Debt Aversion: Theory and Measurement*

David Albrecht†
Thomas Meissner‡

October 23, 2025

Abstract

Debt aversion can adversely impact financial decision-making. We propose a model of debt aversion and conduct an experiment involving real debt and saving contracts to jointly elicit debt aversion with preferences over time, risk, and intertemporal losses. We find that 89% of participants are debt averse, which strongly influences their choices. We estimate the "borrowing premium" – the compensation an average person would require to accept getting into debt – to be around 16% of the principal. Building on these findings, we validate a survey module to measure debt aversion in real-world contexts where complex laboratory experiments are infeasible. Applying the survey module to a large, representative sample of German households, we find that debt aversion is both statistically and economically significantly associated with actual debt-taking and financial health.

Keywords Debt Aversion · Intertemporal Choice · Risk and Time Preferences

JEL Classification D91 · D15 · C91

*Corresponding author: David Albrecht (david.albrecht@protonmail.com). We are thankful for the helpful comments from Alexander Böcking, Arno Riedl, Hakan Ozyilmaz, Christian Seel, Joel Sobel, Shotaro Shiba, Emanuel Vespa, Chris Woolnough, Shohei Yamamoto, and several conference and seminar participants. Thomas Meissner acknowledges funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 795958. Replication files can be found via OSF: `https://osf.io/7sm2f/?view_only=8466d18f89d1492b81baf7ec84ef12ea`

†WZB Berlin Social Science Center

‡Maastricht University

1 Introduction

Rather go to bed without dinner than to rise in debt.
— Benjamin Franklin

Borrowing and saving decisions are among the most important and economically significant choices people face in their lives. An unwillingness to save may have severe implications, such as insufficient retirement savings. In the same way, borrowing too much or too little can have negative economic consequences. Debt aversion, defined as an intrinsic unwillingness to take on debt, has received increased attention from researchers lately for its adverse effects on financial decision-making. Examples span failures to invest in tertiary education (Field, 2009; Caetano et al., 2019) and energy-efficient technologies (Schleich et al., 2021), or credit self-rationing of entrepreneurs (Nguyen et al., 2020).

However, without a theory of debt preferences, accurately measuring debt aversion is challenging. Preferences such as time discounting, risk aversion, and intertemporal loss aversion, as well as external constraints like limited access to credit, can lead to behavior that appears debt averse even if it is not driven by an intrinsic reluctance to take on debt. For example, consider a prospective student evaluating a student loan to finance their education. This decision may be influenced by how steeply the student discounts future benefits and by intertemporal loss aversion if the loan repayment is perceived as a future loss. In such cases, even in the absence of a true aversion to debt, the student might forgo the loan, resulting in behavior that may seem debt averse. Thus, a model is required that allows for the identification of genuine debt aversion separately from these other factors.

The goal of this paper is to understand whether debt aversion exists as a preference in its own right or whether it is merely an emergent behavioral property of other preferences, biases, beliefs, and constraints. To this end, we propose a formal model of debt aversion and design and conduct an experiment to elicit and jointly estimate debt aversion with preferences over time, risk, and intertemporal losses. Further, we elicit debt preferences in a large, German representative sample using a newly developed experimentally validated survey module.

Debt aversion is difficult to identify with field data alone because many factors influencing borrowing and saving decisions are typically unobservable. For students considering a loan, this decision may be influenced by their beliefs about the future return on their college education, their access to credit, peer effects, and many other potential factors that are not debt aversion. Lab experiments are an excellent tool in this case, as they allow to control for confounding factors, such as beliefs about potential returns or access to credit.

In the experiment, participants make real financial decisions by accepting or rejecting a series of borrowing and saving contracts involving actual payments over time. That is, participants can borrow money from or deposit money with the experimenter and must repay or receive funds in later sessions. For instance, a saving contract may involve paying a certain amount of money to the experimenter today and receiving a larger amount in four weeks; a debt contract reverses this sequence.

To identify debt aversion, we exploit the structural similarity between the two types of contracts: both involve a monetary gain and a monetary loss separated by time, differing merely in the order of gains and losses. By measuring and controlling for other relevant preferences, such as time discounting, risk aversion, and intertemporal loss aversion, we are able to identify debt aversion by comparing participants' willingness to accept or reject different debt and saving contracts. To distinguish debt aversion from a mere aversion to future payments, we also offer debt and saving contracts that start four weeks from the time of decision making. In this way, we can compare the willingness to accept payment obligations in the future, differing only in whether they are debt repayments or savings deposits. Additionally, this allows us to test for present bias and to rule out participants' (dis)trust in the experimenter or confidence in their future payment behavior as alternative explanations for debt aversion.

We find that participants require much more favorable interest rates to accept debt contracts compared to saving contracts: Most participants require negative interest rates to borrow while also requiring positive interest rates to save. Such an interest rate gap may be indicative, but it is not sufficient for debt aversion. Our model demonstrates that also intertemporal loss aversion alone may create such a gap, and risk aversion may scale its magnitude. To disentangle the impact of other preferences from debt aversion, we employ maximum likelihood estimations to jointly estimate all preference parameters of our model, i.e., preferences for time, risk, loss, and debt. Our results confirm that participants are, on average, genuinely debt averse, thus establishing debt aversion as a dimension of individual preference in its own right that is distinct from other relevant preferences, particularly intertemporal loss aversion. Comparing the choice of our average participant to a counterfactual debt neutral participant reveals that debt aversion has a quantitatively meaningful impact on choice: Our participants require a "borrowing premium" of around 16% of the principal to accept getting into debt.

To measure the prevalence of debt aversion, we further estimate the full joint distribution of our preference parameters using simulated maximum likelihood estimations. According to our estimated distribution of the debt aversion parameter, around 89% of individuals exhibit debt aversion. Estimating the joint distribution of preference parameters further allows testing for the potential interdependence of the different preference domains. We find that debt aversion is positively correlated with intertemporal loss aversion but not related to risk or time preferences.

To explore potential mechanisms behind debt aversion, we extend the main experiment. A subset of participants receives additional longer-duration saving and borrowing choices. Results from this extension indicate that debt aversion increases with the time people spend in debt. Strengthening our internal validity, we further demonstrate the robustness of debt aversion as a preference in its own right to a wide array of alternative modeling specifications.

Facilitating the investigation of debt aversion beyond the laboratory, we validate a survey module to proxy the incentivized measurement of debt aversion in larger samples. Implementing the experimentally validated survey module in a large, representative sample of German households allows testing the external validity of our findings. The representative survey data reveal that debt aversion predicts real-world indebtedness. Respondents who score higher on our debt aversion measure are significantly less likely to hold any debt. Further, on the intensive margin, a one standard deviation increase in debt aversion corresponds to around €14k less in mortgages and €1.8k less in other liabilities. Moreover, participants with higher debt aversion assess themselves to have a lower default probability and are more likely to state that debt and debt payments prevent them from adequately pursuing other financial objectives such as reaching saving targets, making investments or retirement provisions, or building up financial reserves.

In the following, we first provide an overview of the related literature in Section 1.1. Section 2 introduces the theoretical framework for modeling debt aversion. In Section 3, we describe the experiment. Section 3.2 comprises the results of our lab experiment, and discusses extensions to the laboratory experiment and robustness checks. Section 4 presents evidence on debt aversion from a representative sample. Finally, Section 5 summarizes and evaluates the implications of our findings on debt aversion.

1.1 Related Literature

Our study connects to a growing body of literature investigating debt averse behavior both theoretically and empirically. Theoretical work on debt averse behavior to date considered models of intertemporal choice that feature seemingly debt averse decision-making as an emergent behavioral property of other preferences and not a genuine preference. Loewenstein and Prelec (1992) present a model of intertemporal choice incorporating distinct discounting for positive and negative money streams and different utility curvature for gains and losses. Decision-makers in their model require much more favorable rates to borrow than to save. Prelec and Loewenstein (1998) introduce a framework that differentiates mental accounts for consumption and associated (loan) payments. Their model allows the utility of consumption and disutility of payments to vary depending on the relative timing of consumption and payments. This so-called prospective accounting predicts debt averse choices, where debt might be seen as consuming before paying or receiving payment for future undone work. Both frameworks explain debt averse behavior through variations in utility curvature, time discounting, and loss aversion. In contrast to existing theoretical work, we aim to model debt aversion as a preference in its own right that cannot be explained by preferences over time, risk, and losses. To this end, we explicitly model debt aversion while accounting for other relevant preferences.

Much of the empirical work on debt averse behavior focuses on decision-making in natural settings, such as taking loans for higher education, with somewhat mixed results. In field experiments offering differently labeled loan contracts to students, Field (2009) and Caetano et al. (2019) find that debt aversion might deter investment in education and influence career choices. Using a representative survey on UK final year high-school students, (Callender and Jackson, 2005) find that more debt averse individuals, who oftentimes also have low socioeconomic status, are far less likely actually to go to university. Results on the existence of debt aversion among (prospective) students have later been supported by large-scale surveys for the US (Boatman et al., 2017a) and the Netherlands (Oosterbeek and van den Broek, 2009). Furthermore, Gopalan et al. (2023) find that positive income shocks lead students to substantially decrease their debt, while non-students do not change their borrowing behavior. In contrast, Eckel et al. (2016a) find little evidence that debt-aversion poses a barrier to investing in higher studies among a sample of Canadian adults. Besides investment in education, debt aversion has been associated with investment decisions by small and medium-sized business owners (Nguyen et al., 2020), with low uptake of debt-based public support programs related to COVID-19 (Paaso et al., 2020), with lower loan-to-income ratios and lower propensity to consume (Almenberg et al., 2021), and with hesitancy to invest in retrofit measures to increase the energy efficiency of private buildings (Schleich et al., 2021). Helka and Maison (2021) find that openness to being indebted is a far more important predictor of borrowing for hedonistic purposes than of borrowing for investments and necessities. Ikeda and Kang (2015) find more debt averse people in a sample of Japanese adults to engage less in activities they classify as overborrowing, such as taking unsecured consumer loans, engaging in debt restructuring, or declaring personal bankruptcy. Lastly, Almenberg et al. (2021) argue that individual debt attitudes are not only important as a predictor of individual financial decision-making patterns but seem to capture a cultural predisposition toward debt passed on across generations.

The aforementioned empirical studies either use debt aversion measures that could be confounded by other preferences and/or qualitative measures that ask participants for their stated debt aversion. Such qualitative measures are convenient to include in studies where time is critical. Still, it is unclear whether they actually measure genuine debt aversion, as no validated survey module exists.[1] Moreover, in most field and survey settings, it is difficult to identify whether taking on debt would be optimal, making it hard to identify biases in borrowing behavior and, thus, debt aversion.

An advantage of lab experiments over survey-based studies on debt aversion is that the experimenter can control optimal saving and borrowing, which allows for the identification of debt aversion. Meissner (2016) puts participants into the shoes of a consumer in a life cycle model of consumption: participants have induced preferences and are asked to optimally solve an intertemporal consumption problem. The experiment has two treatments in which participants must either save or borrow within an experimental session to consume optimally. When participants have to borrow they do worse than when they have

[1]We develop such a module based on choices in this experiment (See Section 4).

to save to consume optimally. The suggested mechanism is debt aversion. Ahrens et al. (2022) replicate Meissner (2016) using a student sample from the US, and find similar levels of sub-optimal borrowing. In a similar intertemporal consumption and saving experiment, Duffy and Orland (2020) also attribute sub-optimal borrowing on the extensive and intensive margin to debt aversion.

Focusing on debt repayment rather than borrowing, Martínez-Marquina and Shi (2024) and Ozyılmaz and Zhang (2020) report that participants forgo profitable investments and substantial monetary gains to repay debt as soon as possible. Relatedly, Besharat et al. (2015) and Amar et al. (2019) find people to exhibit debt account aversion, i.e., when holding debt on multiple accounts, people tend to repay the account with the lowest outstanding debt first to reduce the overall amount of debt accounts. All of these lab experiments share a common limitation: any debts remain either entirely hypothetical or get fully settled within the experimental session, so participants invariably leave the lab with positive earnings and no outstanding obligations. Participants thus never genuinely experience indebtedness beyond the lab. In contrast, our design allows participants to borrow real money, leave the lab with an actual debt, and repay it several weeks later, thereby creating a genuine state of indebtedness.

Moreover, most existing approaches only identify debt aversion at an aggregate level, categorizing participants collectively as debt averse or not. By contrast, our design quantifies the strength of debt aversion at the individual level, enabling us – for the first time – to experimentally validate a debt aversion survey module and then deploy it in a large, representative sample.

Summing up, we propose a theory of debt aversion, in which debt aversion is a preference in its own right rather than an emergent behavioral property of other preferences. We are the first to implement actual indebtedness in a laboratory experiment, which improves external validity compared to other experimental approaches in which indebtedness is only implemented hypothetically or within one experimental session. Further, we go beyond existing research by identifying and structurally estimating the debt aversion parameter on the population distribution and individual level and test the correlation of debt aversion with other preference parameters. Finally, we develop an experimentally validated debt aversion survey module and implement it in a large representative sample of German households.

2 A Theory of Debt Aversion

We consider agents who choose between intertemporal prospects defined over streams of monetary gains or losses in up to two periods.[2] $\boldsymbol{x} = (x_t, x_T)$ denotes a stream of payments that offers x_t at time t, and x_T at time T, where $0 \leq t < T$. $X = (\boldsymbol{x}_1, p_1; \boldsymbol{x}_2, p_2; ...; \boldsymbol{x}_N, p_N)$ denotes an intertemporal prospect, that gives the payment stream $\boldsymbol{x}_n$ with probability p_n. The intertemporal utility is written as:

$$U(X) = \mathbb{E}\left[\phi(t)v(x_t) + \phi\left(T\right)v(x_T) - \mathbb{1}_{debt}c\left(\boldsymbol{x}\right)\right], \tag{1}$$

where $v(x_\tau)$ denotes the atemporal utility of monetary gains and losses at time τ. Agents discount future gains and losses with the discount function ϕ.

Saving contracts are payment streams characterized by $x_t < 0$ and $x_T > 0$. Inversely, *debt contracts* are payment streams characterized by $x_t > 0$ and $x_T < 0$. We allow agents to evaluate debt contracts differently than other contracts. To this end, we introduce debt aversion as a cost of being in debt $c(\boldsymbol{x})$, which is only incurred for debt contracts:

$$\mathbb{1}_{debt} = \begin{cases} 1 & \text{if } x_t > 0 \text{ and } x_T < 0 \\ 0 & \text{otherwise.} \end{cases} \tag{2}$$

Following Prospect Theory (Kahneman and Tversky, 1979), we allow gains and losses of money to be evaluated differently, relative to a reference point ($x = 0$):

$$v(x) = \begin{cases} u(x) & \text{if } x \geq 0 \\ -\lambda u(-x) & \text{if } x < 0, \end{cases} \tag{3}$$

where $u(x)$ is a utility function, evaluating deviations from the reference point.

Finally, the utility cost of borrowing could take on many different functional forms. In the following, we will present our preferred specification while acknowledging that other

[2] The model could be generalized to n periods or continuous time. We favor the two-period approach for expositional purposes, tractability, and because our experiment only involves trade-offs between payments in up to two periods.

forms could also be valid, as debt aversion could work in several ways. We will discuss alternative specifications in Section 2.2.

In our preferred specification, the cost of being in debt is modeled to occur at the time of debt repayment, depending on the amount owed x_T:

$$c(\boldsymbol{x}) = (1 - \gamma)\phi(T)v(x_T) \tag{4}$$

Here, γ is the parameter of debt aversion. A parameter of $\gamma = 1$ implies debt neutrality, $\gamma > 1$ implies debt aversion, and $\gamma < 1$ implies debt affinity. We prefer this specification for two reasons. First, it captures debt aversion as a systematic discrimination of contracts based on the order of positive and negative money streams. Second, using this functional form ensures that the resulting parameter of debt aversion can be interpreted similarly to the loss aversion parameter, scaling the disutility from repayment in a debt contract. To illustrate both points, note that the intertemporal utility of a deterministic saving contract simplifies to:

$$U_{saving}(X) = -\lambda\phi(t)u(-x_t) + \phi(T)u(x_T), \tag{5}$$

while the utility of a deterministic debt contract collapses to:

$$U_{debt}(X) = \phi(t)u(x_t) - \lambda\gamma\phi(T)u(-x_T) \tag{6}$$

Thus, debt repayments are scaled with the easy-to-interpret parameter γ, which can be compared in magnitude to the loss aversion parameter λ. In the next subsection (2.1), we derive the interest rate gap that can arise under the model. In subsection 2.2 we discuss our model assumptions in light of their implications for a clean empirical identification of the debt aversion parameter γ.

2.1 Theoretical Predictions and Comparative Statics

The proposed model sheds light on two aspects: (i) under what conditions agents require more favorable interest rates to borrow than to save, and (ii) the importance of controlling for risk and loss aversion when estimating debt aversion parameters. For illustration, we derive the interest rates at which agents are indifferent between accepting or rejecting saving and debt contracts. We consider deterministic contracts, with payment streams $\boldsymbol{x}_s = (-x, (1 + r)x)$ and $\boldsymbol{x}_d = (x, -(1 + r)x)$ for saving and debt contracts respectively, where r denotes the interest rate. To determine the interest rates at which agents are indifferent between accepting and rejecting saving and debt contracts, we set the saving and debt utilities (Equations (5) and (6)) to zero. Assuming that u is strictly increasing and concave (so that its inverse u^{-1} exists and is increasing), we obtain

$$1 + r_s = \frac{1}{x}\, u^{-1}\left(\frac{\lambda\phi(t)}{\phi(T)}\, u(x)\right) \quad \text{and} \quad 1 + r_d = \frac{1}{x}\, u^{-1}\left(\frac{\phi(t)}{\lambda\gamma\,\phi(T)}\, u(x)\right), \tag{7}$$

where r_s and r_d denote the interest rates that make an agent indifferent between accepting or rejecting saving and debt contracts, respectively. These expressions coincide for agents who are neither loss averse nor debt averse ($\lambda = \gamma = 1$), and no interest rate gap exists. Thus, a difference emerges only if agents have preferences over losses and/or debt. When ($\lambda > 1$ and $\gamma \geq 1$) or ($\lambda \geq 1$ and $\gamma > 1$), we have

$$\frac{\lambda\phi(t)}{\phi(T)} > \frac{\phi(t)}{\lambda\gamma\,\phi(T)}, \tag{8}$$

so that by the monotonicity of u^{-1}, $r_s > r_d$. In other words, agents require lower interest rates to borrow than to save.

For a sharper characterization, suppose that agents have CRRA preferences of the form

$$u(x) = \frac{x^{1-\alpha}}{1-\alpha}, \tag{9}$$

with the restriction $\alpha < 1$ to ensure that the value function passes through the reference point.[3] Then, the expressions in Equation 7 become

$$1 + r_s = \left(\frac{\lambda\phi(t)}{\phi(T)}\right)^{\frac{1}{1-\alpha}} \quad \text{and} \quad 1 + r_d = \left(\frac{\phi(t)}{\lambda\gamma\,\phi(T)}\right)^{\frac{1}{1-\alpha}}. \tag{10}$$

Hence, we can describe the interest rate gap by the ratio

$$\frac{1 + r_s}{1 + r_d} = \left(\lambda^2\gamma\right)^{\frac{1}{1-\alpha}}. \tag{11}$$

This expression shows that an interest rate gap arises if either loss aversion, debt aversion, or both are present.[4] Moreover, increases in loss aversion and debt aversion

[3] See also Section 3.2.1 for a discussion of this assumption.

[4] Note that other rationalizations of an interest rate gap may exist. For instance, agents may incur a utility cost of accepting any debt or saving contract. We derive the interest rate gap for this case in Online Appendix E and show that allowing for this does not change the estimate of the debt aversion parameter in a meaningful way.

widen this difference. In addition, the exponent $\frac{1}{1-\alpha}$ increases with α, so greater risk aversion magnifies the difference, provided it exists. These comparative statics underscore that when estimating debt aversion parameters, it is essential to control for risk and loss preferences, as both affect the magnitude of the interest rate gap. We discuss the implications of this and other considerations of our theoretical specification in the next subsection.

2.2 Discussion of the Theoretical Framework

The previous subsection demonstrates that, under our model, an observed difference in the interest rates at which agents are indifferent to saving versus borrowing can emerge from several sources simultaneously. In particular, both loss aversion and risk aversion contribute to this difference. This observation underscores the importance of controlling for these preferences when identifying debt aversion as a distinct behavioral parameter.

To illustrate this point, consider an agent who is moderately loss averse (with an intertemporal loss aversion parameter, $\lambda = 1.2$) but is neither risk averse ($\alpha = 0$) nor debt averse ($\gamma = 1$). Such an agent would display an interest rate gap characterized by $\frac{1+r_s}{1+r_d} = \lambda^2 = 1.44$. If one were to neglect intertemporal loss aversion (for example, by incorrectly assuming $\lambda = 1$), the same difference would misleadingly be attributed to debt aversion, yielding an estimated $\gamma = 1.44$. Hence, without proper controls, one risks conflating loss aversion with debt aversion. Our experimental design explicitly elicits risk preferences, time discounting, and intertemporal loss aversion to ensure that the additional "cost" of being indebted, which we identify for debt contracts is attributable solely to debt aversion.

Of course, whether this approach works depends on the degree to which the underlying model accurately reflects real preferences. We argue that our specification is conservative and will likely lead to an underestimation of debt aversion rather than an overestimation.

First, as illustrated above, controlling for intertemporal loss aversion is a conservative approach. One might question whether people indeed experience loss aversion for temporally separated payments. While this approach has been adopted in the literature, our model in principle allows for the absence of such preferences. We acknowledge that it would be misleading to interpret the loss aversion parameter in our model in the same way as the loss aversion parameter typically derived from lottery choices, where gains and losses are separated by state rather than time. This point has been emphasized by Abdellaoui et al. (2018), who find, as we do, that intertemporal loss aversion is less pronounced than loss aversion over risky gambles. Moreover, we assume that utility curvature is the same in the gain and loss domain, but it might not be. This is because in our experiment, there is no variation in the loss domain that would allow to separately identify a curvature parameter for losses. Any true differences in curvature between gains and losses are thus entirely absorbed into the loss aversion parameter, λ. This means that if the true loss curvature differs from the gain curvature, this will only affect the estimated value of λ, without contaminating our estimates of the debt aversion parameter, γ.

This choice somewhat reduces the interpretability of our estimates of λ as reflecting solely intertemporal loss aversion. It now captures intertemporal loss aversion, and differences in curvature between the loss and gain domains. However, this decision was intentional. By reducing the number of parameters we need to estimate, we simplify the empirical model, which is already complex and contains a relatively large number of parameters. Since our primary interest is not in precisely estimating loss aversion per se but rather in controlling for it when estimating debt aversion, we believe this trade-off is justified. For an easier exposition, we will keep referring to the parameter λ as the intertemporal loss aversion parameter.

Second, there is considerable debate in the literature regarding the standard assumption of discounted expected utility, which posits that risk aversion and the elasticity of intertemporal substitution are governed by the same parameter, implying that the curvature of utility under risk is the same as that over time (see e.g., Andreoni and Sprenger, 2012). Our model makes this assumption and estimates the parameter α from lottery choices, similarly to Andersen et al. (2008). However, the experimental literature often finds that utility under risk exhibits more curvature than utility over time (Abdellaoui et al., 2013; Cheung, 2020). By estimating the utility curvature parameter from lottery choices, we may thus overestimate this parameter as it applies to intertemporal choice. Yet, as can be seen from equation 11, for a given interest rate gap, an overestimation of α leads to an underestimation of the debt aversion parameter γ. We confirm this intuition empirically in Online Appendix E Table 24, where we show that assuming risk neutrality ($\alpha = 0$) substantially inflates the estimated debt aversion parameter.

Third, note that we assume the cost of being in debt occurs at the time of repayment and is thus discounted by $\phi(T)$. This implies that the further in the future the repayment, the less impact debt aversion has. One could envision alternative mechanisms through which debt aversion affects utility; for instance, the cost could be incurred immediately upon accepting the contract. In addition, we assume that the utility cost of debt aversion scales with the amount to be repaid. Although this assumption is not critical for our experiment (since the repayment is fixed at 15 €), we provide alternative models in which the cost is conceptualized as a fixed fee or is incurred at the time a debt contract is accepted in Online Appendix E Table 20 and Table 21.

In summary, while we believe that our model specification represents a good combination of parsimony, interpretational ease and conservativeness, we also acknowledge that there are several ways to extend the model and several ways in which debt aversion can operate. We test alternative specifications in Section 3.2.7 and Online Appendix E. In all cases, our central result, the existence of debt aversion as a distinct preference, remains robust and our specification is conservative, likely underestimating the magnitude of debt aversion. Given that our primary aim is to establish whether debt aversion exists as a distinct preference, we consider this cautious approach justified.

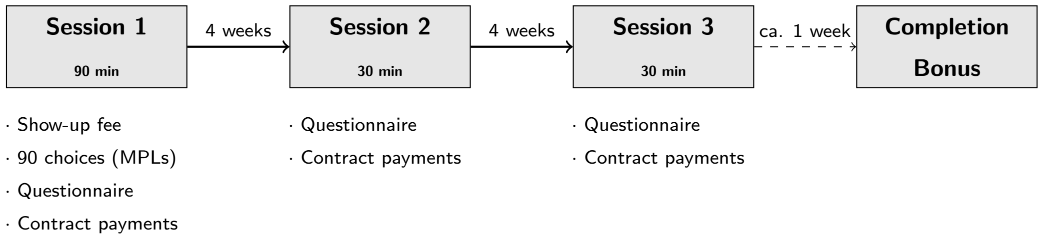
3 Experiment

We design an experiment to measure individual preferences related to saving, borrowing, time, losses, and risk. In the baseline version of the experiment, participants make 90 incentivized financial decisions, each involving a choice between two options. In these choices, the participants either choose between different lotteries, certain payments at different times, or whether to accept or reject several saving and debt contracts.

The structure of the experiment is built around seven distinct sets of choices, known as Multiple Price Lists (MPLs) – a widely used method in experimental economics for eliciting preferences (see e.g. Coller and Williams (1999) and Holt and Laury (2002)). Each MPL focuses on a particular domain, such as risk or time. Table 1 provides an overview of the different MPLs and the number of choices in each. Appendix A contains a detailed list of all choices.

Unlike traditional MPL formats, where participants view an entire list of choices at once, we present all decisions sequentially, one at a time on the screen. This helps reduce cognitive load and ensures focus on each individual decision. The order of MPLs is fixed

Figure 1: Timeline of the experiment



for all participants, following the sequence shown in Table 1. However, the order of choices within each MPL is randomized individually for each participant.

To introduce real intertemporal consequences, participants attend three laboratory sessions, each spaced four weeks apart (see Figure 1). All 90 choices are made in Session 1, which lasts approximately 90 minutes. Sessions 1, 2, and 3 are used to carry out the financial consequences of these choices – i.e., delivering payments and collecting repayments. Participation in all three sessions is mandatory, and we ensured that participants were informed about the scheduling and commitment required.[5]

The first three MPLs measure standard time and risk preferences. For example, MPL1 involves choosing between payments in Session 1 and Session 2, revealing time discounting. MPLs 2 and 3 involve risky choices: one between safe and risky payments, and one between two lotteries.

The remaining MPLs involve real saving and borrowing contracts. MPL4 presents participants with the opportunity to save by paying €15 to the experimenter in Session 1 and receiving a repayment in Session 2, where the repayment amount varies across choices. MPL5 shifts these contracts into the future, requiring the initial payment in Session 2 and repayment in Session 3. MPL6 and MPL7 mirror these as debt contracts: participants receive a loan in either Session 1 or Session 2 and must repay a fixed amount in the following session. Two additional sets, MPL8 and MPL9, were not part of the baseline experiment and were used on a subset of participants to shed further light on how debt aversion affects choices (see section 3.2.4 for more detail).

[5] At sign-up, participants were aware of potential conflicts with their university schedule. The importance of attending all three sessions was emphasized in the invitation email and again in person. Participants who failed to attend a session without valid excuse forfeited their completion bonus and were removed from the subject pool. Consent to these procedures was given electronically and confirmed verbally.

Table 1: Overview of Experimental Choice Categories

MPL	Domain	#	Description of Choices
1	Time Discounting	10	Choose between a payment in Session 1 and a payment in Session 2.
2	Risk Preferences	10	Choose between a safe payment and a risky lottery, both resolved and paid in Session 1.
3	Risk Preferences	10	Choose between two risky lotteries, both resolved and paid in Session 1.
4	Saving	15	Decide whether to accept saving contracts involving a payment to the experimenter in Session 1 and a repayment in Session 2.
5	Future Saving	15	Same as MPL4, but with payment to the experimenter in Session 2 and repayment in Session 3.
6	Debt	15	Decide whether to accept borrowing contracts involving a loan payment to the participant in Session 1 and repayment in Session 2.
7	Future Debt	15	Same as MPL6, but with a loan payment to the participant in Session 2 and repayment in Session 3.
Extension			
8	Long Saving	15	Saving contracts with payment to the experimenter in Session 1 and repayment in Session 3.
9	Long Debt	15	Debt contracts with loan payment to the participant in Session 1 and repayment in Session 3.

Participants could accept or reject each contract according to their preferences for all choices involving debt and saving contracts. Rejection implied that no further payments would take place. Our experiment deliberately abstracts from motives to save or borrow that go beyond individual preferences and utility maximization so that all saving and debt behavior can be seen as driven by individual preferences alone.

In addition to these incentivized choices, we collect survey data on personal characteristics (e.g., age, gender, cognitive ability, financial literacy; see Online Appendix C). We also ask about participants' real-world saving and borrowing behavior and include non-incentivized measures of financial attitudes. These data allow us to assess how well survey responses predict actual choice behavior in the lab, especially with regard to debt aversion.

3.1 Payment procedures

At the end of the opening session and after completing all payment-relevant choices, one decision was randomly drawn as the 'decision that counts' and the corresponding payment was implemented. The random draw was conducted with the help of a bingo cage containing 90 (120 in the extension) numbered balls. If the decision involved payments not only in the opening session, a physical, individualized contract delineating all payments to be made and received was drawn up and signed by the experimenter and the participant (see Online Appendix H). All payments due at the opening session were directly executed. Later payments were executed at the end of the respective session. Payments to participants were always made in cash. Participants were allowed to pay the experimenters in cash or via PayPal to minimize the potential transaction burden of payment. All participants with due payments in later sessions received respective email reminders the day before the due date.[6]

[6]To minimize the risk of confounding preference elicitation, the overall setup was directed at increasing perceived payment reliability, i.e., trust that promised payments by the experimenters will be made, and confidence that promised payments by the participants have to be made in the future. Undertaken measures included issuing physical contracts with contact details of the principal experimenter, emphasizing that the principal experimenter guarantees all payments in the experimental instructions, and providing multiple ways for contacting any of the experimenters and the associated economics department at Maastricht University in case any issues regarding payment should arise.

In addition to the decision-based payments, all participants received a show-up fee of €15 for all three sessions at the beginning of the opening session. This money was handed to participants in cash before any decisions took place. As payments in MPL4 contained saving contracts that required participants to pay €15 to the experimenter in the first session, we allowed participants to pay this out of the show-up fee.

After completing all three sessions and settling all due payments, participants received a completion bonus of €20. This payment was implemented via bank transfer and with a delay of one week to prevent participants from settling any outstanding debt with the completion bonus. Had we paid the completion bonus in cash during the last session, participants may not have thought they were really in debt, which could have impeded the identification of debt aversion.[7]

3.2 Results

Data collection took place at the Behavioral and Experimental Economics Laboratory at Maastricht University during winter 2019/20, autumn 2020, and autumn 2021.[8] A total of 148 participants (62 in winter 2019/20, 53 in autumn 2020, and 33 in autumn 2021) attended the opening session and hence made all choices relevant for the estimation of preferences. Over the course of the experiment, attrition amounted to 21, such that 127 participants (54 in winter 2019/20, 46 in autumn 2020, and 27 in autumn 2021) completed all three sessions.[9] Around 74% followed an undergrad program, and 25%

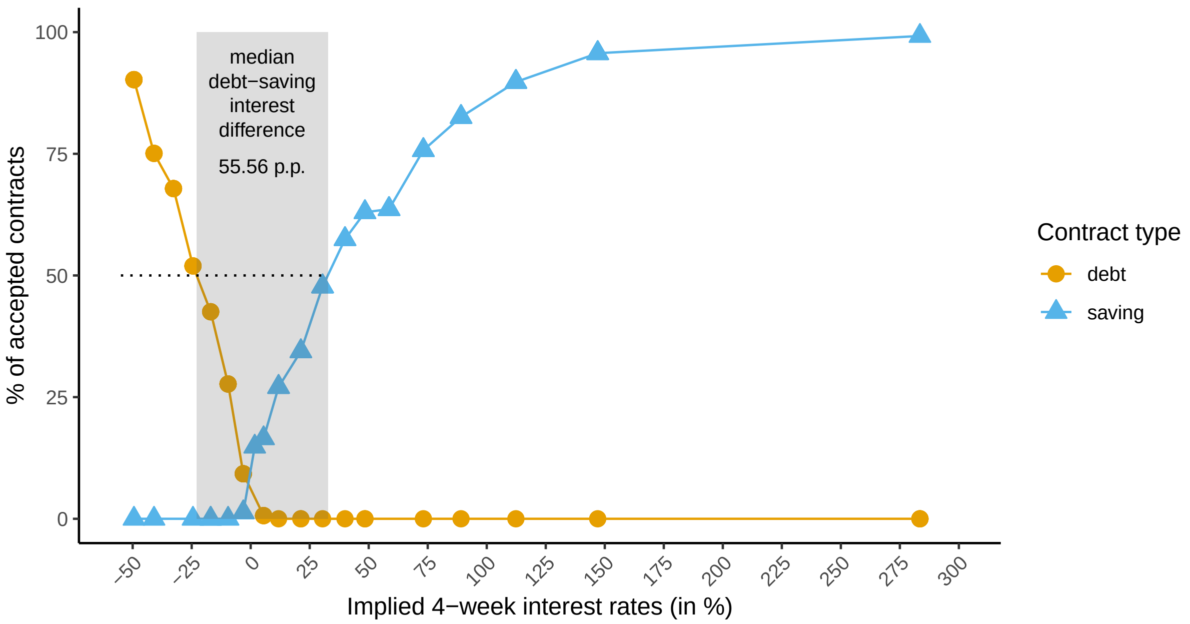
[7]Some experimental sessions in spring 2020 were affected by the closure of Dutch universities, including the BEElab facilities at Maastricht University, due to the COVID-19 pandemic. For 44 participants, it was not possible to conduct Session 3 in the lab as planned. We transformed the respective experimental protocol to an online survey, keeping all content identical and visual appearance as similar as possible. As cash payments were no longer possible, all payments were made via bank transfers. This only affected the collection of non-incentivized questionnaires in Session 3; all payment-relevant choices had been made in January 2020 before the COVID-19 pandemic hit the Netherlands. The same option to conduct Session 3 online was also offered to participants in autumn 2020 and 2021 who needed to quarantine.

[8]The experiment was programmed and conducted using z-Tree (Fischbacher, 2007). The complete instructions can be found in Online Appendix G.

[9]All participants were recruited through ORSEE (Greiner, 2015). Compared to other experiments conducted with the same participant pool, attrition seem normal, if not below average.

pursued a master's degree. Their backgrounds ranged from music to law, with a clear mode in the field of business and economics.

Figure 2: Acceptance of debt and saving contracts by implied interest rates



Notes: The figure depicts implied 4-week interest rates of saving contracts and debt contracts of all different starting dates (now and in four weeks) and durations (four and eight weeks) on the horizontal axis. For clarity, contracts with similar implied 4-week interest rates are binned and depicted as midpoints of the respective interest rate intervals per bin. The vertical axis represents the percentage share of participants who accepted contracts by implied interest rates. As an example, the left-most point for debt contracts reads as debt contracts with an implied 4-week interest rate of ca. −49% are accepted by ca. 90% of participants in the experiment.

Summarizing actual choices of participants Figure 2 plots the percentage of acceptance for debt and saving contracts against the contracts' implied 4-week interest rate. A more detailed summary of participants' decisions in all financial choices can be found in Appendix B. The graph shows that many participants require much more favorable rates to borrow than to save. Notably, most participants only accept debt contracts with negative interest rates. The interest rate at which half of the participants accept a debt contract is negative at −22.89%. To accept saving contracts, however, almost all participants require positive interest rates: the interest rate at which half of the participants accept is 32.67%. The difference between required saving and borrowing interest rates for our median participant is thus substantial, at 55.56 percentage points. As outlined in Section 2.1 such an interest rate gap is not rationalizable in a standard discounted expected utility framework. However, intertemporal loss aversion, debt aversion, and a combination thereof may create an interest rate gap, and risk aversion may scale its magnitude.

In the following, we will use joint structural estimations to isolate the role of genuine debt aversion in the observed choices while accounting for time discounting, risk preferences, and intertemporal loss aversion. We will start in Subsection 3.2.1 with our main specification, which estimates the model as specified in Section 2. We will then consider extensions and employ various robustness checks in Section 3.2.7.

3.2.1 Structural Estimations — Main specification

To estimate preferences structurally, we require specific forms of the functions introduced in Section 2. Below is a summary of our preferred specification. In Section 3.2.7 and Online Appendix E we conduct a series of robustness checks to test whether our finding of debt aversion is robust to different specifications of these functional forms. Debt aversion remains robust. Our preferred specification assumes normalized power utility to model the curvature of utility in gains and losses:

$$u(x) = \frac{(x+\varepsilon)^{1-\alpha} - \varepsilon^{1-\alpha}}{1-\alpha} \tag{12}$$

For $\varepsilon = 0$, this function is characterized by constant relative risk aversion (CRRA). However, for values of α above unity and $\varepsilon = 0$, the derivatives of the utility function diverge around the reference point. We set $\varepsilon = 0.0001$, to maintain a close approximation of CRRA utility while ensuring that preferences are well-behaved around the reference point.[10] Moreover, in our main specification, we assume exponential discounting:

$$\phi(\tau) = \frac{1}{(1+\rho)^{\tau}} \tag{13}$$

Note that our experiment allows to identify other forms of discounting, such as quasi-hyperbolic discounting. In Section 3.2.5, we test a quasi-hyperbolic discount function (Laibson, 1997), but find no empirical support for present bias.

[10]See Wakker (2008) for an illustration, and Meissner et al. (2023) for a recent application.

We will start by estimating preference parameters in the aggregate, that is, for our average participant. We will then account for individual heterogeneity by estimating the joint distribution of all preference parameters.

3.2.2 Aggregate Structural Estimation

We jointly estimate preference parameters for risk aversion, time discounting, intertemporal loss aversion, and debt aversion, according to the model specified in Section 2, and broadly following the estimation strategies described in, e.g., Andersen et al. (2008).

As the basis for all estimations, we consider a random utility model incorporating errors in the decision-making process.[11] Decision-makers may make errors when evaluating the expected utility of different options captured by noise parameter μ. In particular, choices between options A and B are evaluated at their expected intertemporal utility, as specified in Equation 1 plus a stochastic error term ε. A decision-maker with preference parameters $\omega = (\alpha, \rho, \gamma, \lambda)$ chooses option B if $U(X^B, \omega) + \varepsilon^B \geq U(X^A, \omega) + \varepsilon^A$. The probability of observing choice B can then be written as:

$$P^B(\theta) = F\left(\frac{U(X^B, \omega) - U(X^A, \omega)}{\mu}\right) = F(\Delta U(\theta)), \tag{14}$$

where F is the cumulative distribution function of $(\varepsilon^A - \varepsilon^B)$ and $\theta = (\alpha, \rho, \gamma, \lambda, \mu)$ denotes the vector of preference parameters and the error parameter. We assume $(\varepsilon^A - \varepsilon^B)$ to follow a standard logistic distribution with $F(\xi) = (1 + \mathrm{e}^{-\xi})^{-1}$ in our main specification. This specification is often termed Luce model (Luce et al., 1965; Holt and Laury, 2002) or Fechner error with logit link (Drichoutis and Lusk, 2014). Overall, we estimate four preference parameters and one error parameter: risk aversion α, time discounting ρ, debt

[11] Under certain circumstances, preference parameters estimated with a random utility model may be biased due to violations of stochastic monotonicity (Apesteguia and Ballester, 2018). This is not a direct threat to our empirical identification of debt aversion for two reasons. First, in our specification, debt aversion and also loss aversion are stochastically monotone. Second, potential biases in (non-stochastically monotone) risk aversion and time discounting drive estimates of debt aversion downwards. Apesteguia et al. (2024), demonstrate that a random utility model, as chosen in our specification, may underestimate risk aversion. However, as outlined in Section 2.2, lower risk aversion decreases the debt-saving interest gap and thus would lead to lower estimates of debt aversion. Identifying debt aversion in a random utility model thus can be seen as a conservative approach.

Table 2: Aggregate parameter estimates

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.643	0.036	1.0535	1.1074	0.4484
95% confidence interval	0.58 / 0.71	0.02 / 0.05	1.03 / 1.08	1.08 / 1.13	0.37 / 0.53
robust standard error	0.0345	0.006	0.0112	0.0118	0.0402

estimation details: n = 12240, log-likelihood = -4107.91, AIC = 8225.81, BIC = 8262.88, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

aversion γ, intertemporal loss aversion λ, and the Fechner error μ, respectively. Intuitively, the error parameter can be interpreted as follows: for $\mu \to 0$, choice becomes deterministic, and for $\mu \to \infty$, choice approaches uniform randomization. Aggregating over all choices and individuals, the log-likelihood function is written as:

$$ln\,(L(\theta)) = \sum_i \sum_j \left[ln\,(F(\Delta U(\theta)))\,c_{ij} + ln(1 - F(\Delta U(\theta)))(1 - c_{ij})\right], \tag{15}$$

where $c_{ij} = 0$ if individual i chooses A in choice j and $c_{ij} = 1$ if individual i chooses B in choice j.

By maximizing the log-likelihood function over θ, we derive point estimates for all preference parameters and the error parameter. These estimates describe the preferences of the average decision-maker. To account for the dependency of choices made by the same person, we cluster standard errors at the individual level. Estimates are calculated using STATA's modified Newton-Raphson algorithm.

Estimation results are presented in Table 2.[12] Most importantly for this study, the estimate of the parameter indicating debt aversion $\gamma = 1.0535$ is significantly larger than one, suggesting that participants are, on average, debt averse. To put this estimate in perspective, a decision-maker with the preference parameters as in Table 2 would be indifferent between accepting or rejecting a debt contract that involves a loan amount of

[12]To check for potential multiplicity of maximum-likelihood solutions, we estimate the aggregate parameters from 100 combinations of randomly drawn starting values ($\alpha \sim U(0.5, 1)$; $\rho \sim U(0.5, 1)$; $\gamma \sim U(0.5, 1.5)$; $\lambda \sim U(0.5, 2.5)$; $\sigma \sim U(0, 2)$. Parameter estimates are virtually identical to the estimates reported in Table 2 for any of the tested combinations of starting values.

€20.93 today, with an associated repayment of €15 in four weeks. Thus, our average participant would require a negative interest rate to accept a debt contract. This in itself, however, is not yet evidence of debt aversion, as it could also be driven by other preferences. To understand the impact of debt aversion, we calculate what a counterfactual debt-neutral decision-maker with the same preferences, except $\gamma = 1$, would do. Such a decision-maker would accept a loan already as soon as it pays at least €18.08 today, everything else equal. Our average debt averse participant thus requires €2.85 more upfront in order to be indifferent between accepting or rejecting a debt contract compared to the counterfactual debt-neutral decision-maker. We define the "borrowing premium" as the relative increase in the upfront payment (i.e., the principal) a debt averse person would require compared to a debt neutral person in order to accept a debt contract. For the average participant, this would be $2.85/18.08 = 15.76\%$. In other words, the average, debt averse decision-maker requires a borrowing premium of 15.76% larger loan sizes, while keeping repayment constant, to be willing to accept a debt contract compared to their debt-neutral counterpart. Importantly, debt aversion is not only statistically and economically significant but including debt aversion also meaningfully increases the model's performance relative to the benchmark assuming debt neutrality: Both AIC and BIC are reduced in the model including debt aversion.[13] Note that these estimates are based on our experimental setting that deliberately abstracts from motives to save or borrow that go beyond individual preferences and utility maximization, such as financing a home by a mortgage. As such, all saving and debt behavior can be seen as a result of individual preferences alone. A theoretical model without debt aversion is not reconcilable with the observed behavior.

Regarding preferences other than debt aversion, participants are, on average, risk averse with a parameter of relative risk aversion $\alpha = 0.643$. This estimate is comparable to previous studies with large-scale samples using a similar utility specification. Andersen et al. (2008) find a parameter of relative risk aversion in the adult Danish population of 0.741, while Meissner et al. (2023) report 0.456 based on a representative sample from eight European countries. The four-week discount rate ρ is estimated at around 0.036, which is in the range of other lab studies on time preferences as summarized by recent

[13] Compared to the model assuming debt neutrality (see Online Appendix Table 23), AIC decreases by 38.67 and BIC decreases by 31.32.

meta-study results (Matousek et al., 2021). Further, on average, participants are loss averse, with $\lambda = 1.1074$. This is lower than estimates typically observed in the literature, where λ is usually found to be around 2 (Brown et al., 2022). However, in most studies, loss aversion is elicited with risky prospects, i.e., gains and losses are separated by state at one point in time. Abdellaoui et al. (2013) show that intertemporal loss aversion, when gains and losses are separated by time and do not involve risk, such as in our savings and debt contracts, is substantially lower with an estimate at around $\lambda = 1.15$. Also, note that, as discussed in section 2.2, this parameter may reflect other preferences than solely intertemporal loss aversion.

3.2.3 Population Distributions of Parameters

As a further generalization, we account for unobserved heterogeneity of preferences between individuals in our sample by estimating a structural model of the joint distribution of preference parameters in the population as in Conte et al. (2011) and von Gaudecker et al. (2011). To this end, we extend our stochastic specification to align with the non-linear-mixed-logit routine introduced by Andersen et al. (2012).

In particular, we assume that the vector of preference parameters and the error parameter $\theta = (\alpha, \rho, \gamma, \lambda, \mu)$ follows a joint normal distribution f with distribution hyper-parameter vector Θ. Given the joint normal form, Θ comprises the mean and the standard deviation for each parameter in θ and the covariances between all possible pairings of these parameters.

Let θ_i denote a realization of θ for a particular individual i. Analogously to Equation 14, in a particular decision, individual i will choose Option B, conditional on θ_i, with the following probability:

$$P_i^B(\theta_i) = F(\Delta U(\theta_i)) \tag{16}$$

Aggregating over all choices j, the probability of all observed choices by individual i is:

$$P_i(\theta_i) = \prod_j (P_{ij}^B(\theta_i) c_{ij} + (1 - P_{ij}^B(\theta_i))(1 - c_{ij})), \tag{17}$$

Table 3: Maximum simulated likelihood estimates

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
mean	0.5319	0.0391	1.0639	1.1444	0.3116
95% CI	0.51 / 0.56	0.03 / 0.04	1.05 / 1.08	1.13 / 1.16	0.28 / 0.34
SE	0.0127	0.003	0.0074	0.0072	0.0141

estimation details: n = 24480, log-likelihood = -2531.17, AIC = 5102.33, BIC = 5264.44, logit Fechner error

Standard errors (SE) clustered at the individual level, 127 clusters

where, analogously to the aggregate specification, the index $c_{ij} = 0$ if individual i chooses Option A in choice j and $c_{ij} = 1$ if individual i chooses Option B in choice j. Deriving the probability of observed choices conditional on the population distribution hyper-parameters Θ rather than an individual realization θ_i involves integration over the distribution of θ:

$$P_i(\Theta) = \int P_i(\theta_i)\ f(\theta|\Theta)\ \mathrm{d}\theta \tag{18}$$

In particular, $P_i(\Theta)$ for any individual i is given by integrating over the weighted average of conditional probabilities of observed choices $P_i(\theta_i)$ aggregated over all choices j evaluated at different values of θ and weights given by the density of model parameters f. The log-likelihood function over all individuals is then written as:

$$ln\ L(\Theta) = \sum_i ln(P_i(\Theta)) \tag{19}$$

We maximize the log-likelihood numerically, using simulated maximum likelihood, as suggested by Andersen et al. (2012) and reviewed earlier in Cameron and Trivedi (2005) and Train (2009). In particular, we employ STATA's modified Newton-Raphson algorithm to maximize the likelihood function in Equation 19. Resulting estimates of the distributional parameters for preferences over risk, time, losses, and debt are displayed in Table 3 (means) and Table 4 (variance-covariance matrix). The two-dimensional cross-sections of the probability density function for all parameters are illustrated in Figure 3.

Table 4: Variance-covariance matrix

		$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
$\boldsymbol{\alpha}$	**var/cov**	0.0317				
	95% CI	0.0271 / 0.0364				
	SE	0.0024				
$\boldsymbol{\rho}$		-0.0013	0.0013			
		-0.0023 / -0.0004	0.0008 / 0.0018			
		0.0005	0.0003			
$\boldsymbol{\gamma}$		0.0004	0.0005	0.0027		
		-0.0019 / 0.0027	-0.0002 / 0.0013	0.0013 / 0.0041		
		0.0012	0.0004	0.0007		
$\boldsymbol{\lambda}$		-0.0159	0.0042	0.0039	0.0249	
		-0.0183 / -0.0135	0.0034 / 0.0051	0.0014 / 0.0064	0.0204 / 0.0295	
		0.0012	0.0005	0.0013	0.0023	
$\boldsymbol{\mu}$		-0.0298	0.0041	0.0053	0.0264	0.0435
		-0.0345 / -0.025	0.0026 / 0.0056	0.0013 / 0.0093	0.0206 / 0.0321	0.0313 / 0.0558
		0.0024	0.0008	0.002	0.0029	0.0063

estimation details: n = 24480, log-likelihood = -2531.17, AIC = 5102.33, BIC = 5264.44, logit Fechner error

Standard errors (SE) clustered at the individual level, 127 clusters

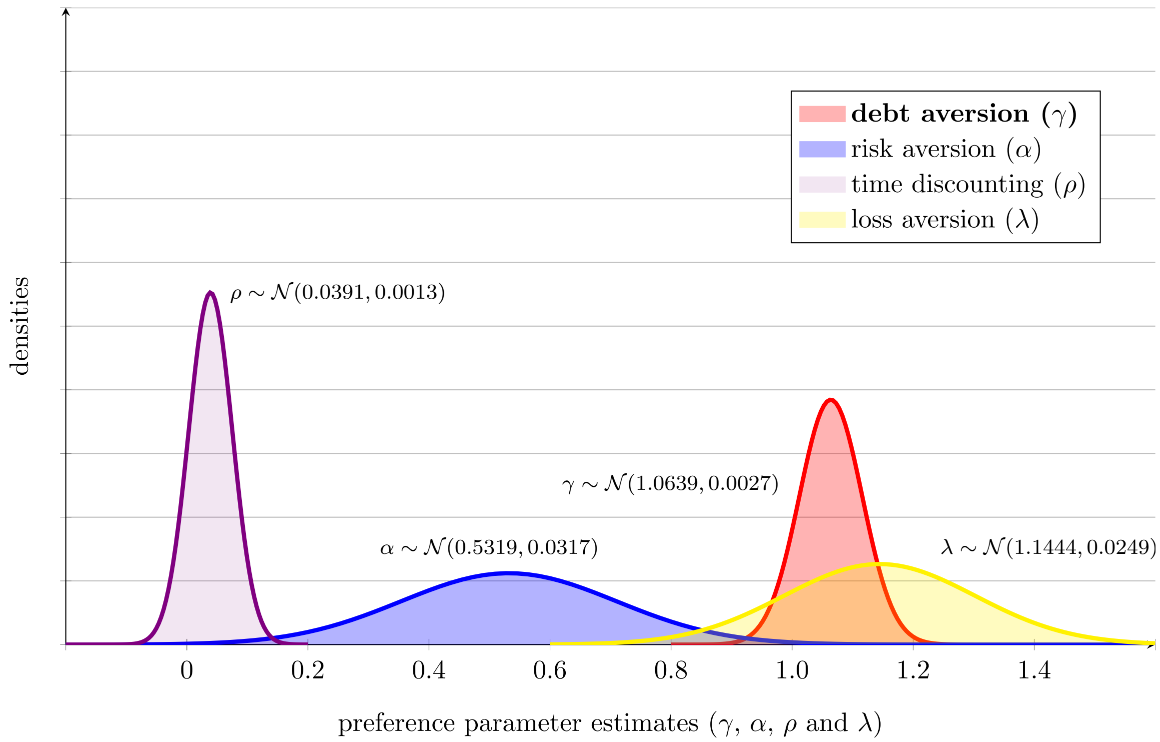
Distribution estimation results support the finding of debt aversion in the aggregate estimations: around 89% of the population is estimated to have a debt aversion parameter above one, i.e., exhibits debt aversion.[14]

A key advantage of estimating the joint distribution of all preference parameters, including the variance-covariance matrix, is that we can identify correlations of the structural preference parameters based on covariances of the estimated population distributions. In this regard, we find that debt aversion is positively correlated with intertemporal loss aversion, with a correlation coefficient of $\rho = 0.4756$.[15] Notably, no other preference parameter appears to be correlated with debt aversion. Regarding preferences other than

[14]The share of the debt averse population is retrieved as $\int_1^\infty$ of the density function corresponding to the estimated normal distribution of γ.

[15]Pearson's correlation coefficient is calculated as $\rho_{x,y} = \frac{Cov_{x,y}}{\sigma_x \sigma_y}$ where Cov is the covariance as reported in Table 4, and σ denotes standard deviations, which can be retrieved as $\sqrt{var}$ using variances reported in Table 4.

Figure 3: Probability density functions of preference parameters



debt aversion, risk aversion appears to be negatively correlated with time discounting ($\rho = -0.2025$) and intertemporal loss aversion ($\rho = -0.5659$), and time discounting is positively correlated with intertemporal loss aversion ($\rho = 0.7382$). These results are in line with Schleich et al. (2019), who test for correlation of preference parameters in a large-scale multi-country representative survey.

3.2.4 Duration of Indebtedness

In this extension, we aim to investigate potential mechanisms of how debt aversion takes effect. Specifically, we will test whether the cost of being in debt could depend on the time a person spends indebted. We find support that debt aversion does not only depend on the amount and timing of repayment but also substantially on the time of indebtedness.

To test this, we extended the main experiment in the final wave of data collection. This extended experiment contained 30 additional choices on savings and debt contracts spanning not four but a longer period of eight weeks. The remaining 90 choices and all general procedures are the same as in the main experiment without extension. As in the original saving and debt contracts, all payments to the experimenter in the additional choices are held constant at €15, i.e., all loans require the same repayment amount.

We consider an extended model specification of debt aversion that additionally depends on the time of being indebted $T - t$:

$$c(\boldsymbol{x}) = (1 - \gamma\zeta^{(T-t-1)})\phi(T)v(x_T) \tag{20}$$

Maintaining the components and interpretation of the previous specification of debt aversion, in this extension, ζ scales debt aversion based on the time of being indebted. In particular, $\zeta > 1$ implies increasing cost of being indebted if the time of being indebted increases, $\zeta = 1$ implies invariance of debt aversion with respect to time of indebtedness, and $\zeta < 1$ describes decreasing cost of being indebted if the time of indebtedness increases.

In this setting, the utility of a short debt contract, i.e. $T - t = 1$, is the same as in the specification without debt duration dependent scaling of debt aversion (ζ):

$$U(x) = \phi(t)u(x_t) - \lambda\gamma\phi(T)u(-x_T), \tag{21}$$

for long debt contracts, i.e. $T - t = 2$ in the setting of our experiment, the utility of debt contracts simplifies to

$$U(x) = \phi(t)u(x_t) - \lambda\gamma\zeta\phi(T)u(-x_T) \tag{22}$$

Using aggregate maximum likelihood estimations and pooled choice data from the standard experiment with 90 choices and the extended experiment with 120 choices yields results as summarized in Table 5. Parameter estimates, including debt aversion as established in the main specification, remain largely unchanged. Interestingly, however, the debt duration aversion parameter ζ is significantly larger than one. This implies that the cost of being indebted increases in the time of indebtedness.

To illustrate what this implies in terms of behavior, the average decision-maker characterized by parameter estimates derived in the frame of the extended model is indifferent between accepting and rejecting a debt contract that offers a loan of €20.67 today and requires repayment of €15 in four weeks. However, the same decision-maker requires a larger loan of €21.11 today if repayment of €15 is not due in four but eight weeks. In

Table 5: Aggregate parameter estimates including debt duration aversion

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\zeta}$ debt duration aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6398	0.0429	1.0635	1.851	1.1007	0.448
95% CI	0.57 / 0.71	0.03 / 0.06	1.04 / 1.09	1.28 / 2.42	1.08 / 1.12	0.37 / 0.53
robust SE	0.034	0.0075	0.0134	0.2919	0.0121	0.0402

estimation details: n = 12240, log-likelihood = -4095.55, AIC = 8203.1, BIC = 8247.57, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

contrast, the hypothetical debt and debt duration neutral counterpart (i.e. $\gamma = 1$ and $\zeta = 1$), requires a four-week loan of size €17.43 and eight-week loan of size €15.51 to be indifferent. Based on the differences, we can calculate borrowing premia of 18.59% for short, four-week debt contracts and 36.10% for long, eight-week debt contracts. In other words, the borrowing premium increases by around 93% if the duration of indebtedness doubles. Note, however, that the identification of the debt duration aversion parameter relies on only 27 participants who completed the extended list of MPLs and should, therefore, be interpreted with caution.

3.2.5 Present Bias

In principle, our experimental setup allows to identify present bias, as we include debt and saving contracts that are shifted into the future while maintaining the same temporal distance between involved dates. To test whether present bias is existent in our sample, we consider an alternative discount function, that incorporates quasi-hyperbolic discounting (Phelps and Pollak, 1968; Laibson, 1997):

$$\phi'(\tau) = \begin{cases} 1 & \text{if } \tau = 0 \\ \frac{1}{(1+\psi)} \frac{1}{(1+\rho)^{\tau}} & \text{if } \tau \neq 0. \end{cases} \tag{23}$$

In this specification, ρ is the exponential discount rate, and ψ is the parameter that

Table 6: Aggregate parameter estimates including present bias

	α risk aversion	ψ present bias	ρ discounting	γ debt aversion	λ loss aversion	μ Fechner error
point estimate	0.6431	-0.0012	0.037	1.0545	1.1069	0.4484
95% CI	0.58 / 0.71	-0.01 / <.01	0.02 / 0.05	1.03 / 1.08	1.08 / 1.13	0.37 / 0.53
robust SE	0.0345	0.0029	0.0065	0.0114	0.012	0.0402
estimation details: n = 12240, log-likelihood = -4107.86, AIC = 8227.71, BIC = 8272.19, logit Fechner error						

Robust standard errors (SE) clustered at the individual level, 127 clusters

determines present bias.[16] A parameter of $\psi > 0$ indicates present bias, $\psi = 0$ indicates no present bias, and $\psi < 0$ indicates future bias. The results of the aggregate maximum likelihood estimation using this alternative specification are presented in Table 6. Present bias is estimated precisely at and statistically indistinguishable from 0. This finding appears to be in line with recent meta-study results on present bias elicited in experiments (Imai et al., 2020).[17]

3.2.6 Different time discounting for gains and losses

Following the argumentation by Loewenstein and Prelec (1992), a debt-saving interest gap and seemingly debt averse behavior may also be explained by different discount rates for gains and losses. We test whether our specification of standalone debt aversion is robust to this by adapting our main specification such that we allow distinct time discounting (TD) parameters for gains and losses: ρ^+ and ρ^-, respectively. Consequently, we need to consider a discount function ϕ which depends on the sign of x:

[16] Note that we present quasi-hyperbolic discounting slightly differently compared to (Laibson, 1997), where the present bias parameter is presented as $\beta = \frac{1}{1+\psi}$. We chose this presentation to ensure a uniform interpretation of estimated coefficients in Table 19: a larger coefficient in this table implies more risk aversion, discounting, present bias, intertemporal loss aversion, and debt aversion, respectively.

[17] For graphical evidence on the absence of present bias, see Figure 7 in the Online Appendix, which shows that required interest rates for debt and saving contracts do not differ between contracts that are offered now and contracts that are shifted into the future.

Table 7: Aggregate parameter estimates with separate time discounting in the gain and loss domain

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho^+}$ TD gains	$\boldsymbol{\rho^-}$ TD losses	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6425	0.0369	0.0307	1.0485	1.1036	0.4484
95% CI	0.57 / 0.71	0.02 / 0.05	0.02 / 0.04	1.03 / 1.07	1.08 / 1.13	0.37 / 0.53
robust SE	0.0346	0.0061	0.0062	0.0109	0.0115	0.0402

estimation details: n = 12240, log-likelihood = -4106.69, AIC = 8225.39, BIC = 8269.86, logit Fechner error

Robust standard errors (SE) clustered at the individual level,

$$\phi(\tau, x) = \begin{cases} \frac{1}{(1+\rho^+)^\tau} & \text{and } x \geq 0 \\ \frac{1}{(1+\rho^-)^\tau} & \text{and } x < 0. \end{cases} \tag{24}$$

Estimation results are presented in Table 7. Unlike proposed by Loewenstein and Prelec (1992), and empirically reported by Ma et al. (2023), we find no significant difference between the discount factors in the gain and loss domain. Importantly, the debt aversion parameter remains significantly larger than one and is similar in magnitude to the debt aversion parameter in our main specification. This can be taken as evidence of debt aversion as a genuine preference that cannot be explained by differences in time discounting in the loss and gain domain.

3.2.7 Further Robustness Checks

Our finding of debt aversion may be sensitive to the assumptions underlying our estimations. We, therefore, employ a wide array of robustness checks. In particular, we first consider alternative forms of the cost of borrowing by modeling debt aversion as a fixed cost of being indebted as well as scaling of utility from borrowed money. Second, we alter various characteristics of our utility specification in general. These comprise not correcting for curvature of utility by abstracting from risk aversion as well as considering alternative forms of the utility function such as CARA utility and CRRA utility without ε-transformation. Third, we scrutinize different error structures: we introduce an additional tremble error, exchange the logit for a probit Fechner error, and allow distinct probit Fechner errors per choice domain. Moreover, we also test the effect of excluding participants who did not complete the entire experimental sequence or expressed some doubt about the trustworthiness of the experimental environment. Summing up the results, debt aversion remains robust regardless of the utilized functional forms and sample selection criteria. Detailed descriptions and results on all robustness checks can be found in Online Appendix E.

4 The Debt Aversion Survey Module

In this section, we develop an experimentally validated, short, and easy-to-use survey module for measuring individual debt aversion. The module enables eliciting debt aversion beyond the laboratory, such as in representative samples where implementing our full, incentivized experiment would not be feasible.

To create the survey module, we first structurally estimate parameters of debt aversion on the individual level, using hierarchical maximum likelihood methods (see Appendix F.1 for details on the estimation). Building on the methodology of the Global Preference Survey - GPS (Falk et al., 2018, 2022), we then test the predictive power of a large set of candidate debt aversion survey items, consisting of existing items from the literature and novel items developed for this study. Out of these, we select a smaller subset of survey items as our debt aversion survey module that jointly best predicts individual debt aversion as measured based on the incentivized experiment (see Appendix F.3 for details on the selection procedure).

The module that provides the best trade-off between in- and out-of-sample fit and brevity of implementation consists of two survey items:

Item 1: How much do you agree with the following statement: *Debt is an integral part of today's life.*

Item 2: How much do you think the average respondent of this survey agrees with the following statement: *There is no excuse for borrowing money.*

Both ratings are given on a 6-point Likert scale from 1 - *Strongly agree* to 6 - *Strongly disagree*. This survey module is short, easy to implement, and predicts debt aversion in the experiment reasonably well. Responses can be mapped an estimate for individual debt aversion $\hat{\gamma}$ as a linear regression of rating R_1 for Item 1 and R_2 for Item 2 as follows

$$\hat{\gamma} = 1.0694 + 0.0045 \times R_1 - 0.0069 \times R_2$$

4.1 Debt Aversion in a Representative Sample of German Households

To investigate debt aversion in a broader population, we implement the debt aversion survey module in the online household panel of the German central bank (Bundesbank BOP-HH). The panel surveys German citizens above the age of 16 and is a representative sample of individuals with respect to age, gender, education, and region. Importantly, it includes information on individual financial behavior (e.g., saving, borrowing, spending) and socio-economic characteristics (e.g., asset and debt-holding). The survey module is included in wave 44 of the BOP-HH, conducted in August 2023 (Boddin et al., 2023). This wave yielded 5025 respondents, for whom we can calculate the individual level of debt aversion, as they completed both items of the module.

We analyze the link between debt aversion and real-world outcomes by testing its predictiveness for actual debt holding (mortgages and other liabilities), potentially debt-related behaviors (paying by credit card and incurring large expenditures), and financial health (default probability and negative spillovers of debt on pursuing other financial objectives). To this end, we estimate separate linear regressions for each of the six outcomes with debt aversion as an independent variable, each with and without a set of socio-demographic control variables.

Debt aversion appears to be significantly lower among people who are indebted ($p < 0.01$) based on t-tests comparing people holding mortgages and/or other liabilities to those not indebted. Around 39% hold mortgages with an average value of €145321, and 29% of respondents hold other liabilities with an average value of €15140. However, there are also around 51% of respondents who are not indebted at all. Table 8 further shows the results of the linear regressions for actual debt-holding: model (1) to (4), for potentially debt-related behaviors: model (5) to (8), and for financial health: model (9) to (12). Debt aversion is correlated with actual debt-holding. The OLS estimates for debt aversion are highly significant for mortgages and other liabilities, both with and without including controls. The point estimates of −1.816 and −13.893 can be interpreted as one standard deviation higher debt aversion corresponds to €13893 less in mortgages €1816 less in other liabilities, suggesting an economically meaningful correlation. Moreover, based on the adjusted R^2, debt aversion accounts for a notable share of variation in debt-holding compared to the explanatory power of other socio-demographic controls. This is especially pronounced for other liabilities. Further, we find suggestive evidence for the correlation between debt aversion and potentially debt-related behaviors. More debt aversion corresponds to fewer payments made by credit cards and less money spent on large expenditures. Finally, debt aversion is predictive of financial health. More debt aversion corresponds to a lower perceived likelihood of default and lower perceived difficulties in adequately pursuing other financial objectives due to debt obligations. The corresponding OLS estimates are highly significant.

Table 8: Predictiveness of Debt Aversion for Real-World Outcomes

	Dependent variable											
	Actual debt				**Behavior**				**Financial health**			
	Mortgages		**Other liabilities**		**Credit card payments**		**Large expenditures**		**Default probability**		**Negative spillovers**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Debt aversion	-23.068***	-13.893***	-1.984***	-1.816***	-0.205*	-0.225*	-0.125**	-0.098*	-0.893***	-1.021***	0.288***	0.309***
	(1.654)	(1.602)	(0.169)	(0.191)	(0.115)	(0.132)	(0.049)	(0.054)	(0.34)	(0.385)	(0.043)	(0.048)
Controls		✓		✓		✓		✓		✓		✓
Observations	4581	3959	4585	3959	2051	1646	2895	2319	2404	1857	2436	1861
Adjusted R^2	0.041	0.287	0.029	0.044	0.001	0.015	0.002	0.039	0.002	0.06	0.017	0.133

Notes: OLS estimates of debt aversion (z-standardized), where debt aversion is measured on the individual level using the debt aversion survey module, standard errors in parentheses. Controls include gender, marriage status, educational attainment, employment status, household net income, household wealth, risk aversion, and first-hand experience living in the German Democratic Republic. Mortgages comprise outstanding loans secured by real estate. Other loans include all other outstanding loans (e.g., overdraft facilities, consumer credit or loans for goods and services, loans to finance an enterprise or a professional activity, loans from friends or family). Both are measured in €1000. Credit card payments represent the percentage share of credit card payments for the last ten purchases of essential goods. Large expenditures represent the money spent on major purchases (e.g., car, furniture, and electrical appliances) in the last month in €1000. Default probability is based on the respondents' self-assessed probability of being unable to service their debts (mortgages, consumer credit, and other debts) over the next three months on a scale from 0-100. Negative spillovers capture the self-assessment to what extent debt and debt payments prevent the respondents from adequately pursuing other financial objectives such as reaching saving targets, making investments or retirement provisions, or building up financial reserves on a scale from 1 (To a very great extent) to 7 (Not at all).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5 Discussion and conclusion

In this paper, we introduce a novel theoretical framework and experiment that allows to model and measure debt aversion. We are able to separately identify debt aversion from other relevant preferences, such as risk aversion, intertemporal loss aversion, and time preferences. In this way, we aim to establish debt aversion as a preference in its own right, as opposed to an emergent behavioral property of other preferences, biases, beliefs, and constraints.

Using a structural maximum likelihood estimation, we find that our participants are, on average, debt averse. They are willing to forgo a substantial amount of money in order to avoid getting into debt. We estimate the "borrowing premium" to be around 16%. This is the increase in the upfront payment our average participant would require compared to a counterfactual debt neutral participant to accept a debt contract. Further, we estimate the joint population distribution of all preference parameters using simulated maximum likelihood. We find that a substantial share of 89% of our participants exhibit debt aversion. Debt aversion appears to be correlated positively with intertemporal loss aversion but not with other preference parameters. Finally, we find evidence that debt aversion depends positively on the duration a person spends indebted. Notably, present bias does not appear to exist in our data, and debt aversion remains robust after a series of robustness checks. Summing up, we find robust evidence supporting debt aversion as a preference in its own right. Most participants are debt averse, and debt aversion appears to have a meaningful impact on choice.

To investigate debt aversion beyond the laboratory, we validate a survey module that proxies the incentivized measurement of debt aversion as in our experiment. We include the survey module in a representative panel among German households and find that individual debt aversion predicts real-world indebtedness, debt-related behaviors and financial health.

The existence of debt aversion and its predictiveness of real-world outcomes may have far-reaching implications for individual financial decision-making. Debt averse individuals could invest less in otherwise profitable investment projects, such as education or energy-efficient technologies, and make consumption and saving decisions that deviate from the standard model of intertemporal choice.

Debt aversion could also have implications on the macroeconomic level. Hundtofte et al. (2019) show that consistent with debt aversion, individuals in the US and Iceland are reluctant to use credit to smooth negative transitory income shocks. They argue that while standard theory predicts countercyclical credit demand, credit demand appears to be pro-cyclical, which could deepen business cycle fluctuations.

Further, our findings also have implications for policy design. Many policies rely on offering favorable loans to subsidize particular behaviors, such as investment in tertiary education or energy-efficient technologies. However, in the face of a largely debt averse population, these loans might not be very effective. Moreover, if debt aversion correlates with individual characteristics, such as income or socioeconomic status, such policies could have unintended effects. For instance, loan-based policies to facilitate tertiary education for students from weak financial backgrounds might be particularly unattractive to these students if they are also more debt averse. For these reasons, we believe that more research on how debt aversion relates to individual characteristics of representative populations is required. To facilitate this, we have constructed a short and easy-to-use survey module for measuring individual debt aversion. Using the data from this experiment, we identify a set of survey items that best predicts the debt aversion parameter as elicited with our experiment. The survey module contains two short items and significantly predicts real world debt taking and financial health. We hope that this survey module will prove useful for future research on debt aversion on a larger scale, where complicated and incentivized experiments are often not feasible.

While we have made a first step in cleanly identifying debt aversion, open questions on the mechanisms that underlie debt aversion and its implications for financial decision-making remain. We test a multitude of ways of modeling debt aversion, and while all specifications lend clear support to its existence, our setup is not well suited to discriminate between different models and different mechanisms of how debt aversion works. In an extension of the base experiment, we show that debt aversion appears to increase in the duration participants spend indebted, suggesting that debt aversion causes disutility based on the time spent in debt, but many other interesting questions remain. We hope that our theoretical and experimental framework can pave the way for future research that could improve the knowledge of the exact mechanisms at play.

Finally, we believe that our setup provides a valuable methodological contribution. To our knowledge, we are first to put participants into actual debt in a laboratory experiment. As the vast majority of participants did not default on their obligations, we believe that such experiments could prove useful to analyze debt-related behavior in the future.

References

ABDELLAOUI, M., H. BLEICHRODT, O. L'HARIDON, AND C. PARASCHIV (2013): "Is There One Unifying Concept of Utility?An Experimental Comparison of Utility Under Risk and Utility Over Time," *Management Science*, 59, 2153–2169. Cited on pages 12 and 23.

ABDELLAOUI, M., C. GUTIERREZ, AND E. KEMEL (2018): "Temporal discounting of gains and losses of time: An experimental investigation," *Journal of Risk and Uncertainty*, 57, 1–28. Cited on page 12.

AHRENS, S., C. BOSCH-ROSA, AND T. MEISSNER (2022): "Intertemporal consumption and debt aversion: a replication and extension," *Journal of the Economic Science Association*, 8, 56–84. Cited on pages 7 and 56.

AKAIKE, H. (1974): "A new look at the statistical model identification," *IEEE Transactions on Automatic Control*, 19, 716–723. Cited on page 78.

ALMENBERG, J., A. LUSARDI, J. SÄVE-SÖDERBERGH, AND R. VESTMAN (2021): "Attitudes towards Debt and Debt Behavior*," *The Scandinavian Journal of Economics*, 123, 780–809. Cited on page 6.

AMAR, M., D. ARIELY, S. AYAL, C. E. CRYDER, AND S. I. RICK (2019): "Winning the Battle but Losing the War: The Psychology of Debt Management," *Journal of Marketing Research*, 48, S38–S50. Cited on page 7.

ANDERSEN, S., G. W. HARRISON, A. R. HOLE, M. LAU, AND E. E. RUTSTRÖM (2012): "Non-linear mixed logit," *Theory and Decision*, 73, 77–96. Cited on pages 23 and 24.

ANDERSEN, S., G. W. HARRISON, M. I. LAU, AND E. E. RUTSTRÖM (2008): "Eliciting Risk and Time Preferences," *Econometrica*, 76, 583–618. Cited on pages 12, 20, and 22.

ANDERSSON, O., H. J. HOLM, J.-R. TYRAN, AND E. WENGSTRÖM (2020): "Robust inference in risk elicitation tasks," *Journal of Risk and Uncertainty*, 1–15. Cited on page 65.

Andreoni, J. and C. Sprenger (2012): "Risk preferences are not time preferences," *American Economic Review*, 102, 3357–76. Cited on page 12.

Apesteguia, J. and M. A. Ballester (2018): "Monotone Stochastic Choice Models: The Case of Risk and Time Preferences," *Journal of Political Economy*, 126, pp. 74–106. Cited on page 20.

Apesteguia, J., M. A. Ballester, and Gutiérrez-daza (2024): "Random Discounted Expected Utility," *Review of Economics and Statistics*, 1–44. Cited on page 20.

Besharat, A., S. Varki, and A. W. Craig (2015): "Keeping consumers in the red: Hedonic debt prioritization within multiple debt accounts," *Journal of Consumer Psychology*, 25, 311–316. Cited on page 7.

Boatman, A., B. J. Evans, and A. Soliz (2017a): "Understanding Loan Aversion in Education," *AERA Open*, 3. Cited on page 5.

——— (2017b): "Understanding Loan Aversion in Education," *AERA Open*, 3. Cited on pages 74 and 75.

Boddin, D., M. Köhler, T. Schmidt, S. Helmschrott, A.-K. Fischer, O. Goldfayn-Frank, M. Cato, G. Afunts, H. Merkle, and S. Walter (2023): "Bundesbank-Online-Panel-Households (BOP-HH)," . Cited on page 32.

Brown, A. L., T. Imai, F. Vieider, and C. F. Camerer (2022): "Meta-analysis of empirical estimates of loss aversion," *Journal of Economic Literature*. Cited on page 23.

Caetano, G., M. Palacios, and H. A. Patrinos (2019): "Measuring Aversion to Debt: An Experiment Among Student Loan Candidates," *Journal of Family and Economic Issues*, 40, 117–131. Cited on pages 2 and 5.

Callender, C. and J. Jackson (2005): "Does the Fear of Debt Deter Students from Higher Education?" *Journal of Social Policy*, 34, 509–540. Cited on page 5.

Cameron, A. C. and P. K. Trivedi (2005): *Microeconometrics: methods and applications*, Cambridge university press. Cited on page 24.

Cheung, S. L. (2020): "Eliciting utility curvature in time preference," *Experimental Economics*, 23, 493–525. Cited on page 12.

Chudry, F., G. Foxall, and J. Pallister (2011): "Exploring Attitudes and Predicting Intentions: Profiling Student Debtors Using an Extended Theory of Planned Behavior," *Journal of Applied Social Psychology*, 41, 119–149. Cited on pages 73, 74, and 75.

Coller, M. and M. B. Williams (1999): "Eliciting Individual Discount Rates," *Experimental Economics*, 2, 107–127. Cited on page 13.

Conte, A., J. D. Hey, and P. G. Moffatt (2011): "Mixture models of choice under risk," *Journal of Econometrics*, 162, 79–88. Cited on page 23.

Cornsweet, T. N. (1962): "The Staircase-Method in Psychophysics," *The American Journal of Psychology*, 75. Cited on page 72.

Davies, E. and S. E. G. Lea (1995): "Student attitudes to student debt," *Journal of Economic Psychology*, 16, 663–679. Cited on pages 73, 74, and 75.

Drichoutis, A. C. and J. L. Lusk (2014): "Judging statistical models of individual decision making under risk using in- and out-of-sample criteria," *PLoS One*, 9, e102269. Cited on pages 20 and 64.

Duffy, J. and A. Orland (2020): "Liquidity Constraints and Buffer Stock Savings: Theory and Experimental Evidence," *SSRN Electronic Journal*. Cited on page 7.

Eckel, C. C., C. Johnson, C. Montmarquette, and C. Rojas (2016a): "Debt Aversion and the Demand for Loans for Postsecondary Education," *Public Finance Review*, 35, 233–262. Cited on page 6.

——— (2016b): "Debt Aversion and the Demand for Loans for Postsecondary Education," *Public Finance Review*, 35, 233–262. Cited on pages 72, 74, and 75.

Falk, A., A. Becker, T. Dohmen, B. Enke, D. Huffman, and U. Sunde (2018): "Global Evidence on Economic Preferences*," *The Quarterly Journal of Economics*, 133, 1645–1692. Cited on page 31.

Falk, A., A. Becker, T. Dohmen, D. Huffman, and U. Sunde (2022): "The Preference Survey Module: A Validated Instrument for Measuring Risk, Time, and Social Preferences," *Management Science*. Cited on pages 31 and 77.

Farrell, S. and C. J. Ludwig (2008): "Bayesian and maximum likelihood estimation of hierarchical response time models," *Psychon Bull Rev*, 15, 1209–17. Cited on page 69.

Field, E. (2009): "Educational Debt Burden and Career Choice: Evidence from a Financial Aid Experiment at NYU Law School," *American Economic Journal: Applied Economics*, 1, 1–21. Cited on pages 2 and 5.

Fischbacher, U. (2007): "z-Tree: Zurich toolbox for ready-made economic experiments," *Experimental Economics*, 10, 171–178. Cited on page 17.

George, E. E., M. E. Hansen, and J. L. Routzahn (2018): "Debt Tolerance, Gender, and the Great Recession," *Journal of Consumer Affairs*, 52, 711–732. Cited on page 73.

Gopalan, R., B. H. Hamilton, J. Sabat, and D. Sovich (2023): "Aversion to Student Debt? Evidence from Low-Wage Workers," *The Journal of Finance*, 79, 1249–1295. Cited on page 5.

Greiner, B. (2015): "Subject pool recruitment procedures: organizing experiments with ORSEE," *Journal of the Economic Science Association*, 1, 114–125. Cited on page 17.

Harrison, N. and S. Agnew (2016): "Individual and Social Influences on Students Attitudes to Debt: a Cross-National Path Analysis Using Data from England and New Zealand," *Higher Education Quarterly*, 70, 332–353. Cited on page 73.

Haultain, S., S. Kemp, and O. S. Chernyshenko (2010): "The structure of attitudes to student debt," *Journal of Economic Psychology*, 31, 322–330. Cited on pages 73, 74, and 75.

Helka, A. M. and D. Maison (2021): "Predictors of the Propensity to Incur Loans for Varying Purposes in the Future," *European Research Studies*, 24.1, 1114–1128. Cited on page 6.

Holt, C. A. and S. K. Laury (2002): "Risk Aversion and Incentive Effects," *American Economic Review*, 92, 1644–1655. Cited on pages 13 and 20.

Hundtofte, S., A. Olafsson, and M. Pagel (2019): "Credit smoothing," *working paper*. Cited on page 36.

Ikeda, S. and M.-I. Kang (2015): "Hyperbolic Discounting, Borrowing Aversion and Debt Holding," *Japanese Economic Review*, 66, 421–446. Cited on page 6.

Imai, T., T. A. Rutter, and C. F. Camerer (2020): "Meta-Analysis of Present-Bias Estimation Using Convex Time Budgets," *The Economic Journal*. Cited on page 29.

Kahneman, D. and A. Tversky (1979): "Prospect Theory: An Analysis of Decision under Risk," *Econometrica*, 47. Cited on page 8.

Krupka, E. L. and R. A. Weber (2013): "Identifying Social Norms Using Coordination Games: Why Does Dictator Game Sharing Vary?" *Journal of the European Economic Association*, 11, 495–524. Cited on page 75.

Laibson, D. (1997): "Golden Eggs and Hyperbolic Discounting," *The Quarterly Journal of Economics*, 112, 443–478. Cited on pages 19, 28, and 29.

Loewenstein, G. and D. Prelec (1992): "Anomalies in Intertemporal Choice: Evidence and an Interpretation," *The Quarterly Journal of Economics*, 107, 573–597. Cited on pages 5, 29, and 30.

Luce, R. D., P. Suppes, et al. (1965): "Preference, Utility, and Subjective Probability," *Handbook of Mathematical Psychology*, 3, 252–410. Cited on page 20.

Ma, J.-T., L. Wang, L.-N. Chen, Q. He, Q.-Z. Sun, H.-Y. Sun, and C.-M. Jiang (2023): "Comparing mixed intertemporal tradeoffs with pure gains or pure losses," *Judgment and Decision Making*, 16, 709–728. Cited on page 30.

Martínez-Marquina, A. and M. Shi (2024): "The Opportunity Cost of Debt Aversion," *American Economic Review*, 114, 1140–1172. Cited on page 7.

Matousek, J., T. Havranek, and Z. Irsova (2021): "Individual discount rates: a meta-analysis of experimental evidence," *Experimental Economics*, 25, 318–358. Cited on page 23.

Meissner, T. (2016): "Intertemporal consumption and debt aversion: an experimental study," *Experimental Economics*, 19, 281–298. Cited on pages 6 and 7.

Meissner, T., X. Gassmann, C. Faure, and J. Schleich (2023): "Individual characteristics associated with risk and time preferences: A multi country representative survey," *Journal of Risk and Uncertainty*, 66, 77–107. Cited on pages 19, 22, and 56.

Murphy, R. O. and R. H. W. ten Brincke (2018): "Hierarchical Maximum Likelihood Parameter Estimation for Cumulative Prospect Theory: Improving the Reliability of Individual Risk Parameter Estimates," *Management Science*, 64, 308–326. Cited on pages 69 and 70.

Nguyen, H. T., H. M. Nguyen, M. Troege, and A. T. H. Nguyen (2020): "Debt aversion, education, and credit self-rationing in SMEs," *Small Business Economics*. Cited on pages 2 and 6.

Oosterbeek, H. and A. van den Broek (2009): "An empirical analysis of borrowing behaviour of higher education students in the Netherlands," *Economics of Education Review*, 28, 170–177. Cited on page 5.

Ozyilmaz, H. and G. Zhang (2020): "The Debt Payment Puzzle: An Experimental Investigation," Tech. rep., Working Paper. Cited on page 7.

Paaso, M., V. Pursiainen, and S. Torstila (2020): "Entrepreneur Debt Aversion and the Effectiveness of SME Support Programs: Evidence from the COVID-19 Pandemic," *SSRN Electronic Journal*. Cited on page 6.

Phelps, E. S. and R. A. Pollak (1968): "On Second-Best National Saving and Game-Equilibrium Growth," *The Review of Economic Studies*, 35. Cited on page 28.

Prelec, D. and G. Loewenstein (1998): "The Red and The Black: Mental Accounting of Savings and Debt," *Marketing Science*, Vol. 17. Cited on page 5.

Scheibehenne, B. and T. Pachur (2015): "Using Bayesian hierarchical parameter estimation to assess the generalizability of cognitive models of choice," *Psychon Bull Rev*, 22, 391–407. Cited on page 70.

Schleich, J., C. Faure, and T. Meissner (2021): "Adoption of retrofit measures among homeowners in EU countries: The effects of access to capital and debt aversion," *Energy Policy*, 149. Cited on pages 2, 6, and 74.

Schleich, J., X. Gassmann, T. Meissner, and C. Faure (2019): "A large-scale test of the effects of time discounting, risk aversion, loss aversion, and present bias on household adoption of energy-efficient technologies," *Energy Economics*, 80, 377–393. Cited on page 26.

Schwarz, G. (1978): "Estimating the Dimension of a Model," *The Annals of Statistics*, 6, 461–464. Cited on page 78.

Stone, M. (1974): "Cross-Validatory Choice and Assessment of Statistical Predictions," *Journal of the Royal Statistical Society. Series B (Methodological)*, 36, 111–147. Cited on page 78.

Train, K. E. (2009): *Discrete choice methods with simulation*, Cambridge university press. Cited on page 24.

von Gaudecker, H.-M., A. van Soest, and E. Wengström (2011): "Heterogeneity in Risky Choice Behavior in a Broad Population," *American Economic Review*, 101, 664–694. Cited on page 23.

Wakker, P. P. (2008): "Explaining the characteristics of the power (CRRA) utility family," *Health Economics*, 17, 1329–1344. Cited on page 19.

Walters, D., C. Erner, C. Fox, M. Scholten, D. Read, and C. Trepel (2016): "Debt Aversion: Anomalous in Theory, Advantageous in Practice," *NA - Advances in Consumer Research*, 44, 179–184. Cited on page 74.

Appendix

A Multiple Price Lists

Table 9: Multiple price list of intertemporal choices (MPL1)

Choice	Option A	Option B
1	Receive an amount of €18.2 today	Receive an amount of €18.0 in 4 weeks
2	Receive an amount of €18.0 today	Receive an amount of €18.0 in 4 weeks
3	Receive an amount of €17.8 today	Receive an amount of €18.0 in 4 weeks
4	Receive an amount of €17.3 today	Receive an amount of €18.0 in 4 weeks
5	Receive an amount of €16.8 today	Receive an amount of €18.0 in 4 weeks
6	Receive an amount of €16.0 today	Receive an amount of €18.0 in 4 weeks
7	Receive an amount of €14.0 today	Receive an amount of €18.0 in 4 weeks
8	Receive an amount of €12.0 today	Receive an amount of €18.0 in 4 weeks
9	Receive an amount of €10.0 today	Receive an amount of €18.0 in 4 weeks
10	Receive an amount of €8.0 today	Receive an amount of €18.0 in 4 weeks

Table 10: Multiple price list of certain payments vs. risky gambles (MPL2)

	Option A		Option B	
Choice	Coin shows Heads	Coin shows Tails	Coin shows Heads	Coin shows Tails
1	€30 today	€30 today	€30 today	€1 today
2	€25 today	€25 today	€30 today	€1 today
3	€20 today	€20 today	€30 today	€1 today
4	€17 today	€17 today	€30 today	€1 today
5	€16 today	€16 today	€30 today	€1 today
6	€15 today	€15 today	€30 today	€1 today
7	€12 today	€12 today	€30 today	€1 today
8	€10 today	€10 today	€30 today	€1 today
9	€5 today	€5 today	€30 today	€1 today
10	€1 today	€1 today	€30 today	€1 today

Table 11: Multiple price list of less risky vs. more risky gambles (MPL3)

	Option A		Option B	
Choice	Coin shows Heads	Coin shows Tails	Coin shows Heads	Coin shows Tails
1	€14 today	€17 today	€17 today	€1 today
2	€14 today	€17 today	€20 today	€1 today
3	€14 today	€17 today	€25 today	€1 today
4	€14 today	€17 today	€28 today	€1 today
5	€14 today	€17 today	€29 today	€1 today
6	€14 today	€17 today	€30 today	€2 today
7	€14 today	€17 today	€30 today	€3 today
8	€14 today	€17 today	€32 today	€8 today
9	€14 today	€17 today	€32 today	€10 today
10	€14 today	€17 today	€32 today	€14 today

Table 12: Multiple price list of 4-week saving contracts starting at Session 1 (MPL4)

	Early saving contracts	
Choice	Session 1 (today)	Session 2 (in 4 weeks)
1	Pay an amount of €15	Receive an amount of €45
2	Pay an amount of €15	Receive an amount of €40
3	Pay an amount of €15	Receive an amount of €36
4	Pay an amount of €15	Receive an amount of €34
5	Pay an amount of €15	Receive an amount of €32
6	Pay an amount of €15	Receive an amount of €30
7	Pay an amount of €15	Receive an amount of €28
8	Pay an amount of €15	Receive an amount of €26
9	Pay an amount of €15	Receive an amount of €24
10	Pay an amount of €15	Receive an amount of €22
11	Pay an amount of €15	Receive an amount of €20
12	Pay an amount of €15	Receive an amount of €18
13	Pay an amount of €15	Receive an amount of €16
14	Pay an amount of €15	Receive an amount of €14
15	Pay an amount of €15	Receive an amount of €12

Table 13: Multiple price list of 4-week saving contracts starting at Session 2 (MPL5)

Choice	**Late saving contracts**	
	Session 2 (in 4 weeks)	Session 3 (in 8 weeks)
1	Pay an amount of €15	Receive an amount of €40
2	Pay an amount of €15	Receive an amount of €35
3	Pay an amount of €15	Receive an amount of €31
4	Pay an amount of €15	Receive an amount of €29
5	Pay an amount of €15	Receive an amount of €27
6	Pay an amount of €15	Receive an amount of €25
7	Pay an amount of €15	Receive an amount of €23
8	Pay an amount of €15	Receive an amount of €21
9	Pay an amount of €15	Receive an amount of €19
10	Pay an amount of €15	Receive an amount of €17
11	Pay an amount of €15	Receive an amount of €15
12	Pay an amount of €15	Receive an amount of €13
13	Pay an amount of €15	Receive an amount of €11
14	Pay an amount of €15	Receive an amount of €9
15	Pay an amount of €15	Receive an amount of €7

Table 14: Multiple price list of 4-week debt contracts starting at Session 1 (MPL6)

Choice	**Early debt contracts**	
	Session 1 (today)	Session 2 (in 4 weeks)
1	Receive an amount of €31	Pay an amount of €15
2	Receive an amount of €27	Pay an amount of €15
3	Receive an amount of €24	Pay an amount of €15
4	Receive an amount of €21	Pay an amount of €15
5	Receive an amount of €19	Pay an amount of €15
6	Receive an amount of €17	Pay an amount of €15
7	Receive an amount of €16	Pay an amount of €15
8	Receive an amount of €15	Pay an amount of €15
9	Receive an amount of €14	Pay an amount of €15
10	Receive an amount of €13	Pay an amount of €15
11	Receive an amount of €11	Pay an amount of €15
12	Receive an amount of €9	Pay an amount of €15
13	Receive an amount of €7	Pay an amount of €15
14	Receive an amount of €5	Pay an amount of €15
15	Receive an amount of €3	Pay an amount of €15

Table 15: Multiple price list of 4-week debt contracts starting at Session 2 (MPL7)

	Late debt contracts	
Choice	Session 2 (in 4 weeks)	Session 3 (in 8 weeks)
1	Receive an amount of €33	Pay an amount of €15
2	Receive an amount of €30	Pay an amount of €15
3	Receive an amount of €27	Pay an amount of €15
4	Receive an amount of €24	Pay an amount of €15
5	Receive an amount of €22	Pay an amount of €15
6	Receive an amount of €20	Pay an amount of €15
7	Receive an amount of €18	Pay an amount of €15
8	Receive an amount of €16	Pay an amount of €15
9	Receive an amount of €15	Pay an amount of €15
10	Receive an amount of €14	Pay an amount of €15
11	Receive an amount of €12	Pay an amount of €15
12	Receive an amount of €10	Pay an amount of €15
13	Receive an amount of €8	Pay an amount of €15
14	Receive an amount of €6	Pay an amount of €15
15	Receive an amount of €3	Pay an amount of €15

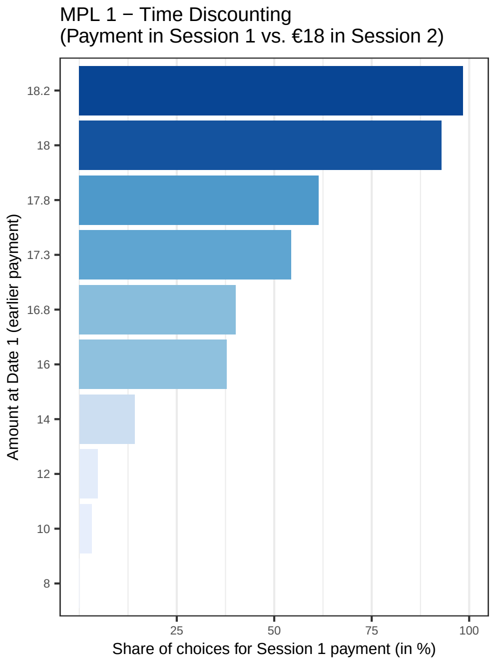
Table 16: Multiple price list of 8-week saving contracts starting at Session 1 (MPL8)

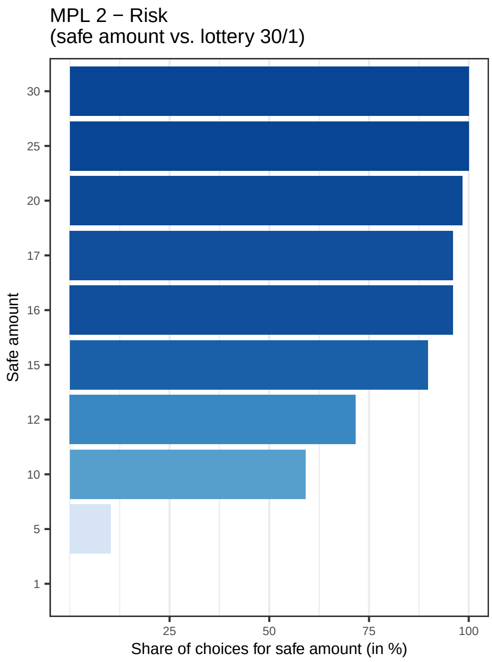
Choice	**Long saving contracts**	
	Session 1 (today)	Session 3 (in 8 weeks)
1	Pay an amount of €15	Receive an amount of €50
2	Pay an amount of €15	Receive an amount of €45
3	Pay an amount of €15	Receive an amount of €40
4	Pay an amount of €15	Receive an amount of €36
5	Pay an amount of €15	Receive an amount of €34
6	Pay an amount of €15	Receive an amount of €32
7	Pay an amount of €15	Receive an amount of €30
8	Pay an amount of €15	Receive an amount of €28
9	Pay an amount of €15	Receive an amount of €26
10	Pay an amount of €15	Receive an amount of €24
11	Pay an amount of €15	Receive an amount of €22
12	Pay an amount of €15	Receive an amount of €20
13	Pay an amount of €15	Receive an amount of €18
14	Pay an amount of €15	Receive an amount of €16
15	Pay an amount of €15	Receive an amount of €14

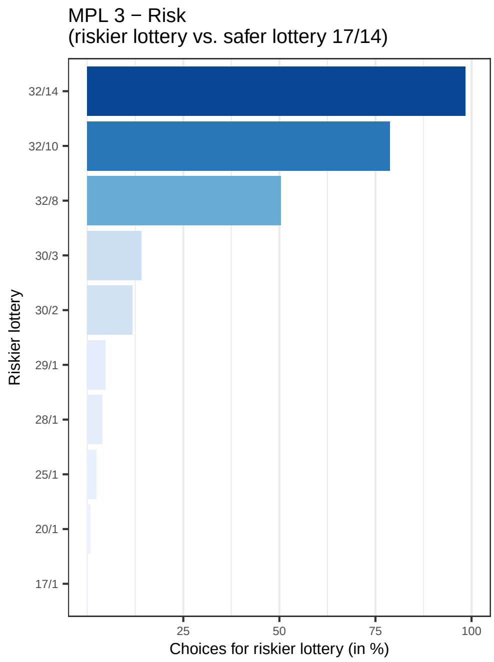
Table 17: Multiple price list of 8-week debt contracts starting at Session 1 (MPL9)

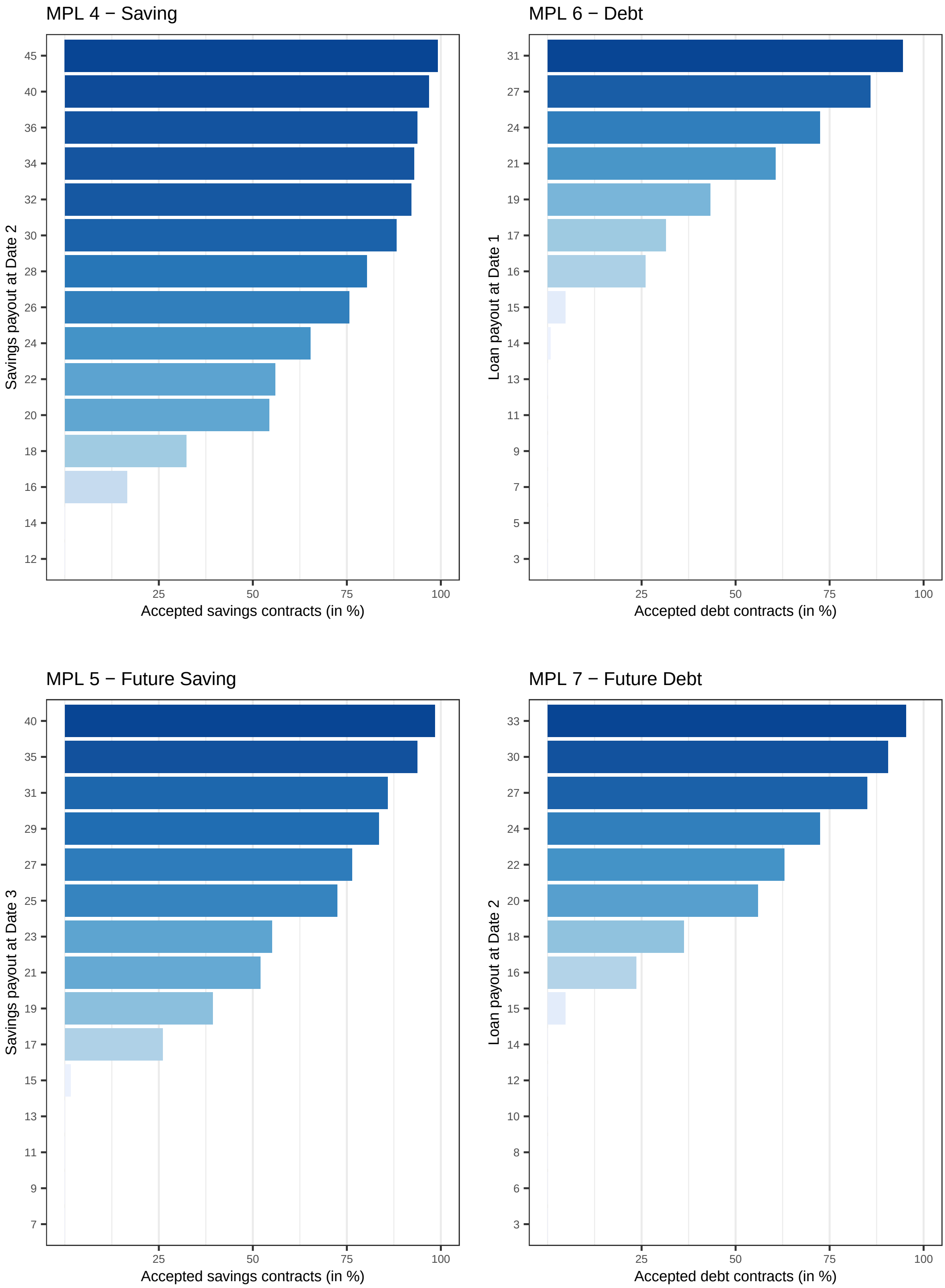
Choice	Long debt contracts	
	Session 1 (today)	Session 3 (in 8 weeks)
1	Receive an amount of €39	Pay an amount of €15
2	Receive an amount of €35	Pay an amount of €15
3	Receive an amount of €31	Pay an amount of €15
4	Receive an amount of €27	Pay an amount of €15
5	Receive an amount of €24	Pay an amount of €15
6	Receive an amount of €21	Pay an amount of €15
7	Receive an amount of €19	Pay an amount of €15
8	Receive an amount of €17	Pay an amount of €15
9	Receive an amount of €16	Pay an amount of €15
10	Receive an amount of €15	Pay an amount of €15
11	Receive an amount of €14	Pay an amount of €15
12	Receive an amount of €13	Pay an amount of €15
13	Receive an amount of €11	Pay an amount of €15
14	Receive an amount of €9	Pay an amount of €15
15	Receive an amount of €7	Pay an amount of €15

B Summary of Individual Choices








MPL 4 − Saving
Savings payout at Date 2
45
40
36
34
32
30
28
26
24
22
20
18
16
14
12
25
50
75
100
Accepted savings contracts (in %)
MPL 6 − Debt
Loan payout at Date 1
31
27
24
21
19
17
16
15
14
13
11
9
7
5
3
25
50
75
100
Accepted debt contracts (in %)
MPL 5 − Future Saving
Savings payout at Date 3
40
35
31
29
27
25
23
21
19
17
15
13
11
9
7
25
50
75
100
Accepted savings contracts (in %)
MPL 7 − Future Debt
Loan payout at Date 2
33
30
27
24
22
20
18
16
15
14
12
10
8
6
3
25
50
75
100
Accepted debt contracts (in %)

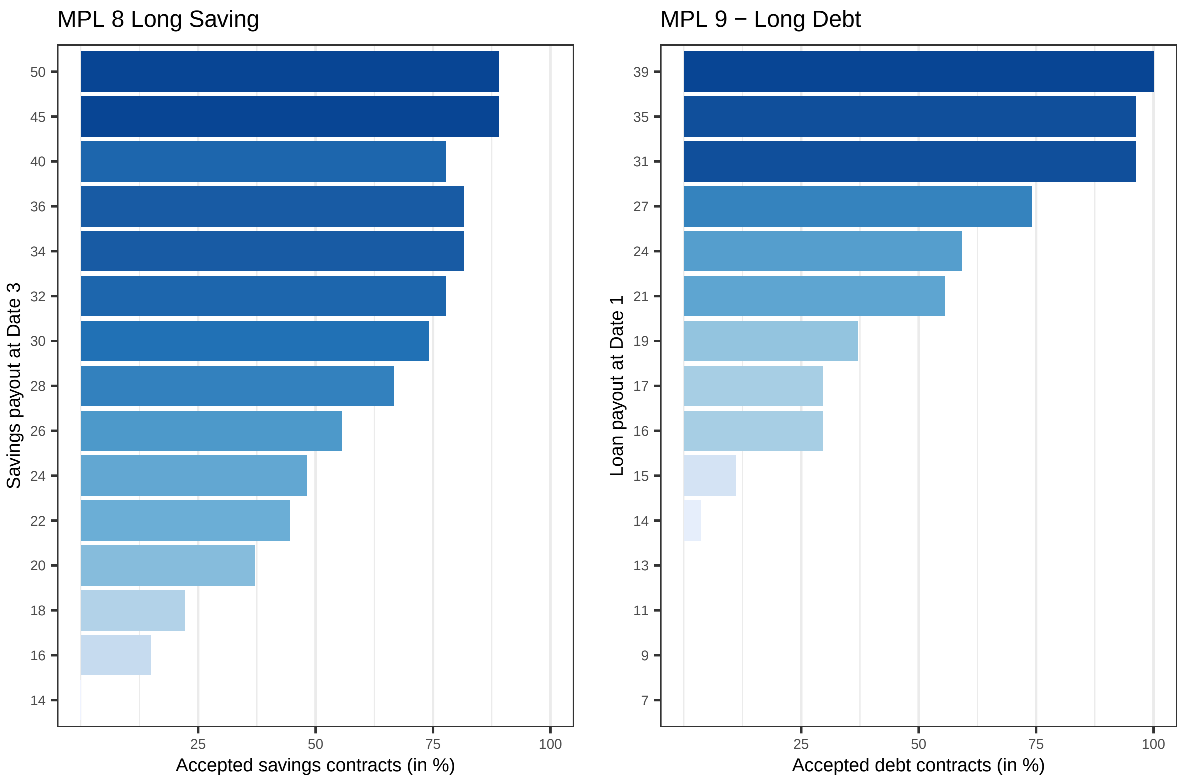


Figure 6: Summary of actual choices made by participants in each of the 120 financial choices in the experiment, displayed per multiple price list, excluding participants who dropped out before completing the entire experimental sequence (n=127 for MPL1 to MPL7 and n=27 for MPL8 and MPL9 in the extension)

Online Appendix

C Debt Aversion and Observable Individual Characteristics

Supplementing structural estimations at the aggregate level and estimations of population distribution, we investigate the variation of debt aversion with respect to observable characteristics in the sample of our lab experiment. To this end, we allow preference and error parameters to vary with observable individual characteristics. More precisely, the parameters are estimated within the joint ML procedure used in Section 3.2.2 as linear functions of individual characteristics, including age, gender, cognitive ability, financial literacy, and personality traits, as described in Table 18. The estimation results are presented in Table 19.

Table 18: Description of variables of observable characteristics

Variable label	**Variable description**
Age	Participant age in years
Cognitive ability	Number of correct answers in cognitive reflection, numeracy and raven tests weighted according to number of items per category (z-score, see Appendix Table 18 for more details)
Female	Dummy coded = 1 if female
Financial Literacy	Number of correct answers in financial literacy quiz (z-score)
Agreeableness	Big-5 personality trait agreeableness (z-score)
Conscientiousness	Big-5 personality trait conscientiousness (z-score)
Extraversion	Big-5 personality trait extraversion (z-score)
Negative emotionality	Big-5 personality trait negative emotionality (z-score)
Openmindedness	Big-5 personality trait open mindedness (z-score)

First, focusing on individual characteristics associated with debt aversion, we can identify a weak negative association between debt aversion and cognitive ability: People who score higher on our measure of cognitive ability, which includes tests on cognitive reflection, numeracy, and fluid intelligence, appear to have lower levels of debt aversion. This finding is interesting, as it has the opposite sign of what is reported in Ahrens et al. (2022). They report a weak positive association. However, the two findings are difficult to compare, as different measures of individual debt aversion as well as cognitive ability are used.

Other individual characteristics, such as age, cognitive abilities, gender, financial literacy, and personality, appear unrelated to debt aversion.

Further findings include a positive correlation between age and risk aversion and strong evidence for a negative correlation between age and intertemporal loss aversion. These findings are in line with the thrust of the literature (Meissner et al., 2023). Finally, we find weak evidence suggesting that females are more risk but less loss averse and that people with higher agreeableness scores tend to be more loss averse.

Table 19: Individual characteristics associated with preference parameters

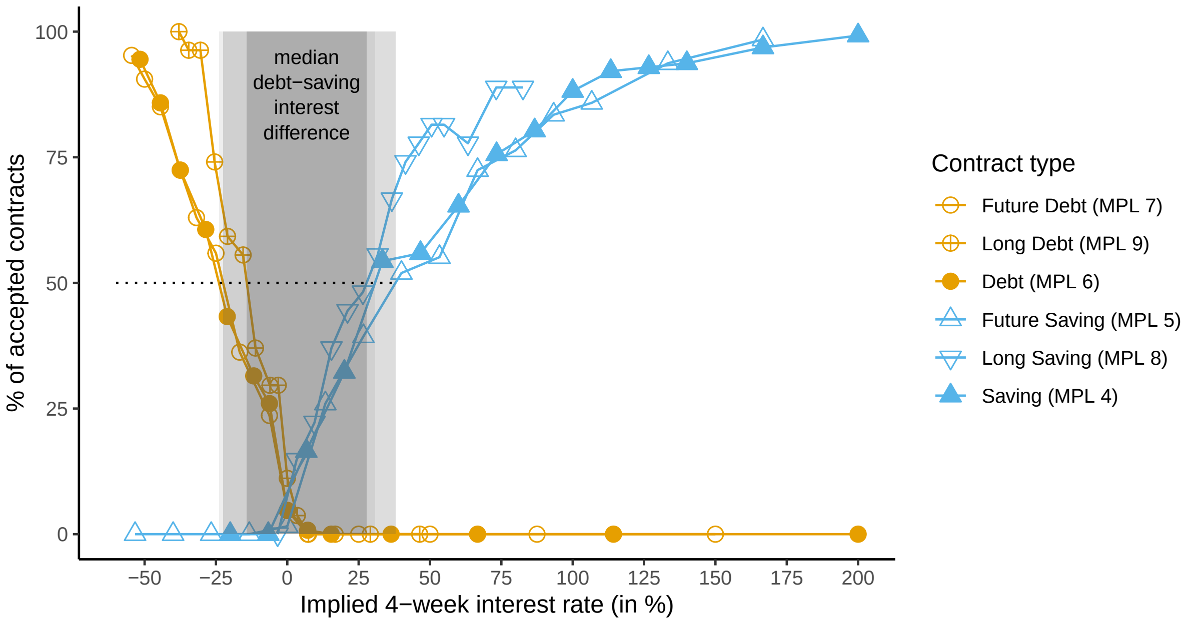
	Risk aversion α	Discounting ρ	Debt Aversion γ	Loss Aversion λ	Fechner error μ
Age	0.035**	-0.003	-0.006	-0.012***	-0.038***
	(0.015)	(0.002)	(0.005)	(0.004)	(0.013)
Cognitive ability	-0.007	-0.012	-0.022*	-0.015	-0.034
	(0.038)	(0.008)	(0.012)	(0.011)	(0.056)
Female	0.165*	-0.008	0.009	-0.064*	-0.290*
	(0.094)	(0.015)	(0.034)	(0.037)	(0.154)
Financial literacy	-0.032	0.003	-0.003	-0.006	0.008
	(0.025)	(0.006)	(0.013)	(0.006)	(0.028)
Agreeableness	-0.027	0.005	0.003	0.014**	0.010
	(0.027)	(0.005)	(0.010)	(0.007)	(0.026)
Conscientiousness	-0.040	-0.005	-0.016	0.005	0.054
	(0.037)	(0.007)	(0.014)	(0.014)	(0.049)
Extraversion	-0.007	-0.002	0.002	-0.005	0.005
	(0.053)	(0.009)	(0.014)	(0.011)	(0.061)
Negative emotionality	0.041	-0.002	-0.007	-0.015	-0.034
	(0.076)	(0.011)	(0.017)	(0.017)	(0.101)
Openmindedness	0.021	0.001	0.005	-0.015	-0.008
	(0.030)	(0.007)	(0.014)	(0.009)	(0.032)
Constant	-0.204	0.107**	1.176***	1.414***	1.427***
	(0.294)	(0.053)	(0.110)	(0.081)	(0.281)
estimation details: n = 12240, log-likelihood = -3695, AIC = 7489, BIC = 7860, logit Fechner error					

Standard errors (clustered at the subject level) in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D Additional Graphs

Figure 7: Acceptance of debt and saving contracts by implied interest rates, starting dates and duration



Notes: The figure depicts implied interest rates of saving contracts and debt contracts of all different starting dates (now and in four weeks) and durations (four and eight weeks) on the horizontal axis. The vertical axis represents the percentage share of participants who accepted contracts by implied interest rates.

E Robustness Checks

In this section, we consider a wide range of robustness tests around the different structural assumptions pertaining to the cost of being in debt, the utility and discount functions, and the decision error process. To keep the appendix size manageable, we will make use of the simple aggregate maximum likelihood specification, outlined in Section 3.2.2

E.1 Alternative Specifications of the Utility Cost of Borrowing

Fixed cost of being indebted: In our main specification, the cost of being in debt depends on the timing and amount of the required repayment. Instead, debt aversion

Table 20: Aggregate parameter estimates with fixed cost of debt at the time of going in debt

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6421	0.0371	0.4332	1.1064	0.449
95% confidence interval	0.57 / 0.71	0.02 / 0.05	0.25 / 0.61	1.08 / 1.13	0.37 / 0.53
robust standard error	0.0344	0.0063	0.0911	0.0118	0.0402

estimation details: n = 12240, log-likelihood = -4106.98, AIC = 8223.95, BIC = 8261.01, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

Table 21: Aggregate parameter estimates with fixed cost of debt at the time of decision-making

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6424	0.0366	0.418	1.1069	0.4487
95% confidence interval	0.57 / 0.71	0.02 / 0.05	0.25 / 0.59	1.08 / 1.13	0.37 / 0.53
robust standard error	0.0345	0.0062	0.0857	0.0117	0.0402

estimation details: n = 12240, log-likelihood = -4107.33, AIC = 8224.67, BIC = 8261.73, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

could also be modeled as a fixed cost, which is either incurred at the time of going into debt $c(\boldsymbol{x}) = \gamma\phi(t)$ or at the time the decision to go into debt is made $c(\boldsymbol{x}) = \gamma$.[18]

For interpretation, the fixed cost $\gamma = 0$ corresponds to debt neutrality, i.e. no utility cost of borrowing, $\gamma > 0$ corresponds to debt aversion and $\gamma < 0$ to debt affinity. Estimation results are presented in Tables 20 and 21. Debt aversion incurred at the time of going into debt is estimated at $\gamma = 0.4332$ and at the time of decision-making at $\gamma = 0.418$. Accordingly, the average decision-maker faces positive fixed utility costs when going into debt or, respectively, when deciding to go into debt, i.e., they are debt averse.

Scaling utility of borrowed money: As a second alternative, we consider a utility cost of borrowing that is dependent on the timing and amount of loan receipt. Intuitively, one

[18] In the context of this study all decisions on going into debt take place in period $t = 0$

Table 22: Aggregate parameter estimates with gamma as scaling factor for utility from loan payments

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6421	0.034	0.9543	1.1111	0.4435
95% confidence interval	0.57 / 0.71	0.02 / 0.05	0.93 / 0.98	1.09 / 1.14	0.37 / 0.52
robust standard error	0.0348	0.006	0.0108	0.0124	0.0399

estimation details: n = 12240, log-likelihood = -4112.31, AIC = 8234.62, BIC = 8271.68, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

could think of the decision-maker experiencing less pleasure from money that is actually borrowed compared to money from other sources. The cost of being in debt is thus defined as:

$$c(\boldsymbol{x}) = (1-\gamma)\phi(t)v(x_t). \tag{25}$$

The interpretation of γ is inverted as compared to the main specification, i.e. $\gamma < 1$ corresponds to debt aversion and $\gamma > 1$ to debt affinity. Estimation results are presented in Table 22. Again, except for γ, parameter estimates remain largely unchanged. The new debt aversion parameter is estimated at $\gamma = 0.9543$, i.e. the average decision-maker remains debt averse.

Assuming debt neutrality: Finally, we consider a model based on our main specification, but abstracting from debt aversion, i.e. assuming $\gamma = 1$. Comparing our main specification to the debt neutral model, allows to scrutinize whether incorporating any form of cost of being indebted increases explanatory power.

Estimation results are presented in Table 23. Comparing the information criteria AIC and BIC we observe that any model incorporating cost of being in debt is superior to the specification abstracting from debt attitudes, thus corroborating debt attitudes as a distinct domain of individual preferences. This holds irrespective of whether the cost of being in debt is modeled as scaling disutility from repayments (main specification), fixed cost of being indebted or scaling utility from borrowed money.

Table 23: Aggregate parameter estimates assuming debt neutrality

	α risk aversion	ρ discounting	γ debt aversion	λ loss aversion	μ Fechner error
point estimate	0.649	0.0165		1.1342	0.4496
95% confidence interval	0.58 / 0.72	0.01 / 0.02		1.11 / 1.16	0.37 / 0.53
robust standard error	0.0346	0.0034		0.0133	0.0403

estimation details: n = 12240, log-likelihood = -4128.24, AIC = 8264.48, BIC = 8294.13, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

Table 24: Aggregate parameter estimates assuming risk neutrality

	α risk aversion	ρ discounting	γ debt aversion	λ loss aversion	μ Fechner error
point estimate		0.1018	1.154	1.3533	3.0901
95% confidence interval		0.07 / 0.14	1.09 / 1.22	1.3 / 1.41	2.8 / 3.38
robust standard error		0.0175	0.033	0.0269	0.1468

estimation details: n = 12240, log-likelihood = -4813.36, AIC = 9634.73, BIC = 9664.38, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

E.2 Alternative Utility Specifications

Besides the cost of being in debt, we consider a wide range of alternatives to characteristics of our utility specification in general.

Risk neutrality: As utility curvature, determined through α, has a major effect on the size of the remaining preference parameters in our main specification we also consider an adaption abstracting from utility curvature. In particular, we consider the case of risk neutrality with $\alpha = 0$. Estimation results are presented in Table 24. Debt aversion persists and appears higher than in our main specification allowing for risk aversion. As expected, also the remaining parameter estimates change substantially, which makes intuitive sense due to the different shape of the atemporal utility function $u(x)$ when assuming $\alpha = 0$.

No loss aversion: Our experiment, model and estimation allows to differentiate debt aversion from intertemporal loss aversion, which both appear to have a major influence on financial decision-making in our study. In Table 25 we present estimation results

Table 25: Aggregate parameter estimates assuming loss neutrality

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6716	0.0901	1.225		0.4475
95% confidence interval	0.6 / 0.74	0.07 / 0.11	1.18 / 1.27		0.37 / 0.53
robust standard error	0.0363	0.0098	0.0243		0.0396

estimation details: n = 12240, log-likelihood = -4331.37, AIC = 8670.73, BIC = 8700.38, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

assuming loss neutrality, i.e. $\lambda = 1$. This assumption substantially decreases the model's fit as represented by AIC and BIC in comparison to our main specification. Moreover, disregarding loss aversion leads to higher estimates for the parameters for time discounting and debt aversion.

Fixed cost of accepting a contract: As argued in Section 2.2, agents who perceive accepting any kind of debt or saving contract as inherently costly require lower interest rates to deem debt contracts acceptable than the interest rates they require for saving contracts. This can be illustrated by deriving the interest rate gap using the modified intertemporal utility for accepting saving and contracts:

$$U_{saving}(X) = -\lambda\phi(t)u(-x_t) + \phi(T)u(x_T) - f, \tag{26}$$

$$U_{debt}(X) = \phi(t)u(x_t) - \lambda\gamma\phi(T)u(-x_T) - f \tag{27}$$

Here, f is a fixed cost for accepting any contract. With this extension, the interest rate gap can be characterized by:

$$\frac{1+r_s}{1+r_d} = \left(\lambda^2\gamma \cdot \frac{\phi(t) + \dfrac{f(1-\alpha)}{\lambda x^{1-\alpha}}}{\phi(t) - \dfrac{f(1-\alpha)}{x^{1-\alpha}}}\right)^{\frac{1}{1-\alpha}}.$$

It is straightforward to see that for feasible values of f, i.e. $f < \phi(t)\frac{x^{1-\alpha}}{1-\alpha}$, the interest rate gap increases in f, and thus a fixed cost of accepting any contract could potentially widen the interest rate gap.

Table 26: Aggregate parameter estimates considering additional fixed costs of accepting a contract

	α risk aversion	ρ discounting	γ debt aversion	λ loss aversion	f fixed cost	μ Fechner error
point estimate	0.6425	0.0369	1.0584	0.922	1.3188	0.4484
95% CI	0.57 / 0.71	0.02 / 0.05	1.03 / 1.08	0.73 / 1.12	-0.1 / 2.73	0.37 / 0.53
robust SE	0.0346	0.0061	0.013	0.1	0.7219	0.0402

estimation details: n = 12240, log-likelihood = -4106.71, AIC = 8225.42, BIC = 8269.89, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

In Table 26 we present corresponding results for estimating a model including intertemporal loss aversion and a fixed cost of accepting a saving or debt contract, which is incurred at the time of decision. Notably, the magnitude of the estimated parameter of debt aversion is virtually identical to the one in our preferred specification.

However, the estimates for both the loss aversion parameter and the fixed cost parameter are not statistically different from their baseline values (a loss aversion parameter of 1 and a fixed cost of 0). This finding likely reflects the practical difficulty of separately identifying these two parameters, particularly given that our experimental design features only a single loss magnitude, which limits the variation needed for their distinct estimation.

CARA utility: Our main specification assumes atemporal utility to be characterized by constant relative risk aversion (CRRA). We examine the robustness of our findings by additionally considering exponential utility characterized by constant absolute risk aversion (CARA):

$$u(x) = \frac{1 - e^{-\varphi x}}{\varphi} \tag{28}$$

Here, φ is the parameter of absolute risk aversion. Estimation results are presented in Table 27. Again as in the previous robustness check, this adaption leads to a substantial change in the shape of the atemporal utility function $u(x)$. As a consequence, also parameter estimates beyond φ change considerably. Debt aversion, however, persists.

Table 27: Aggregate parameter estimates with CARA utility

	φ risk aversion	ρ discounting	γ debt aversion	λ loss aversion	μ Fechner error
point estimate	0.0112	0.0898	1.1358	1.3055	2.4346
95% confidence interval	<.01 / 0.02	0.06 / 0.12	1.08 / 1.19	1.26 / 1.35	2.08 / 2.79
robust standard error	0.0042	0.0141	0.027	0.0252	0.1805

estimation details: n = 12240, log-likelihood = -4182.05, AIC = 8374.1, BIC = 8411.16, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

Table 28: Aggregate parameter estimates estimated without ε-transformation

	α risk aversion	ρ discounting	γ debt aversion	λ loss aversion	μ Fechner error
point estimate	0.6429	0.0355	1.0528	1.106	0.4487
95% confidence interval	0.58 / 0.71	0.02 / 0.05	1.03 / 1.07	1.08 / 1.13	0.37 / 0.53
robust standard error	0.0344	0.006	0.0111	0.0121	0.0402

estimation details: n = 12240, log-likelihood = -4108, AIC = 8226, BIC = 8263.06, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

No ε-transformation: Lastly, in our main specification we consider CRRA utility including an ε-transformation, because of its beneficial properties for estimation. As a final alteration of the utility specification, we consider a robustness check without the ε-transformation, i.e. atemporal utility takes the form:

$$u(x) = \frac{x^{1-\alpha}}{1-\alpha} \tag{29}$$

Estimation results are presented in Table 28. Parameter estimates remain largely unchanged compared to the main specification. Debt aversion remains robust.

E.3 Alternative Error Structures

In line with Drichoutis and Lusk (2014), we acknowledge that parameter estimates may depend on assumptions about the decision error process. Therefore, we employ three alternative error structures as robustness checks.

Table 29: Aggregate parameter estimates with probit Fechner error

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6411	0.0373	1.0559	1.1099	0.7963
95% confidence interval	0.58 / 0.71	0.03 / 0.05	1.03 / 1.08	1.09 / 1.13	0.66 / 0.93
robust standard error	0.0327	0.0063	0.0118	0.0117	0.0671
estimation details: n = 12240, log-likelihood = -4109.29, AIC = 8228.58, BIC = 8265.65, **probit Fechner error**					

Robust standard errors (SE) clustered at the individual level, 127 clusters

Probit-link Fechner error: First, we consider a Fechner error with probit link instead of logit link as in our main specification. Technically, $F(\xi)$ is no longer a standard logistic distribution function but the standard normal distribution function, i.e $F(\xi) = \Phi(\xi)$, where Φ represents the standard normal CDF. Estimation results are presented in Table 29. Parameter estimates, except for the Fechner error term, remain largely unchanged compared to the main specification. Debt aversion is robust.

Additional Tremble error: Second, we introduce a second type of error aside from the logit Fechner error of our main specification. In particular, we consider that decision-makers may make a tremble error, i.e. randomize choice between both options with some probability $|\kappa|$ as e.g. in Andersson et al. (2020). Consequently, the probability of observing choice B is given by:

$$P^B(\theta') = (1 - |\kappa|)F\left(\frac{U(X^B, p) - U(X^A, p)}{\mu}\right) + \frac{|\kappa|}{2} = (1 - |\kappa|)F(\Delta U(\theta)) + \frac{|\kappa|}{2}, \quad (30)$$

where $\theta' = (\alpha, \rho, \gamma, \lambda, \mu, \kappa)$. The corresponding log-likelihood function writes as:

$$ln\ L(\theta') = \sum_i \sum_j \left[ln\left(P^B(\theta')\right) c_{ij} + ln\left(1 - P^B(\theta')\right)(1 - c_{ij})\right] \quad (31)$$

Intuitively, the error parameter can be interpreted as follows: for $|\kappa| \to 0$ the tremble error has no effect on choices, while for $|\kappa| \to 1$ choices approach uniform randomization.

Estimation results are presented in Table 30. The estimated tremble error probability $|\kappa|$ is statistically indistinguishable from 0, and the remaining parameter estimates are

Table 30: Aggregate parameter estimates with tremble and logit Fechner error

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error	$\boldsymbol{\kappa}$ tremble error
point estimate	0.643	0.036	1.0535	1.1074	0.4484	−0.000·
95% CI	0.58 / 0.71	0.02 / 0.05	1.03 / 1.08	1.08 / 1.13	0.37 / 0.53	−0.0· / 0.0·
robust SE	0.0345	0.006	0.0112	0.0118	0.0402	0.000·

estimation details: n = 12240, log-likelihood = -4107.91, AIC = 8225.81, BIC = 8262.88, **logit FE + tremble error**
−0.0· (resp. 0.0·) is between 0 and −0.01 resp. (0.01); −0.000· (resp. 0.000·) is between 0 and −0.0001 resp. (0.0001)

Robust standard errors (SE) clustered at the individual level, 127 clusters

virtually unchanged compared to the main specification. Debt aversion also persists when considering an additional tremble error.

Multiple Fechner errors: Third, we consider a specification with distinct Fechner error terms for all domains, as represented through our set of seven different MPLs. Accordingly, we end up with seven Fechner error terms μ_1, ..., μ_7 for MPL1 to MPL7, respectively. Estimation results are presented in Appendix Table 31. While we observe significant variation in the Fechner errors across some MPLs, the remaining parameter estimates are virtually unchanged compared to the main specification. Debt aversion persists.

E.4 Sample Variations

Finally, we check whether the composition of the sample used to estimate preference parameters does have an effect on the estimation. To this end, we scrutinize two variations.

Drop-outs: First, we take into account, that participants who completed the entire experimental sequence of three sessions might be systematically different from those who dropped out along the way. Estimation results presented in Table 32, are based on all observations including participants who dropped out prematurely. Parameter estimates do change to some degree compared to estimated parameters of the main modeling specification based on the more restrictive sample of people who completed the entire experimental sequence. However, debt aversion also characterizes this extended population.

Trust and confidence: Second, we consider a sample variation along the dimensions of trust and confidence of participants. As outlined earlier, if participants exhibit either

Table 31: Aggregate parameter estimates with multiple Fechner errors

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion		$\boldsymbol{\mu_1}$ FE MPL1
point estimate	0.6553	0.0326	1.0442	1.1029		0.2169
95% CI	0.58 / 0.73	0.02 / 0.04	1.03 / 1.06	1.08 / 1.13		0.15 / 0.28
robust SE	0.0379	0.0054	0.0097	0.014		0.0339
	$\boldsymbol{\mu_2}$ FE MPL2	$\boldsymbol{\mu_3}$ FE MPL3	$\boldsymbol{\mu_4}$ FE MPL4	$\boldsymbol{\mu_5}$ FE MPL5	$\boldsymbol{\mu_6}$ FE MPL6	$\boldsymbol{\mu_7}$ FE MPL7
point estimate	0.4142	0.5186	0.3886	0.3905	0.48	0.4404
95% CI	0.33 / 0.5	0.42 / 0.61	0.29 / 0.48	0.3 / 0.49	0.35 / 0.61	0.33 / 0.55
robust SE	0.0433	0.0478	0.0485	0.0485	0.065	0.0564

estimation details: n = 11430, ln-likelihood = -3676.81, AIC = 7375.62, BIC = 7456.41, **distinct errors per MPL**

Robust standard errors (SE) clustered at the individual level, 127 clusters

mistrust in the payment reliability of the experimenter, or a lack of confidence in their own payment reliability, on average debt contracts would appear more and savings contracts less appealing to them. In this situation, our estimate of debt aversion would be biased downwards. To investigate this possibility, we make use of participants' self-reported ratings on two questions presented at the very end of the experimental sequence at Session 3: *"Back then* [in the first session when you made all financial decisions]*, 1. how sure have you been that the experimenters will make the promised payments in the future in case such a decision has been chosen as the decision that counts? 2. how sure have you been that you will make the promised payments in the future in case such a decision has been chosen as the decision that counts?"* To derive parameter estimates unperturbed by suboptimal trust or confidence, we consider a sample excluding all people who did not answer in the most positive way *"very sure"*.

Estimation results are presented in Table 33. Albeit our very strict exclusion criteria affects around 50% of participants, parameter estimates remain similar to those of the main specification estimated on the entire sample. Debt aversion persists.

Only future contracts: The estimation of preference parameters may be influenced by an asymmetry in the payment of the show-up fee and completion bonus. The show-up

Table 32: Aggregate parameter estimates including drop-outs

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6624	0.0311	1.0499	1.1056	0.4356
95% confidence interval	0.6 / 0.72	0.02 / 0.04	1.03 / 1.07	1.08 / 1.13	0.37 / 0.51
robust standard error	0.0311	0.0054	0.0099	0.0109	0.0357
estimation details: n = 14310, log-likelihood = -4848.86, AIC = 9707.72, BIC = 9745.56, logit Fechner error					

Robust standard errors (SE) clustered at the individual level, 148 clusters

Table 33: Aggregate parameter estimates including only participants who perfectly trust the experiment

	$\boldsymbol{\alpha}$ risk aversion	$\boldsymbol{\rho}$ discounting	$\boldsymbol{\gamma}$ debt aversion	$\boldsymbol{\lambda}$ loss aversion	$\boldsymbol{\mu}$ Fechner error
point estimate	0.6248	0.0379	1.0575	1.0943	0.444
95% confidence interval	0.54 / 0.71	0.02 / 0.06	1.02 / 1.09	1.06 / 1.12	0.34 / 0.55
robust standard error	0.0436	0.0101	0.0178	0.015	0.0544
estimation details: n = 5700, log-likelihood = -1837.52, AIC = 3685.05, BIC = 3718.29, logit Fechner error					

Robust standard errors (SE) clustered at the individual level, 60 clusters

fee was paid at the beginning of Session 1. It could be used to pay for a saving contract starting in Session 1. A comparable option was not available for debt contracts. As the completion bonus was only paid ca. one week after Session 3 of the experiment, participants never had the option to settle debt repayments with the completion bonus. We test for the robustness of our findings with respect to this asymmetry by considering an estimation that excludes choices form debt and saving contracts starting at Session 1 of the experiment, i.e. we include only saving and debt contract that are shifted in the future and thus none of the corresponding payment obligations could be settled with either the show-up fee or the completion bonus.

Estimation results are presented in Table 34. Parameter estimates remain similar to those of the main specification estimated on the entire sample. Debt aversion persists.

Table 34: Aggregate parameter estimates excl. saving and debt contracts starting in Session 1

	α risk aversion	ρ discounting	γ debt aversion	λ loss aversion	μ Fechner error
point estimate	0.6066	0.0416	1.0574	1.1183	0.4565
95% confidence interval	0.54 / 0.67	0.03 / 0.06	1.03 / 1.08	1.09 / 1.14	0.38 / 0.54
robust standard error	0.032	0.0071	0.013	0.0124	0.041

estimation details: n = 7620, log-likelihood = -2457.03, AIC = 4924.07, BIC = 4958.76, logit Fechner error

Robust standard errors (SE) clustered at the individual level, 127 clusters

F The Debt Aversion Survey Module

F.1 Individual Structural Estimation

To construct the debt aversion survey module, we extend our estimation procedure and employ hierarchical maximum likelihood estimation to retrieve preference parameters at the individual level. Loosely following Murphy and ten Brincke (2018) and Farrell and Ludwig (2008) we estimate the set of individual preference parameters that is most likely to produce the observed choices of a person, weighted by the probability of occurrence of such parameter estimates given the population distribution of parameter estimates. This technique has been established to increase the reliability of individual preference parameter estimates which have to rely on far less data than aggregate estimations. In our case individual level estimations rely on 90 financial choices per individual, which yield seven independent observations (one per type of choice: intertemporal, risk (safe), risk (lottery), saving (immediate), saving (future), debt (immediate), and debt (future).

The first step of the hierarchical estimations is the retrieval of population distributions of preference parameters, which is identical to the estimations summarized in Section 3.2.3. In the second step, individual level parameters are estimated based on the choices made by each individual and the estimated distribution of preference parameters for the population of all individuals taken together. For this purpose, we make use of the econometric specification outlined for aggregate estimation in Section 3.2.2, and apply it to choice data of one individual at a time, rather than all individuals taken together. Let us further denote the population distributions by the normal density functions $d(\alpha)$, $d(\rho)$, $d(\gamma)$ and

$d(\lambda)$. We denote the product of these normal densities as $d(\omega) = d(\alpha)d(\rho)d(\gamma)d(\lambda)$. The hierarchical likelihood function on the individual level then writes as

$$ln\left(L(\theta)\right) = \sum_j \left[ln\left(F(\Delta U(\theta))w(d(\omega))\right)c_j + ln\left(1 - F(\Delta U(\theta))w(d(\omega))\right)(1 - c_j)\right], \quad (32)$$

where $c_j = 0$ if Option A was chosen in choice j, $c_j = 1$ if Option B was chosen in choice j. Further, $w(d(\omega))$ denotes the product of preference parameters' density functions, given their distribution in the population, weighted by function w.

We introduce the weighting function w to prevent excessive influence of population distributions on individual preference parameters as opposed to the influence of individual choices, a concern articulated by Scheibehenne and Pachur (2015). Hierarchical estimation without weighting may produce excessive shrinkage of individual parameter estimates toward their population mean.[19] Based on a suggestion by Murphy and ten Brincke (2018) we mitigate this effect by weighing $d(\omega)$ in the following form

$$w(d(\omega)) = d(\omega)^s, \quad (33)$$

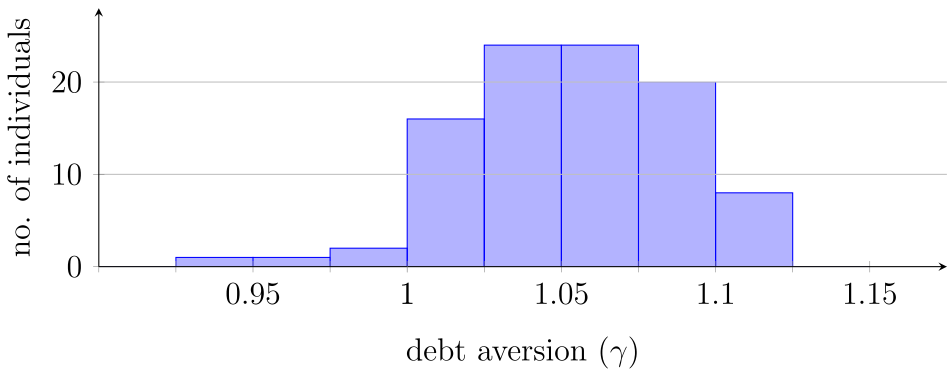
where s is a shrinkage factor determining the relative weight given to population distributions as opposed to individual choices when estimating individual preference parameters.[20] If $s = 1$, then $w(d(\omega)) = d(\omega)$, for $s < 1$ the influence of population distributions on individual level estimates decreases, and for $s > 1$ the influence increases as compared to a specification without weighting.

We estimate the optimal shrinkage factor s based on simulated, hypothetical individuals with known preference parameters. To this end, we apply the outlined hierarchical ML procedure to estimate preference parameters from simulated choices. By comparing the estimated parameters to true, assumed parameters, we can quantify the goodness-of-fit. Using grid-search, we find $s = 0.0139$ to minimize mean squared error (MSE) of estimated and true individual parameters of debt aversion γ.

[19]We find such excessive shrinkage to likely also apply to our setting, based on estimations for simulated decision makers, with hypothetical, known preference parameters.

[20]We employ the exponential form, as it preserves the range of $d(\omega)$, i.e. both $d(\omega)$ and $w(d(\omega))$ lie in the range of probabilities $[0, 1]$. Further, the exponential form introduces only one additional parameter to be estimated.

Figure 8: Individual level estimates of the debt aversion parameter γ.



By maximizing the hierarchical log-likelihood function (Equation 32) we derive point estimates for all preference parameters and the error parameter per individual.[21] In this way, we retrieve individual preference parameters, including γ, the coefficient of debt aversion, for 96 participants. Figure 8 summarizes the distribution of individual estimates of γ. The parameter estimates range from $\gamma = 0.9468$, corresponding to debt affinity, to $\gamma = 1.1171$, corresponding to debt aversion. Around 96% of individuals are estimated as debt averse with a parameter $\gamma > 1$, and the median level of debt aversion is $\gamma = 1.0523$.

F.2 Candidate Survey Items

Next to the incentivized financial choices in our experiment we collected a battery of self-reported, qualitative measures of debt behavior and attitudes. For this purpose, we composed a comprehensive set of 54 survey items, roughly spanning the clusters experience and usage of borrowing, appropriateness to be indebted, rules, norms and personal preferences on debt. The items are collected from previous studies using questionnaire-based measures of debt attitudes but also include novel items developed for this study. Items range from directly asking respondents to state "how much they (dis)like being in debt in general" to more indirect survey items around the topic of debt and money. The

[21]To increase the reliability of estimates, we ensure that the same estimates can be retrieved using STATA's modified Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithm and through maximization using the Nelder-Mead algorithm implemented in R. Individuals, whose parameters cannot be estimated consistently, i.e. estimates from R are more than 10% higher or lower than estimates from STATA, are discarded. For consistent estimates, we choose results from either STATA or R depending on which routine yielded a higher likelihood score for the given individual's parameter estimates.

complete list of items can be found in Section F.2.1. In addition to the set of survey items, we implemented a hypothetical, multiple price list consisting of 15 debt contracts (as described in Section F.2.2. To minimize the required response time, the hypothetical debt contracts were presented using the staircase method (Cornsweet, 1962). This mode of presentation allows to identify the switchpoint between accepting and not accepting each of the 15 contracts by only asking four successive questions. For detailed instructions see Section F.2.2. We count the switchpoint in the hypothetical choice task as one additional quantitative survey item.

F.2.1 List of Candidate Survey Items

No.	Survey Item	Scale	Reference
Usage			
1	Did you ever use overdraft on your bank account?	yes/no	-
2	Do you use credit cards?	yes/no	(Eckel et al., 2016b)
3	In total, how many credit cards with different accounts do you use?	categorical 0 to > 5	-
4	If you have a credit card balance. Do you usually pay it off each month?	yes/no	(Eckel et al., 2016b)
5	How would you categorize your access to loans/credits/capital?	Likert	-
6	Did you ever take out a loan at a bank?	yes/no	-
7	Do you owe money in student loans?	yes/no	(Eckel et al., 2016b)
8	In total, what is your best guess of your outstanding debt as of today in €? (including informal loans, family, friends, etc.)	integer	-
9	How certain are you about your guess on your overall outstanding debt?	Likert	-
10	Does your current level of debt burden you?	Likert	(Eckel et al., 2016b)
11	In total, what is your best guess of your savings as of today in €?	integer	-

(Continued on next page)

No.	Survey Item	Scale	Reference
12	How certain are you about your guess on your overall savings?	Likert	-
Appropriateness: "Please rate the following statements"			
13	It is okay to accrue debt for living the style you desire.	Likert	(Chudry et al., 2011)
14	It is okay to be in debt if you know you can pay it off.	Likert	(Haultain et al., 2010)
15	It is ok to borrow money to pay for necessities (e.g. food, rent, utilities).	Likert	
16	It is ok to borrow money to pay for essential purchases (e.g. car, housing, appliances).	Likert	adapted based on: (Davies and Lea, 1995; Haultain et al., 2010; Harrison and Agnew, 2016; George et al., 2018)
17	It is ok to borrow money to finance investments (e.g. tertiary education, starting a business, solar panels).	Likert	
18	It is ok to borrow money to pay for luxuries (e.g. expensive holiday, status symbols).	Likert	
19	Students should take the maximum permissible student debt (loans/overdraft, etc.).	Likert	(Chudry et al., 2011)
20	Debt is an integral part of today's life.	Likert	(Davies and Lea, 1995; Haultain et al., 2010; Chudry et al., 2011)
21	Reducing/controlling debt leads to a better quality of life.	Likert	(Chudry et al., 2011)
22	Reducing/controlling debt leads to greater success.	Likert	(Chudry et al., 2011)
23	Reducing/controlling debt leads to feeling a sense of achievement.	Likert	(Chudry et al., 2011)
24	Reducing/controlling debt leads to a feeling that you are fitting in with friends.	Likert	(Chudry et al., 2011)
25	Reducing/controlling debt leads to being perceived as boring.	Likert	(Chudry et al., 2011)
26	Reducing/controlling debt leads to being perceived as tight.	Likert	(Chudry et al., 2011)

(Continued on next page)

No.	Survey Item	Scale	Reference
27	Reducing/controlling debt leads to enjoying yourself less.	Likert	(Chudry et al., 2011)
28	Once you are in debt it is very difficult to get out of it.	Likert	(Davies and Lea, 1995; Haultain et al., 2010)
29	Owing money is basically wrong.	Likert	(Haultain et al., 2010; Boatman et al., 2017b)
30	You should always save up first before buying something.	Likert	(Davies and Lea, 1995; Haultain et al., 2010; Boatman et al., 2017b)
31	There is no excuse for borrowing money.	Likert	(Davies and Lea, 1995; Haultain et al., 2010; Boatman et al., 2017b)
32	Borrowing money for tertiary education is a good investment.	Likert	(Haultain et al., 2010)
33	You should rather restrict your lifestyle than go into debt.	Likert	-
Personality: "Please rate the following statements"			
34	I like to pay my debts as soon as possible.	Likert	(Walters et al., 2016)
35	I prefer to delay paying my debts if possible, even if it means paying more in total.	Likert	(Walters et al., 2016)
36	Having debts makes me feel uncomfortable.	Likert	(Walters et al., 2016)
37	Having debt doesn't bother me.	Likert	(Walters et al., 2016)
38	I dislike borrowing money.	Likert	(Schleich et al., 2021)
39	I feel OK borrowing money for 'essential' purchases e.g. cars, appliances, mortgage.	Likert	(Schleich et al., 2021)
40	I enjoy being able to borrow money to buy things I like, and to pay for things I cannot afford.	Likert	(Schleich et al., 2021)
41	I would rather be in debt than change my lifestyle.	Likert	(Haultain et al., 2010)
42	If I had to make an unexpected expenditure today of 500 € or more, I would use a credit card/borrow from a financial institution, family or friends.	Likert	(Eckel et al., 2016b)

(Continued on next page)

No.	Survey Item	Scale	Reference
43	If I had to make an unexpected expenditure today of 5000 € or more, I would use a credit card/borrow from a financial institution, family or friends.	Likert	(Eckel et al., 2016b)
44	I like saving money.	Likert	-
Norms, i.e. second order beliefs (Krupka and Weber, 2013) *“What do you think, how does the average participant in this experiment rate the following statements on borrowing money?”*			
45	It is okay to accrue debt for living the style you desire.	Likert	(Chudry et al., 2011)
46	Students should take the maximum permissible student debt (loans/overdraft, etc.).	Likert	(Chudry et al., 2011)
47	Debt is an integral part of today’s life.	Likert	(Davies and Lea, 1995; Haultain et al., 2010; Chudry et al., 2011)
48	Once you are in debt it is very difficult to get out of it.	Likert	(Davies and Lea, 1995; Haultain et al., 2010)
49	Owing money is basically wrong.	Likert	(Haultain et al., 2010; Boatman et al., 2017b)
50	You should always save up first before buying something.	Likert	(Davies and Lea, 1995; Haultain et al., 2010; Boatman et al., 2017b)
51	There is no excuse for borrowing money.	Likert	(Davies and Lea, 1995; Haultain et al., 2010; Boatman et al., 2017b)
52	It is okay to be in debt if you know you can pay it off.	Likert	(Haultain et al., 2010)
53	Borrowing money for tertiary education is a good investment.	Likert	(Haultain et al., 2010)
54	You should rather restrict your lifestyle than go into debt.	Likert	-

Notes: All Likert scales follow a 6-point format, items without reference were created by the authors.

F.2.2 Hypothetical Debt Contracts

The multiple price list on hypothetical debt contracts contains a total of 15 decisions. Aiming at brevity of the debt aversion survey module, its implementation and validity has been tested using the staircase

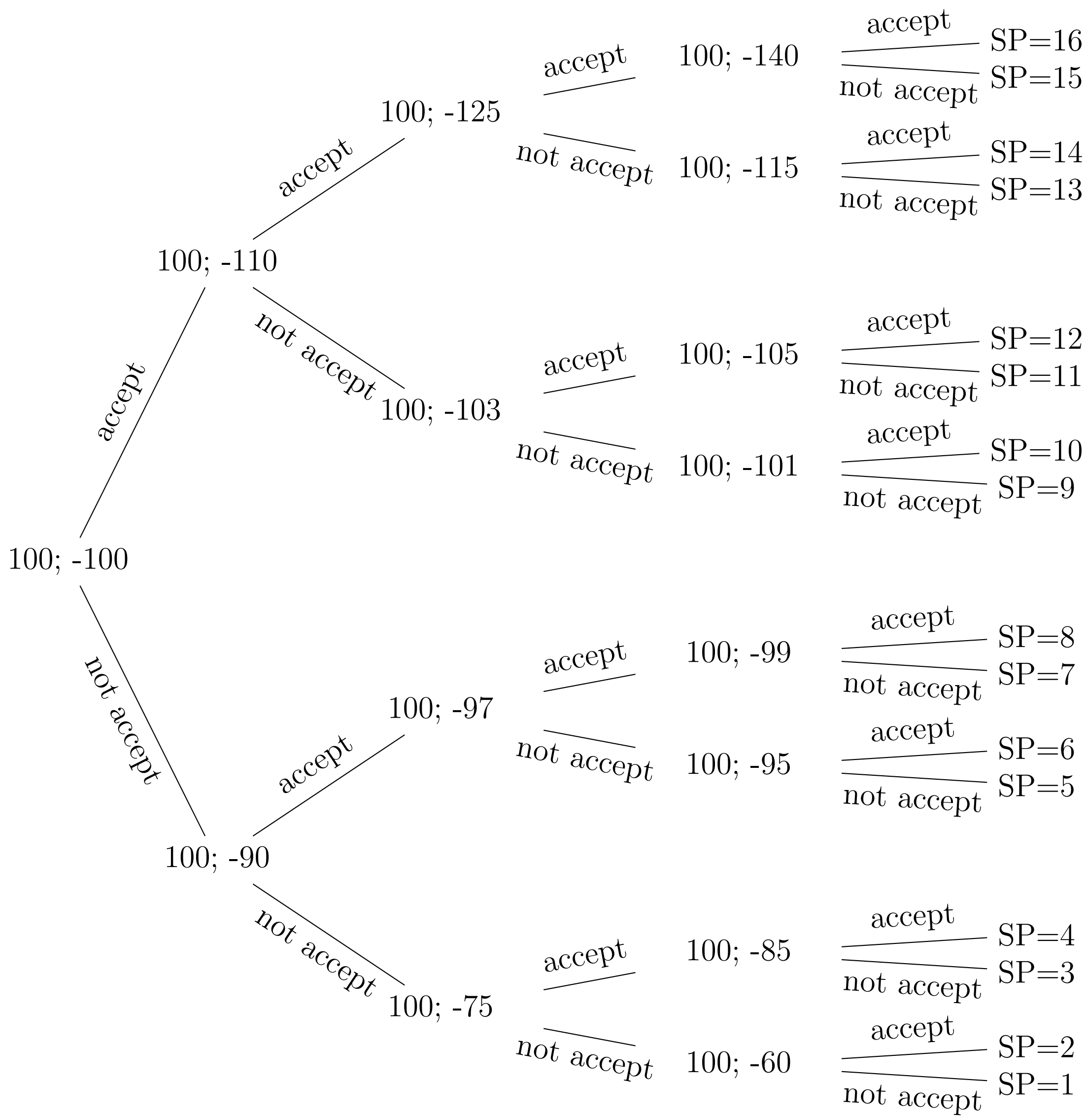


Figure 9: Staircase elicitation of choices on hypothetical debt contracts

method. Thus respondents effectively only see and make four yes/no choices. Participants are asked whether they would, hypothetically, accept four financial debt contracts, under which they receive 100€ today, with the obligation to repay between 60 to 140€ in six months:

Imagine your bank offered you a debt contract. Under this contract you receive 100€ from your bank today and have to pay back XX€ in 6 months. Please assume that you must pay the full amount you owe to the bank on time.

Would you accept such a contract?

Figure 9 illustrates all 15 choices. Nodes depict a hypothetical debt contract. Branches depict the available choices. Based on the choice in a specific node the path through the staircase is determined.

The fixed, positive amounts of 100€ indicates the hypothetical amount to be received today and the node/contract-specific negative amounts indicate the respective hypothetical amount of repayment in six months (to be inserted in for XX in the above mentioned question text). Respondents start at the left-most node and work their way through four questions until reaching a end-point at the right side. The label in the end-point states the switchpoint (SP) associated with the given choice path.

F.3 Item Selection for the Debt Aversion Survey Module

To identify an experimentally validated survey module for debt aversion, we follow the procedures established for the Global Preference Survey - GPS (Falk et al., 2022). Constructing the survey module, we first consider the entirety of 55 collected survey items, and all possible combinations thereof. Subsequently, we identify the subset of items that jointly, most accurately predicts individual debt aversion while also valuing the brevity of the survey module. By stepwise reduction, we condense the number of items to a debt aversion survey module of two items.

In the first step, we discard thirteen items that appear improper to construct an easy and widely applicable survey module. Six items have a specific focus on (debt) financing tertiary education, which makes them inappropriate for use beyond the university context. For further five items, we could not identify an intuitive directional hypothesis on the relation of the item and debt aversion. Lastly, two items exhibit a correlation with debt aversion, which goes against the direction of an intuitive hypothesis. A potential reason for this could be a misunderstanding of these items due to double negative wording.

As a second step, we consider linear regressions, modeling the experimentally elicited debt aversion parameter γ per individual i as the dependent variable and all possible subsets of the remaining 42 items as independent variables. In other words, we scrutinize all possible combinations of one item, two items, ..., n items as independent variables in a standard linear model, see Equation 34, and estimate the regression parameters $\beta_0, ..., \beta_p$ using ordinary least squares (OLS).

$$\gamma_i = \beta_0 + \beta_1 x_{1i} + ... + \beta_p x_{pi} + \varepsilon_i \tag{34}$$

The number of potential combinations increases rapidly in the number of considered items and quickly becomes intractable with conventional computational resources.[22]

[22]The number of C potential combinations of r items from a candidate pool of size n follows the formula $C(n,r) = \frac{n!}{r!(n-r)!}$. This results in 42 combinations of a single item, i.e. each and every item itself. 861 combinations of two items, 11 480 combinations of three items, 111 930 combinations of four items, and so on, with a maximum of 538 257 874 440 combinations of 21 items. As subsets/combinations of items are sampled disregarding the order of elements and without the possibility to include the same element more than once the number of combinations reaches a maximum for models including 21 variables. For larger subsets, the number of potential combinations decreases again. There is only one subset containing all items from the pool.

We therefore create a shortlist of items that appear in any of the ten best-performing models, evaluated according to adjusted R^2 for models with one, two, three, four, five, and six items, respectively.[23] This shortlist contains 16 items. We run linear OLS regressions on all possible combinations of shortlisted items, i.e. 524 288 regressions. In line with the GPS identification procedure, we use adjusted R^2, a criterion of in-sample-fit, to identify the best subset for each number of items.

Third, to discriminate between models comprising different numbers of variables we additionally consider information criteria and estimates of out-of-sample predictive power based on cross-validation. We consider the Akaike Information Criterion (AIC) as introduced by Akaike (1974) and the Bayesian or Bayes-Schwarz Information Criterion (BIC) as introduced by Schwarz (1978). With respect to cross-validation, we implement k-fold cross-validations (Stone, 1974) splitting our sample into $k = 5$ and $k = 10$ data chunks with 100 random samples each to calculate mean squared prediction errors (MSE) for the parameter of debt aversion γ of the candidate models. The performance of the five best candidate models per number of items are summarized in Figure 10.

Bringing together the variety of performance measures, we identify a survey module containing two items as providing a good trade-off between brevity and predictive power.

Item 1: How much do you agree with the following statement: *Debt is an integral part of today's life.*

Item 2: How much do you think the average respondent of this survey agrees with the following statement: *There is no excuse for borrowing money.*

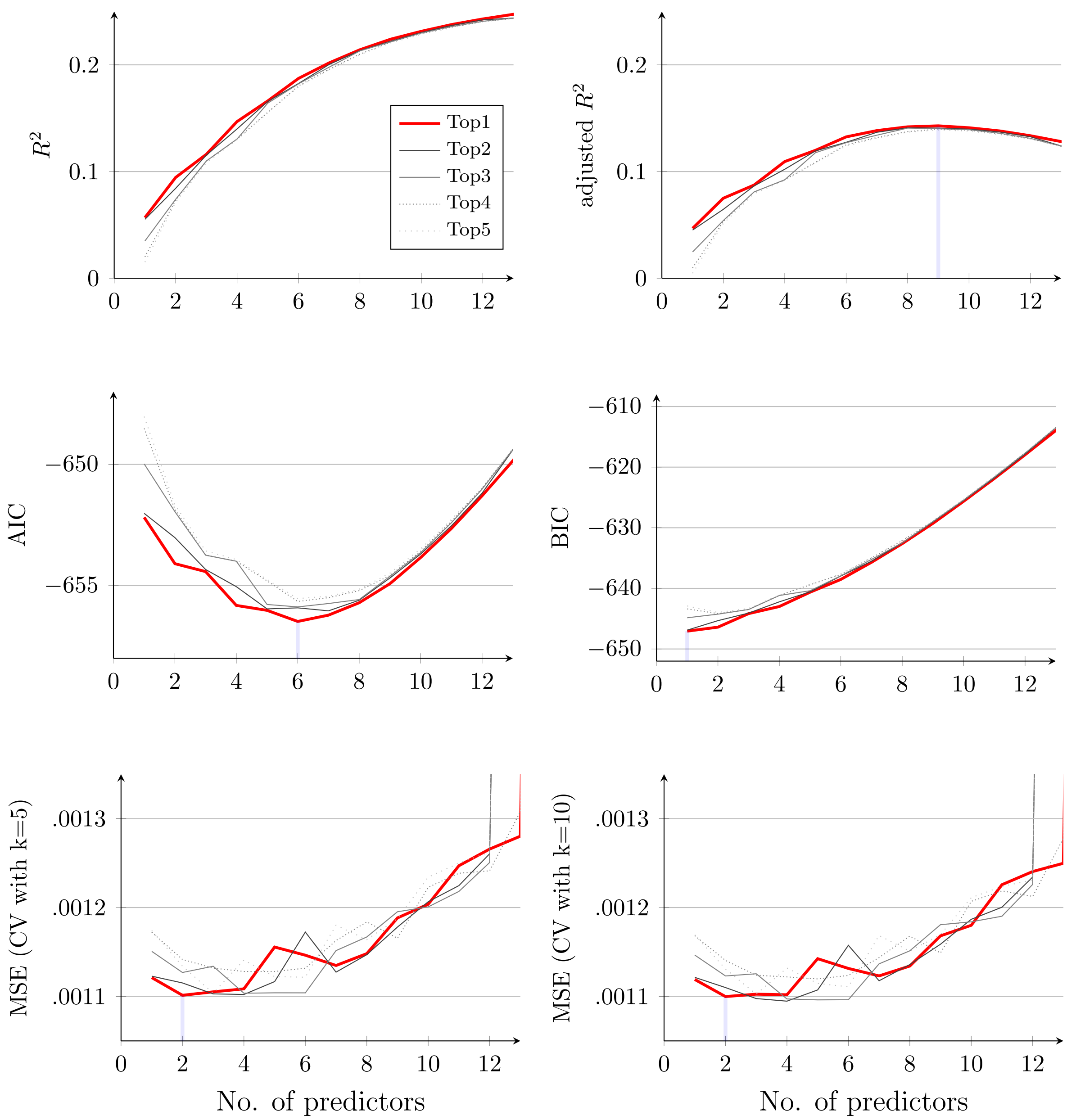
Both ratings are given on a 6-point Likert scale from 1 - *Strongly agree* to 6 - *Strongly disagree.* The survey module based estimate for individual debt aversion $\hat{\gamma}$ can be calculated as a linear regression of rating R_1 for Item 1 and R_2 for Item 2 as follows

$$\hat{\gamma} = 1.0694 + 0.0045 \times R_1 - 0.0069 \times R_2$$

Summarizing the insights across performance measures, Figure 10 shows that adjusted R^2 is maximized for a model with nine items, while AIC favors a six and BIC a one item model. The discrepancy in terms of favored models does not come as a surprise, as the three performance criteria differ in the penalty they put on including additional items into the model. Adjusted R^2 incorporates the smallest and BIC the largest penalty. To complement in-sample fit based performance metrics, we scrutinize the cross-validation-based MSE of the candidate models. Successively including more items, MSEs for $k = 5$ and $k = 10$ decrease for the Top1 models with up to two items, remain relatively flat up to four items and increases for more than four items. These favored numbers of items are largely corroborated by considering not only the best model (Top1) but also its close competitors (Top2 to Top5). Just as in the GPS module we value brevity of the survey module and thus favor the BIC. However, we do not want to

[23] For the creation of this shortlist we run a total of 36 211 980 regressions.

Figure 10: Performance metrics of the candidate survey modules



Notes: **First row:** coefficients of determination; **Second row:** information criteria; **Third row:** mean squared error (MSE) derived through k-fold cross validation (CV) with $k = 5$ and $k = 10$ data chunks and 100 repetitions each; minimum indicated by blue lines

fully disregard adjusted R^2 and AIC, as the discrepancy of suggested items is rather large. We reconcile the number of items by following the best model according to cross validation, comprising two items. This appears to be a reasonable compromise between BIC and AIC, which still puts a strong weight on brevity.

G Experimental Instructions

Upon first arrival at the lab, detailed instructions regarding the experiment as a whole and Session 1, in particular, were given as a printed handout. Identical instructions were displayed on the screen throughout the course of the experiment. Task-specific instructions were displayed on the screen sequentially before the respective tasks in all sessions. After reading the instructions, participants completed the tasks and then received instructions for the following task. Participants were given time to carefully read the instructions and ask questions.

The study design as delineated in the main paper Section Experiment and in the instructions was approved by the Ethics Review Committee of Maastricht University (Reference Number: ERCIC_138_07_05_2019).

G.1 Instructions at the beginning of Session 1 (on screen + printout to reread)

G.1.1 Overview

As announced in the invitation email, this is a three-part experiment. Today is the first part of the experiment (Session 1). The second part (Session 2) will take place in exactly four weeks from now (*Day, Date*, at the same starting time as today). The third part (Session 3) will take place in exactly eight weeks from now (*Day, Date*, at the same starting time as today). The experiment today will last 90 minutes, Session 2 and Session 3 will last 30 minutes respectively. To participate in today's experiment, you have to be able to participate in all sessions. If you cannot participate at one of these dates, please raise your hand now.

The following will happen during the three sessions:

G.1.2 Session 1 (today)

Today you will make a total of 90 *(120 in extension)* financial decisions, involving real money. The choices are simple and not meant to test you - the only correct answers are the ones you really think are best for you.

In the financial decisions you either have the choice between two options (Option A and Option B), or you have the choice of accepting or not accepting a savings or debt contract.

Generally, the financial decisions specify amounts of money that you will receive at different dates with different probabilities, or that you have to pay to the experimenter at different dates. The timing of the payments corresponds to the timing of the sessions. For instance, a financial decision may look as follows:

Option A	Option B	Your choice	
Receive €18 today	Receive €20 in 4 weeks	❒ Option A	❒ Option B

In this case, you have the choice between receiving €18 today (i.e. at the end of today's session) or in four weeks, at the end of Session 2. A financial decision may also only involve future dates:

Option A	Option B	Your choice
Receive €18 in 4 weeks	Receive €20 in 8 weeks	❐ Option A ❐ Option B

In this case you choose between monetary amounts to be paid either in four weeks, at the end of Session 2 (Option A), or in eight weeks, at the end of Session 3 (Option B).

At the end of today's session, you will be asked to fill out a short questionnaire. Afterwards, one of the 90 *(120 in extension)* decision situations will be drawn randomly as the 'decision that counts'. Your choice in that decision situation will then actually be implemented, and you will receive or pay the specified monetary amounts depending on your actual decision. Each decision situation has the same chance to be selected as the 'decision that counts'. It is therefore in your interest to consider all decision situations with equal care.

G.1.3 Session 2 (In four weeks)

In four weeks, we will ask you to complete a questionnaire. Additionally, all monetary payments that are due at Session 2 will be implemented. Please note that because of the questionnaire you will have to show up at this date, even if you will not receive or pay any monetary amounts at this date.

G.1.4 Session 3 (In eight weeks)

In eight weeks, we will ask you to complete a questionnaire. Additionally, all monetary payments that are due at Session 3 will be implemented. Please note that because of the questionnaire you will have to show up at this date, even if you will not receive or pay any monetary amounts at this date.

G.1.5 Your Payment

The selection of the 'decision that counts' will be made randomly and individually for each participant at the end of today's session. This selection will be made with the help of a bingo cage with 90 *(120 in extension)* numbered balls. All decision situations are numbered, and the number drawn by the bingo cage will be the 'decision that counts'. This decision will then actually be implemented, and you will receive or pay monetary amounts, as specified in the 'decision that counts'.

At the beginning of today's session, you already received a show-up fee of €15 for all three sessions in cash. On top of that money you will receive the money earned from your decisions. Additionally, you will receive a completion bonus of €20 after Session 3, provided you have shown up on time at each session, and have made all payments as agreed (more on this later). This completion bonus will be transferred to your bank account around one week after Session 3. For this payment, we will ask you for your bank details at the end of Session 3.

Please note, should you, arising through your own fault, fail to attend all sessions or fail to make any payments agreed upon you will be excluded from the remaining experiment and all payments associated with it. You will also be removed from the BEElab participant pool and thus not receive any further invitations for economic experiments.

G.2 Instructions throughout Session 1 (on screen before respective task + printout to reread)

G.2.1 Let's go

The 90 *(120 in extension)* decision situations are separated into four parts. You will now receive the specific instructions for part 1.

G.2.2 Part1

In this part, you will make a total of 10 decisions. In each decision, you can choose between receiving monetary amounts today, or in one month, at Session 2. For instance, one of these decisions could look like this:

Option A	**Option B**	**Your choice**
Receive €18 today	Receive €20 in 4 weeks	❐ Option A ❐ Option B

If you choose Option A in this decision situation, you will receive €18 today. If you choose Option B, you will receive €20 in four weeks, at Session 2.

If you prefer to receive €18 today and nothing in four weeks, choose Option A.

If you prefer to receive €20 in four weeks and nothing today, choose Option B.

Please note that we guarantee the later payment, even if you cannot participate on the due date for any unforeseen reason. In that case, we will transfer the money to your bank account, or you can pick it up at the secretarial office of the department of economics (MPE) at the School of Business and Economics. At the end of today's session, you will receive a receipt containing the email address of the principal investigator, who you can contact should there be any issues with the payment process.

Subsequently, participants made the 10 decisions of MPL1 (Appendix Table 9).

G.2.3 Part 2

In the following part, you will make a total of 20 choices. All payments occur today but depend on the outcome of a coin flip. If a decision situation from this part has been randomly selected as the 'decision that counts', you will make this coin flip yourself after the experiment today. The coin is fair. There is an equal chance of observing HEADS or TAILS.

For example, you might be asked to choose between the following options:

Option A		**Option B**		**Your choice**	
Coin shows HEADS	Coin shows TAILS	Coin shows HEADS	Coin shows TAILS		
€5	€4	€10	€1	❒ Option A	❒ Option B

In this decision situation, if you choose Option A and the coin shows HEADS, you win €5; if the coin shows TAILS, you win €4. If you choose Option B and the coin shows HEADS, you win €10; if the coin shows TAILS, you win €1.

In some decision situations, one option will be a safe amount and in the other option, the amount depends on a coin flip. For instance, such a decision situation may look as follows:

Option A	**Option B**		**Your choice**	
safe	Coin shows HEADS	Coin shows TAILS		
€5	€10	€1	❒ Option A	❒ Option B

In this decision situation, if you choose Option A you receive €5 for sure.

If you choose Option B and the coin shows HEADS, you win €10; if the coin shows TAILS, you win €1.

Subsequently, participants made the 20 decisions of MPL2 and MPL3 (Appendix Tables 10 and 11).

G.2.4 Part 3

In the following part, you will make a total of 30 *(45 in extension)* choices. This time, you will be offered a series of real savings contracts, that you can either accept or not accept. Savings contracts involve the payment of some monetary amount by you to the experimenter at an earlier date and the repayment of a monetary amount to you at a later date.

For example, consider the following contract:

Savings Contract		**Your choice**	
Pay €10 today	Receive €12 in 4 weeks	❒ Accept	❒ Not Accept

Under such a contract, you pay the experimenter €10 today, and receive €12 in four weeks, at Session 2. Note that if you have accepted one of these contracts and in case it has been selected as the 'decision that counts', you may use your show-up fee of €15, to pay this amount today.

Please note that we guarantee the later payment, even if you cannot participate on the due date for any unforeseen reason. In that case, we will transfer the money to your bank account, or you can pick it up at the secretarial office of the department of economics (MPE) at the School of Business and Economics.

Some savings contracts are defined over dates in the future. This is an example of such a savings contract:

Savings Contract		**Your choice**	
Pay €10 in 4 weeks	Receive €15 in 8 weeks	❒ Accept	❒ Not Accept

Under such a contract, you pay the experimenter €10 in four weeks, at Session 2; and receive €12 in eight weeks, at Session 3. Note that if you have accepted one of these contracts and in case it has been selected as the 'decision that counts', you need to bring the specified amount in cash at Session 2. In any case, you will receive a receipt today, specifying what payments you agreed to make at what session. Additionally, we will send a reminder email before the session at which your payment is due, specifying the amount you need to bring to the session.

The receipt you get also contains the email address of the principal investigator, who you can contact should there be any issues with the payment process.

Should you fail to pay the specified amount at the specified Session, you will be excluded from the experiment, and will not receive any further payments, including the completion bonus payment of €20.

Note that you always have the choice to not accept a savings contract! If you do not accept, you won't pay any money at the earlier date, and won't receive any money at the later date.

Subsequently, participants made the 30 (45 in extension) decisions of MPL4 and MPL5 (and MPL8 in extension) (Appendix Tables 12, 13 and 16).

G.2.5 Part 4

In the following task, you will make a total of 30 *(45 in extension)* choices. This time, you will be offered a series of real debt contracts, that you can either accept or not accept. Debt contracts involve the payment of some monetary amount by the experimenter to you at an earlier date and the repayment of a monetary amount by you to the experimenter at a later date.

For example, consider the following contract:

Debt Contract		**Your choice**	
Receive €10 today	Pay €12 in 4 weeks	❒ Accept	❒ Not Accept

Under such a contract, the experimenter pays you €10 today, and you have to pay back €12 to the experimenter in four weeks, at Session 2. Note that similar to the Saving Contracts, some debt contracts are defined over dates in the future. Here is an example of such a debt contract:

Debt Contract		**Your choice**	
Receive €10 in 4 weeks	Pay €12 in 8 weeks	❒ Accept	❒ Not Accept

Under such a contract, the experimenter pays you €10 in four weeks, at Session 2; and you have to pay back €12 to the experimenter in eight weeks, at Session 3.
Please note that should you accept a debt contract, we expect you to repay your debt in full, even if you cannot participate on the due date for any unforeseen reason. If you have accepted one of these contracts and in case it has been selected as the 'decision that counts', you need to bring the specified amount in cash at the respective session.[24] In any case, you will receive a receipt today, specifying what payments you agreed to make at what session. Additionally, we will send a reminder email before the session at which your payment is due, specifying the amount you need to bring to the session.

Should you fail to pay the specified amount at the specified session, you will be excluded from the experiment, and will not receive any further payments, including the completion bonus payment of €20.

Note that you always have the choice to not accept a debt contract! If you do not accept, you won't receive any money at the earlier date, and won't have to pay back any money at the later date.

Subsequently, participants made the 30 (45 in extension) decisions of MPL6 and MPL7 (and MPL9 in extension) (Appendix Tables 14, 15 and 17).

G.2.6 Check-out questionnaire

You completed all decisions. Now you still need to fill out a questionnaire and then you are done with today's session.

In this part we ask you to answer some questions and rate some statements about yourself. Some of them you need to classify according to how much they resemble yourself, others need to be ranked according to how much you agree with them or you think society agrees with them, accordingly.

Subsequently, participants provided basic sociodemographic information and answered the collection of 54 items on debt behavior and attitudes as described in detail in Online Appendix F.2.1

[24]Alternatively, you may also pay the specified amount via PayPal to the experimenter at the respective session.

G.2.7 Random Draw

Please give a sign to the experimenter. The experimenter will then come to you in order to draw the decision that counts from the bingo cage and implement your choice. Afterwards today's payments will be completed and you can leave the lab.

G.3 Instructions at Session 2 (on screen before respective task)

G.3.1 General Intro

Today we ask you to solve some logical tasks and answer a set of questions. Additionally, at the end of the session, all monetary payments that are due today will be implemented.

G.3.2 CRT and Numeracy

You will start by solving 19 logical tasks, afterwards, there will be a questionnaire. Before you start with the logical tasks you will see an example on the next screen.

In each task there will be a short text explaining an issue. Underneath you will find a box where you can type your answer. The answer may be in form of a number or text depending on the task. When appropriate the answer's unit of measurement is already given.

Note, once you typed your answer and hit the continue button you will proceed to the next task and not be able to return.

Subsequently, participants completed tasks on numeracy and cognitive reflection (see C).

G.3.3 BFI

You finished all logical tasks. In the next section, we ask you to answer some questions about yourself.

All questions have the same structure: "I am someone who ..." followed by something like "is outgoing and sociable." and need to be rated according to your level of agreement.

Subsequently, participants completed 30 items of the Big Five Inventory-2-S (see Appendix C).

G.3.4 Preference Module

There is one more section with questions about yourself to go.

Subsequently, participants completed 12 items of the Preference Survey Module (see Appendix C).

G.4 Instructions at Session 3 (on-screen before respective task)

G.4.1 General Intro

Today we ask you to solve some logical tasks and to answer a set of questions. Additionally, at the end of the session, all monetary payments that are due today will be implemented.

G.4.2 Raven

You will start by solving 36 logical tasks, afterwards, there will be a questionnaire. Before you start with the logical tasks you will see an example on the next screen.

In each task there will be a picture on the left side of the screen. In the upper half of the picture, you may see a puzzle with different pieces. Most pieces are shown while the space for the last piece is left blank. You need to choose from the suggestions in the lower half, which piece fits the blank in the puzzle best.

Note, once you typed your answer and hit the continue button you will proceed to the next task and not be able to return.

Subsequently, participants completed 36 Raven matrices (see Appendix C).

G.4.3 Planned Behavior

In the next section, we ask you to answer some questions about the likelihood that you will make certain purchases in the future and how you will finance them.

Subsequently, participants completed seven items on their likelihood to purchase certain things within the one year and the likelihood to loan-finance these purchases (see Appendix C).

G.4.4 Financial Literacy

In the next section, we ask you to answer 16 financial questions.

Please note, for your convenience, you may use the Windows built-in calculator. To start the calculator use the calculator button in the bottom right-hand corner of the screen. If you want to, you can try that now. Please note, you can also set the calculator to the scientific mode in case you want to do calculations involving exponents or the like.

Subsequently, participants completed 36 financial literacy items (see Appendix C).

G.4.5 Hypothetical Debt Contracts

There is one more section to go. You will be asked how you would behave in a series of four different hypothetical situations.

Imagine your bank offered you a debt contract. Under this contract, you receive €100 from your bank today and have to pay back some amount in 6 months.

Please assume that in all these choices you must pay the full amount you owe to the bank on time.

Subsequently, participants completed the four-item staircase measure (see Online Appendix F.2.2 for details).

G.4.6 Additional Questions on Honesty and Trustworthiness of Experimental Environment

In the next section, we ask you to answer some questions about yourself and how you think about certain things.

Subsequently, answered eight items from the HEXACO-60 Inventory in the honesty domain (see Appendix C) and four further questions on the trustworthiness of the experimental environment.

H Contract Form

Maastricht University

School of Business and Economics

Dr. Thomas Meissner
Assistant Professor

Department of Economics
Section MPE

direct line
+31 43 3883891

Maastricht
January 2020

Dear

based on today's experimental session you agree and confirm the following contractual details.

1. *Receival of a show up fee of 15 € today.*

2. *Receival of € decision-based payoff today.*
3. *Receival of € decision-based payoff in four weeks on (, . .2020).*
4. *Receival of € decision-based payoff in eight weeks on (, . .2020).*

5. *Receival of 20 € completion bonus after Session 3, conditional on showing up at each session and making all payments as agreed.*

6. *Payment of € decision-based payment today.*
7. *Payment of € decision-based payment in four weeks on (, . .2020).*
8. *Payment of € decision-based payment in eight weeks on (, . .2020).*

For the payment of the completion bonus we will ask you for your bank details after Session 3.

Please also leave your mail address, so that we can send a reminder for future due payments.

Mail:

Date, Signature:

AACSB ACCREDITED
EFMD EQUIS ACCREDITED
ASSOCIATION OF MBAS ACCREDITED

Visiting address
Tongersestraat 53
6211 LM Maastricht

Postal address
P.O. Box 616
6200 MD Maastricht
The Netherlands

T +31 43 3883891

www.maastrichtuniversity.nl
t.meissner@maastrichtuniversity.nl