABLE 4. Equality of means test for $c_t \in [0, 150]$.

	All	NWTF	ML
(1) $\bar{c}_t^{NC} - \bar{c}_t^{C}$	17.36	17.62	17.10
	(0.550)	(0.770)	(0.786)
N	39,348	20,160	19,188

	All	C	NC
(2) $\bar{c}_t^{\text{ML}} - \bar{c}_t^{\text{NWTF}}$	3.617	3.878	3.357
	(0.557)	(0.792)	(0.764)
N	39,348	19,674	19,674

	All	C	NC
(3) $\bar{c}_t^{1+r=1} - \bar{c}_t^{1+r=2.67}$	13.28	17.06	9.503
	(1.280)	(1.783)	(1.785)
N	8744	4372	4372

Note: Standard errors in parentheses.

5.1 *Descriptive statistics*

Choice behavior is expected to respond to experimental variations in four dimensions: payment guarantee, institution, interest rate $1 + r$, and delay d. Table 4 presents average differences in c_t for the first three variations. Figure 4 illustrates current allocations c_t across the four variations. For ease of illustration and interpretation, we show results for uncapped decisions with interest rates $1 + r < 3$.[12]

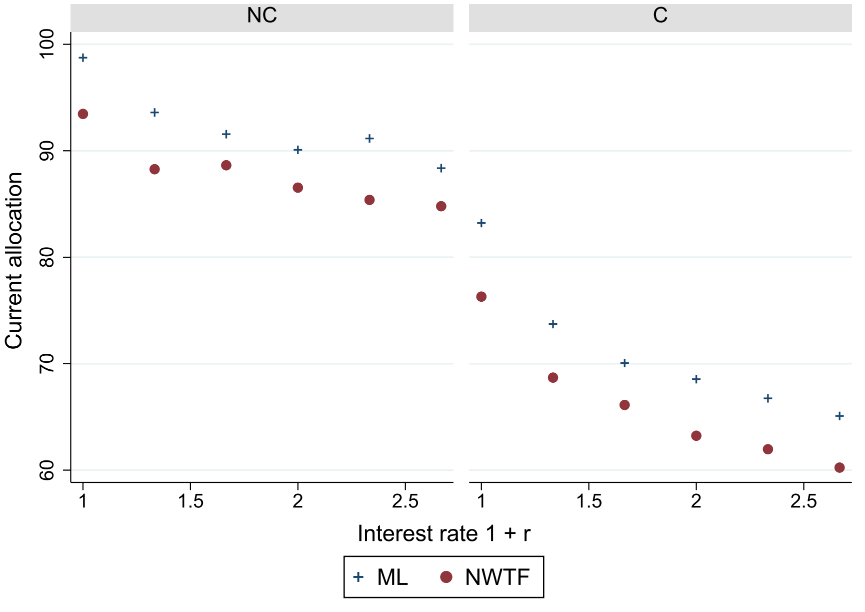
First, the payment guarantee in the form of a check is expected to influence the subjective probability of receiving the later payment in a positive way. This increase in expected future payment should result in an increased "investment" in the future and reduced current allocations.

Indeed, row 1 shows that current allocations without guarantee are significantly higher by PHP 17.36 than with the guarantee. This number represents 11.6% of the endowment and indicates by how much the *NC* decisions would have to increase on average for a full trust result with $\hat{P}_{NC} = 1$. The remaining entries of that row indicate the differences between the two institutions to be rather small.

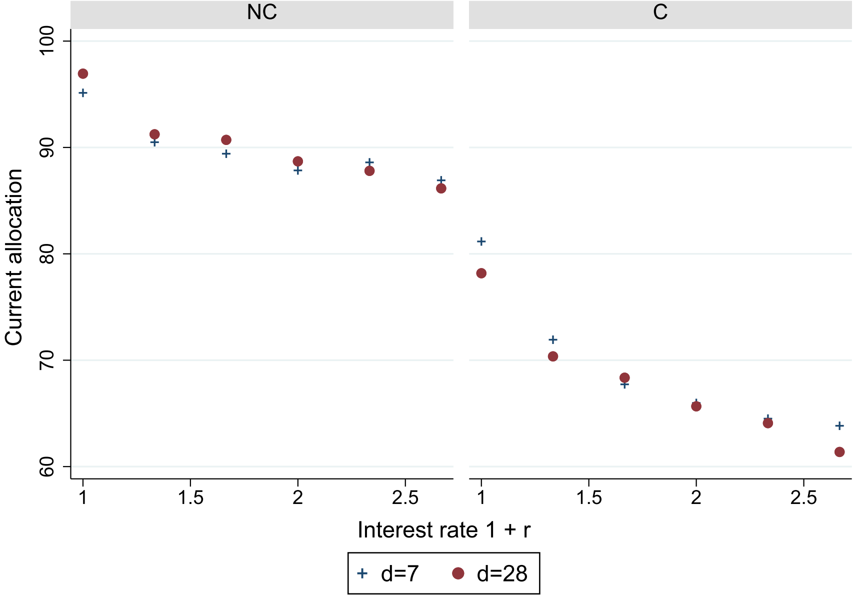
Second, we expect that the probability of payment is higher for NWTF than ML, leading to lower current allocations. This should be driven by the decision without guarantee because the guarantee should reduce the relevance of the institution.

As expected, row 2 of Table 4 shows that the current allocations are significantly higher by PHP 3.62 in the ML treatment than in the NWTF treatment (see Figure 4a). The remaining difference between institutions in C imply that even when the check is provided, beliefs or preferences toward the institutions still matter.

[12]Supplemental Appendix A.7 shows data for remaining interest rates. It also shows data by C/NC and NC/C treatments and discusses differences.



(a) By institution, pooled across delay lengths.



(b) By delay lengths, pooled across institutions.

FIGURE 4. Current allocation $c_t \in [0, 150]$ by interest rate and payment guarantee, *NC* vs. *C*.

Quantitatively, a difference-in-difference analysis shows no significant interaction between institutions and payment guarantee ($p = 0.889$), reiterating the point that the check does not entirely mute the differences due to institutions. If the C choices for ML were lower, the trust in ML would be estimated lower. In an "ideal" C scenario, in which the institution is entirely irrelevant, the C choices would not differ between institution. If there was no difference between institutions in C, the difference in estimated trust between the institutions would be larger. We simulate such ideal scenarios and provide conceivable ranges of $\hat{P}_{NC}$ in Section 5.4.

Third, a higher interest rate makes the investment more attractive and should result in lower current allocations. Row 3 shows that a move from $r = 1$ to $r = 2.67$ decreases current allocations by 13.28 PHP overall. Without a check guarantee, this decrease is about 9.5 PHP. Even at this very aggregate level of analysis, it is noteworthy that the change in the interest rate from 1 to 2.67 results only in about 55% of the effect of the payment guarantee on $\bar{c}_t$. In other words, the reduction in investment due to low levels of trust in the institution is much larger than the impact of a very significant reduction in the interest rate.

Finally, due to standard exponential time discounting, a higher delay d makes the investment with a given interest rate less attractive. We therefore expect higher current allocations for $d = 28$ compared to $d = 7$. At 0.25 PHP, these differences turn out to be small and insignificant, suggesting basically no exponential time discounting (see Figure 4b).[13]

5.2 *Estimation*

This section presents the estimation results of specifications 1 and 2.

5.2.1 *Specification 1* Table 5 presents two-limit Tobit maximum likelihood estimates following the model of Section 3.1.[14] In columns 1 and 2, removing the payment guarantee is estimated to significantly change the perceived probability of receiving the later payment. This probability is 0.393 in the NWTF sample, higher than the 0.324 in the ML sample. Therefore, compared to a benchmark with a payment guarantee, the trust in a nonguaranteed payment from NWTF is higher than for ML. The difference is statistically insignificant. In columns 3 and 4, we include other income ω of PHP 50.25, the average daily consumption in our sample. The probabilities $\hat{P}_{NC}$ of receiving the later payment are 0.500 for the NWTF sample and 0.442 for the ML sample. Finally, for the exponential CARA utility specification in columns 5 and 6, the probability attached to receiving the later payment by the institution, is 0.573 for NWTF and 0.524 for ML.

[13]Indeed, at commonly observed discount rates, standard exponential discounting is probably not relevant for these specific time horizons. Even present bias might be less relevant for monetary decisions (Augenblick, Niederle, and Sprenger (2015)). Unfortunately, our data does not allow us to estimate present bias.

[14]We restrict the analysis to uncapped choices with $a = 0$, that is, $1 + r < 3$. Including choices for higher interest rates with $a \in \{50, 100, 140\}$ lead to qualitatively similar results. However, compared to the literature, the curvature estimates are less plausible. Generally, the cap makes it more difficult to draw insights from these observations.

Table 5. CRRA and CARA parameters estimates, specification 1.

	(1) NWTF	(2) ML	(3) NWTF	(4) ML	(5) NWTF	(6) ML
Curvature $\hat{\alpha}$ (CRRA)	0.77	0.774	0.121	0.097		
	(0.0234)	(0.0246)	(0.0638)	(0.0695)		
Curvature $\hat{\rho}$ (CARA)					0.005	0.005
					(0.0003)	(0.0003)
Daily discount rate $\hat{\delta}$	1.005	1.000	1.003	0.9983	1.002	0.9986
	(0.003)	(0.005)	(0.0019)	(0.0036)	(0.0014)	(0.0027)
$\hat{P}_{NC}$	0.393	0.324	0.497	0.442	0.573	0.524
	(0.0558)	(0.0626)	(0.0465)	(0.058)	(0.0412)	(0.0537)
$\hat{P}_{NC}^{\text{NWTF}} = \hat{P}_{NC}^{\text{ML}}$	$p = 0.2129$		$p = 0.2354$		$p = 0.2359$	
Other income ω	0.01	0.01	50.25	50.25		
Observations	13,440	12,792	13,440	12,792	13,440	12,792
LL	−33,960	−31,560	−21,480	−20,295	−56,232	−51,482
Uncensored	7077	6359	7077	6359	7077	6359
Clusters	30	29	30	29	30	29

Note: Two-limit Tobit maximum likelihood estimates. Clustered standard errors at the session level in parenthesis calculated via the delta method. The reported p-values result from a simple linear hypothesis Wald test.

Overall, compared to an independent benchmark with payment guarantee, the trust in the institution as expressed by the probability of receiving the later payment is quite low in absolute terms. Only about one out of two payments are expected to take place. And while the level of trust in NWTF is consistently higher than the level of trust in ML, the differences between the two institutions are smaller than the reported trust level led us to expect and are not statistically significantly different.[15]

The estimated curvature parameters are in the range of results from previous estimations by Andreoni and Sprenger (2012a) and Andersen et al. (2008). The daily discount rate $\hat{\delta}$ is estimated to be close to 1 as expected from the descriptive statistics.

5.2.2 *Specification 2* Table 6 presents the estimation results of specification 2 on the basis of the binary decisions. The curvature parameters imply stronger risk aversion than the estimates in specification 1. These results are in line with those of Andersen et al. (2008). The discount rate is estimated to be at or slightly above 1 throughout the different variations of specification 2.

We find that the levels of $\hat{P}_{NC}$ depend strongly on other income ω and the utility function, but the difference between the institutions and its direction persist. Again, the differences between institutions are insignificant. As in specification 1, this emphasizes the point that the differences between institutions in our experimental trust measure are smaller than expected. A closer look at the self-reported trust measures in the next section suggests an explanation.

[15]Alternatively, if we follow Andreoni and Sprenger (2012a) in clustering the standard errors at the individual level, the differences are marginally significant. See Supplemental Appendix A.4.

Table 6. CRRA and CARA parameters estimates, specification 2.

	(1) NWTF	(2) ML	(3) NWTF	(4) ML	(5) NWTF	(6) ML
Curvature $\hat{\alpha}$ (CRRA)	0.313	0.266	0.646	0.572		
	(0.026)	(0.019)	(0.033)	(0.028)		
Curvature $\hat{\rho}$ (CARA)					0.012	0.014
					(0.0011)	(0.0008)
Daily discount rate $\hat{\delta}$	1.009	1.002	1.019	1.004	1.010	1.003
	(0.003)	(0.004)	(0.007)	(0.008)	(0.003)	(0.003)
$\hat{P}_{NC}$	0.452	0.437	0.166	0.103	0.507	0.517
	(0.057)	(0.069)	(0.089)	(0.115)	(0.049)	(0.057)
$\hat{P}_{NC}^{\text{NWTF}} = \hat{P}_{NC}^{\text{ML}}$	$p = 0.7900$		$p = 0.4779$		$p = 0.8422$	
Other income ω	0.01	0.01	50.25	50.25		
Observations	30,240	28,782	30,240	28,782	30,240	28,782
LL	−19,719	−18,935	−20,172	−19,381	−19,522	−18,699
Clusters	30	29	30	29	30	29

Note: Maximum likelihood estimates. Standard errors in parenthesis are clustered at the session level. The noise parameter μ is set to 1 to allow for noise and to avoid its estimation. The reported p-values result from a simple linear hypothesis Wald test.

5.3 *General and reported trust*

Our elicitation tasks, the trust game and the survey questions provide us with an array of data to investigate differences between elicited and reported measures of trust.

The amount invested in the trust game is commonly seen as a measure of general trust since players are confronted with a random, anonymous opponent from a known, general population.

The top part of Table 7 presents the amounts invested and received in the trust game (see Section 2.3). Out of PHP 50, subjects on average invest PHP 26.0 and return PHP 31.4. The levels of trust and trustworthiness with a return on investment slightly higher than 1 are in line with other results in the literature (see Camerer (2003), Cardenas and Carpenter (2008)). Comparing the ML and NWTF samples, we only observe slight and insignificant differences. The same picture emerges for reported general trust in the lower part of the table, where we see that the institution responsible for delivery in the TE task does not play a role.

Between treatments, we observe a small, significant difference in reported trust in NWTF, which shows that the level of trust reported after the experiment tasks is higher when NWTF is the treatment institution.

The last two lines of the table report markedly higher levels of reported trust in NWTF (6.3) than in ML (3.81). Given that our trust estimates $\hat{P}_{NC}$ differ less than expected between NWTF and ML, a look at these measures in a different sample can tell us more about these differences in reported trust levels.

In addition to our main sample that consists exclusively of NWTF clients, we have a separate sample from four villages that consists of 79 NWTF clients and 77 nonclients

Table 7. Trust game and survey questions.

	Full Sample (1)	NWTF treatment (2)	ML treatment (3)	ML-NWTF (4)
		Behavioral trust		
Invested amount in TG	26.03	25.76	26.31	0.5412
	(8.80)	(8.58)	(9.03)	(0.744)
Returned amount in TG	31.35	30.99	31.67	0.674
	(14.78)	(14.25)	(15.34)	(1.282)
Fraction returned in TG	0.40	0.41	0.40	−0.001
	(0.14)	(0.14)	(0.14)	(0.012)
Observations (invest)	560	288	272	
Observations (return)	533	272	261	
		Reported trust		
General trust level	4.33	4.34	4.32	−0.011
	(1.37)	(1.41)	(1.34)	(0.083)
Trust level in NWTF	6.30	6.49	6.11	−0.381
	(1.18)	(0.94)	(1.36)	(0.070)
Trust level in ML	3.81	3.79	3.82	0.031
	(2.03)	(2.08)	(1.98)	(0.123)
Observations	1093	560	533	

Note: The trust survey questions are based on a 7-point Likert scale: 1–no trust, 7–complete trust. In parentheses is the standard deviation (columns 1–3) and standard errors of the equality of means test (column 4).

who were subject to the NWTF treatment.[16] Among NWTF clients, the self-reported trust levels in Table 8 replicate the large difference in reported trust between institutions. Interestingly, however, this difference disappears entirely in the nonclient sample. Given that the estimated trust levels are not very far apart in our main sample, these numbers suggest that client status correlates strongly with reported trust levels for NWTF, but less with our experimental measure.

Table 8. Reported and estimated trust levels in NWTF for clients and nonclients.

		NWTF clients	NWTF nonclients
Reported trust level	NWTF	6.10	3.96
	ML	4.05	3.94
Observations		79	77

Note: The trust survey questions are based on a 7-point Likert scale: 1–no trust, 7–complete trust.

[16]For a separate project, these 156 subjects were randomly selected but all allocated to the NWTF treatment. Hence, they were not included in our main sample (See Supplemental Appendix A.3).

TABLE 9. CRRA and CARA parameters estimates in ML for adjusted c_t^C.

	Specification 1		
	(2)	(4)	(6)
Curvature $\hat{\alpha}$ (CRRA)	0.793	0.141	
Curvature $\hat{\rho}$ (CARA)			0.005
Daily discount rate $\hat{\delta}$	1.013	1.006	1.005
$\hat{P}_{NC}$	0.288	0.410	0.491
Other income ω	0.01	50.25	
Observations	12,792	12,792	12,792
LL	−33,318	−20,516	−57,726
Uncensored	7560	7560	7560
Clusters	29	29	29

Note: Two-limit Tobit maximum likelihood estimates.

5.4 *Estimation results with adjusted c_t^C for Money Lenders*

So far, our estimation results illustrate the relevance of the payment guarantee for the decisions, but Section 5.1 also discussed the slight differences in current allocations between institutions in the benchmark (C) decisions. These are relevant because we normalize the behavior in C to $P_C = 1$. In order to gauge the maximal influence of these slight differences on our trust estimations, we simulate alternative ML data in C decisions that feature similar current allocation averages as in the NWTF C data. Due to their lower level of c_t, we take NWTF C decisions as the choices closest to the $P_C = 1$ ideal. There are multiple ways to adjust the ML C data to lower averages, none of which we see as a superior way to approximate an inherently hypothetical behavior. We chose to lower all ML subjects' c_t choices in C by the same amount until the average c_t at a given interest rate matches the corresponding average of the NWTF subjects. When some individuals' choices are reduced to the lower bound of 0 in this process, we continue adjusting other individuals' choices downwards. We report results only for specification 1 since the binary data for specification 2 cannot easily be adjusted in the same way.

The results in Table 9 show that the $\hat{P}_{NC}$ estimates for the ML treatment are lower by about 0.03 compared to those in Table 5. These numbers therefore give conservative lower bounds of what trust in ML measured by $\hat{P}_{NC}$ could be, if the c_t choices under guarantee in the ML treatment were as low as those in the NWTF treatment. On the adjusted data, the difference-in-difference analysis shows a stronger, yet still insignificant interaction between institutions and check provision ($p = 0.441$).

5.5 *Discussion*

From our structural estimations, we obtain levels of trust $\hat{P}_{NC}$ between 0.10 and 0.57, which result from differences between C and NC clearly visible in the descriptive statistics. The variation of $\hat{P}_{NC}$ across estimations shows that the measure depends considerably on the exact forms of the utility function and the level of other income ω. At this point, attaching a particular absolute level of trust to a single institution would require a firm stance on those parameters. At the same time, a relative comparison between institutions is readily available as it can be done for any given set of parameters. In any case, the trust measure would benefit from a convergence in the literature on the best method to identify time and risk preferences and from a set of agreed values for a valid calibration of the necessary parameters.

Nevertheless, all estimates are located in the lower two-thirds of the interval [0, 1], in contrast to the trustworthiness beliefs in Table 3(b) and reported trust levels in NWTF discussed later. This suggests a qualitative difference in the trust evaluation depending on it being behaviorally elicited or self-reported.

In this first implementation of the trust measure, we use the delayed delivery of money as the most basic object of an institution's legally nonbinding promise to provide value to a voluntarily invested individual. Similar to other experimental measurements of beliefs and preferences, the elementary nature of a monetary payment makes the measure universal, and thus applicable to institutions across the board. Of course, a good or service closer to an institution's day-to-day operations can be used if this substitute for the monetary payment is an equally well-quantifiable and homogeneous carrier of value and if comparability with measures of trust in other domains is not essential. At the same time, it might be useful to place the promise of an institution in a different context than its core operations in order to maintain a level of uncertainty that calls for trust and not merely for confidence obtained through long prior interaction (Seligman (1998)).

6. Effect of the promise on savings

Lack of trust in financial institutions has been identified as one of the possible causes for low levels of savings with formal financial institutions in developing countries (Karlan, Lakshmi Ratan, and Zinman (2014), Dupas, Green, Keats, and Robinson (2014)). If this is true, an exogenous variation that influences trust in the institution should also change the savings held at this institution.

In our experiment, the random selection of the decision to be paid generates such variation. Subjects make 54 decisions, 36 on the trust elicitation task and 18 on the risk preference elicitation task. The one decision to be paid is selected uniform randomly from these 54 decisions. Indeed, 34% of all subjects were paid for the RPE task and 66% were paid for a choice taken in the TE task (see Supplemental Appendix A.8).

Choices in the RPE task are paid fully at the end of the experiment, since RPE payoffs do not feature any time delay. In contrast, all choices in the TE task potentially include a future payment in 7 or 28 days. This future payment, kept and delivered by the institution, constitutes a promise to the subject. Fulfillment of that promise could have a positive effect on the subject's trust toward the institution. We therefore consider the payment for a TE choice as a potential, exogenous variation of trust.[17]

[17]Note that a TE payment establishes the eligibility for a future payment and promise of delivery. The promise and delivery materialize unless the subject chose $c_t = 150$, which led to no future payment. Choices in which interest rates are low have a higher likelihood of $c_t = 150$. Out of the 1093 subjects, 721 were randomly determined to be paid for a TE choice and and were thus eligible for a future payment. Of those, 551 decided for *positive* future earnings ($c_t < 150$).

In our analysis of savings, we use weekly financial data about NWTF clients. Our aim is to test whether the variation of trust has an effect on savings with NWTF after the experiment.

To examine our question, we run the following panel data regression:

$$\text{Sav}_{i,t+k} = \theta + \phi_1 \cdot T_i + \phi_2 Z_i + \phi_3 \cdot X_i + \varepsilon_{i,t+k},$$

where $\text{Sav}_{i,t+k}$ corresponds to the weekly savings level of subjects held at NWTF. We look at the effects in the 8 weeks after the experiment took place, $k \in \{1, \dots, 8\}$.[18] The treatment indicator is $T_i = 1$ if the subject is paid on a TE task and $T_i = 0$ if the subject is paid for a RPE task. Table 17 in Supplemental Appendix A.9 shows descriptive statistics for the sample of interest. Covariates are balanced between subjects paid for a TE task and subjects paid for a RPE task.[19]

Since subjects' earnings in the experiment could have an effect on their savings level after the experiment, we control for the total amount earned in the experiment, Z_i. Finally, X_i is a vector of covariates, which includes risk aversion estimates, covariates used for balancing during the sampling (baseline savings, loan amount, distance to municipality, and urban indicator) and household characteristics (household size, age, electricity in the household's dwelling). Standard errors are clustered at the session level. Our estimates are robust to alternative specifications with random effects and with time-fixed effects.

Column 1 in Table 10 shows a positive and significant effect on savings of being eligible for receiving the later payment from NWTF. Savings significantly increase by PHP 66, representing 25% of baseline savings. If the trust mechanism is behind this increase, a check guarantee should dampen this effect since the client is less exposed to the institution keeping its promise. Column 2 exhibits payment eligibilities separately for *C* and *NC* decision payments by including a dummy variable $\mathbf{1}_C$. The coefficient for T_i then derives exclusively from *NC* decision payments. The coefficient of $\mathbf{1}_C$ turns out to be insignificant, but the negative sign of the coefficient is in-line with the trust mechanism.

If the causal mechanism is indeed via an increased level of trust in NWTF, the ML treatment provides an interesting point of comparison because the causal mechanism from the kept promise in a ML treatment to savings with NWTF is, if at all existing, very different. Column 3 shows that savings increase for ML participants, but only by PHP 34.[20] More interestingly, in the ML treatment the payment guarantee positively contributes to the savings increase (column 4). This is likely due to the local cashing option.

[18]Compared to the estimation analysis, the NWTF sample reduces over time since savings data is not available for those subjects whose loan has come to an end, limiting our ability to look at longer-term effects. The effect size and significance are robust for savings observations of 4, 6, and 10 weeks.

[19]The balance of covariates for subjects 8 weeks after the experiment is unchanged from the one presented in Supplemental Appendix A.9. Electricity in the dwelling and banking distance are different across groups. We control for electricity in the dwelling in our analysis. We do not control for bank distance, given that a local option for cashing the check is provided.

[20]The difference is not statistically significant. Testing the T_i coefficient for NWTF in column (1) against the same for ML in column (3) leads to a p-value of 0.265. Testing column (2) against column (4) leads to a p-value of 0.147.

TABLE 10. Effect of future payment eligibility on savings.

	$\mathrm{Sav}_{i,t+k}$			
	NWTF treatment		ML treatment	
	(1)	(2)	(3)	(4)
Future payment eligibility	66.49	72.84	34.31	18.63
T_i	(28.24)	(36.25)	(28.86)	(27.36)
Check guarantee		−14.17		31.97
$\mathbf{1}_C$		(47.86)		(29.93)
Experiment earnings	−0.140	−0.134	−0.138	−0.148
Z_i	(0.113)	(0.119)	(0.110)	(0.110)
Constant	−151.4	−152.3	−119.0	−119.4
	(97.07)	(97.11)	(216.3)	(217.9)
Covariates X_i	Yes	Yes	Yes	Yes
R^2	0.45	0.45	0.24	0.24
N	3537	3537	3260	3260

Note: Standard errors in parentheses, clustered at the session level.

All subjects, including those in the ML treatment, learned about the NWTF involvement in that option at the end of the experiment.

Despite the experimental nature and the modest financial size of the manipulation, we find significant effects of the eligibility for a future payment. Even though we do not have direct evidence of higher levels of trust after the experiment, the savings consequences of the exogenous variation in the eligibility for a future payment are throughout consistent with the mentioned mechanism of an increased level of trust in NWTF. Thanks to the exogenous variation, this field exercise thus is first indicative evidence that trust influences savings levels even for existing clients of an institution in the context of a developing country. The results suggest that our method or elements of it are promising for future investigations of trust and its causal effects in the field.

7. CONCLUSION

This study proposes a novel way of measuring trust in institutions, which draws on the experimental method of eliciting time preferences. It allows us to elicit levels of trust toward institutions in an incentivized way that is not identified by the participants as a measure of trust. In contrast to other measures of trust, it is provided in the meaningful metric of subjective probability of completion of a payment and seems less confounded with other factors such as social preferences.

The potential of an exogenous variation of trust resulting from the measure is documented to change subjects' savings behavior and opens up new paths of investigating the influence of trust on economic behavior and outcomes. For time preference elicitation, our results confirm that the payment arrangement is an important aspect and can substantially change money allocations over time.

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