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Time inconsistency and overdraft use: Evidence from transaction data and behavioral measurement experiments

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Non-technical summary

Research Question

Households regularly make financial mistakes, which can have severe consequences for the economic prosperity and well-being of individuals making them. Helping to prevent such financial mistakes therefore constitutes an important policy objective. However, designing corresponding policies requires a better understanding of the underlying mechanisms that ultimately lead to these mistakes in the first place. Are people simply unaware of how to make good financial decisions and therefore need to be better educated and informed? Or do they suffer from biases at the fundamental level of decision-making and thus require behavioral policies that take these biases into account?

Contribution

In this paper we focus on the excessive use of overdraft borrowing in Germany as a particularly relevant financial mistake and investigate the role of a fundamental behavioral bias – time inconsistent preferences – as a potential underlying factor. Due to its high costs, regular overdraft usage seems to conflict with optimal financial decision-making. We cooperate with a German fintech, enabling us to create a unique data set combining measures of time inconsistency from two fundamentally different types of data – individual bank account transaction data and behavioral measures of time preferences. Additionally, we compare this data to a survey measure of financial literacy, which is an alternative explanation for poor financial decision-making regularly mentioned in the literature.

Results

Our central result reveals that paycheck sensitivity, our measure for time inconsistency from bank account data, is systematically associated with overdraft usage and that the estimated effects are large. An increase of paycheck sensitivity by one standard deviation increases the probability of using overdrafts by 2.3 percentage points. For the behavioral measure of time inconsistency we also find a robust correlation with overdraft usage, while financial literacy is virtually unrelated. Our results document the role that biases in decision-making in general, and time inconsistency in particular, play in poor financial decisions, as we find a robust empirical association using two conceptually different measures based on fundamentally different types of data.

Nichttechnische Zusammenfassung

Fragestellung

Haushalte treffen immer wieder falsche Entscheidungen in Finanzfragen, was gravierende Konsequenzen für ihr ökonomisches und persönliches Wohlergehen haben kann. Solche Fehler zu verhindern, ist daher ein wichtiges Politikziel. Das Gestalten entsprechender Politikeingriffe setzt jedoch ein gutes Verständnis der zugrunde liegenden Mechanismen voraus, die zu diesen Fehlern führen. Wissen Leute einfach nicht, wie gute Entscheidungen in Finanzfragen zu treffen sind und müssen daher besser informiert und aufgekärt werden? Oder unterliegt ihr Entscheidungsverhalten fundamentalen, systematischen Fehlern, sodass Politikeingriffe erforderlich sind, die diese Verhaltensneigungen berücksichtigen?

Beitrag

Dieses Paper betrachtet die übermäßige Verwendung von Dispokrediten in Deutschland als ein besonders relevantes finanzielles Fehlverhalten und untersucht die Rolle einer fundamentalen Verhaltensverzerrung – zeitinkonsistente Präferenzen – als potentiellen Auslöser. Aufgrund der hohen Kosten ist das übermäßige Nutzen von Dispokrediten zumeist schwerlich als optimales Finanzgebaren zu verstehen. Wir kooperieren dafür mit einem deutschen Fintech-Unternehmen. Dies erlaubt uns, einen einzigartigen Datensatz zu erstellen, der Maße für Zeitinkonsistenz aus zwei fundamental verschiedenen Quellen enthält – individuelle Kontotransaktionsdaten und behavioristische Experimente für Zeitpräferenzen. Zusätzlich vergleichen wir diese Daten mit einem Maß für Finanzwissen, was häufig als alternative Erklärung für finanzielles Fehlverhalten in der Literatur genannt wird.

Ergebnisse

Unser zentrales Ergebnis besagt, dass unser mit Kontodaten erhobenes Maß für Zeitinkonsistenz systematisch mit einer höheren Nutzung von Dispokrediten einhergeht. Die Effekte sind deutlich: Ein Anstieg des Zeitinkonsistenzmaßes um eine Standardabweichung erhöht die Wahrscheinlichkeit, den Dispokredit zu verwenden um 2.3 Prozentpunkte. Für das behavioristische Zeitinkonsistenzmaß finden wir ebenfalls eine robuste Korrelation mit höherer Disponutzung, während das Maß für Finanzwissen kaum einen Zusammenhang zeigt. Unsere Ergebnisse dokumentieren die Rolle, die Verzerrungen im Entscheidungsverhalten generell und Zeitinkonsistenz im Speziellen für suboptimales Finanzverhalten spielen, da wir einen robusten empirischen Zusammenhang mit zwei konzeptionell verschiedenen Maßen finden, die dazu auf fundamental unterschiedlichen Daten beruhen.

Bundesbank Discussion Paper No 18/2022

Time Inconsistency and Overdraft Use: Evidence from Transaction Data and Behavioral Measurement Experiments *

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May 13, 2022

Abstract

Households regularly fail to make optimal financial decisions. But what are the underlying reasons for this? Using two conceptually distinct measures of time inconsistency based on bank account transaction data and behavioral measurement experiments, we show that the excessive use of bank account overdrafts is linked to time inconsistency. By contrast, there is no correlation between a survey-based measure of financial literacy and overdraft usage. Our results indicate that consumer education and information may not suffice to overcome mistakes in households' financial decision-making. Rather, behaviorally motivated interventions targeting specific biases in decision-making should also be considered as effective policy tools.

Keywords: Household Finance, Paycheck Sensitivity, Fintech, Time Inconsistency, Time Preferences, Experiment, Behavioral Measurement

JEL classification: D14, D90, G51, G53

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1 Introduction

Households regularly make financial mistakes,[1] which can have severe consequences for the economic prosperity and well-being of individuals making them. Helping to prevent such financial mistakes therefore constitutes an important policy objective. However, designing corresponding policies requires a better understanding of the underlying mechanisms that ultimately lead to these mistakes in the first place. Are people simply unaware of how to make good financial decisions and therefore need to be better educated and informed? Or do they suffer from biases at the fundamental level of decision-making and thus require behavioral policies that take these biases into account?

In this paper we focus on the excessive use of overdraft borrowing in Germany as a particularly relevant financial mistake and investigate the role of a fundamental behavioral bias – time inconsistent preferences (Laibson, 1997; O'Donoghue and Rabin, 1999) – as a potential underlying factor. While credit card debt is the major source of short-term consumer borrowing in the US and other countries, overdrafts on current accounts can be considered the analogous vehicle in Germany. Due to its high costs, regular overdraft usage seems to conflict with optimal financial decision-making (Stango and Zinman, 2009). For example, although the default rates on overdrafts are substantially lower than those of regular consumer loans (0.2% compared to 2.5%, see Dick, Knobloch, Al-Ulmaray, Jaroszek, Schröder, and Tiffe, 2012), overdrafts are substantially more expensive.

Time inconsistency means that individuals make different choices about the very same issue, just depending on the point in time in which they make the choice. As financial decisions are inherently inter-temporal, time inconsistency is an obvious potential cause of suboptimal financial decisions as it implies that actual behavior may substantially deviate from long-run plans. Accordingly, time inconsistent individuals might rely on overdrafts to finance short-term consumption more strongly than their long-run plans would prescribe.

We cooperate with a German fintech, enabling us to create a unique data set combining measures of time inconsistency from two fundamentally different types of data – individual bank account transaction data and behavioral measures of time preferences. The bank account data allows for the extraction of detailed information regarding frequency, size, and duration of overdraft usage at the individual household level, which serve as the outcome measure we aim to explain. Our field partner employs a machine-learning-based classification algorithm of individual transactions. This classification of individual transactions enables us to identify the paychecks an individual receives as well as expenditure on immediate consumption.[2] Following Kuchler and Pagel (2021), we use this information to construct individual *paycheck sensitivities* of household consumption spending. We then consider households to be time inconsistent if they spend relatively more on im-

[1] For example, Bertrand and Morse (2011) describe Americans' excessive use of expensive payday loans, Agarwal and Mazumder (2013) document suboptimal use of old and new credit cards as well as mistakes when filing for home equity loan applications, and Gathergood, Mahoney, Stewart, and Weber (2019) show how individuals make systematic and costly mistakes in repaying their debt.

[2] The word "paycheck" is used in this paper to denote salary payments.

mediate consumption directly after receiving their regular paychecks than at later points in time.

For a subset of individuals we also elicit incentivized behavioral measures of time preferences. In an online experiment, participants distribute *actual* monetary payments over different points in time and at different inter-temporal exchange rates (reflecting different interest rates). Due to the specific structure of these decisions, they reveal whether an individual behaves in a time inconsistent manner or not. Taken together, these different approaches allow the notion of time inconsistency to be captured in a broader way. While bank account transaction data reveal how individuals potentially make time inconsistent daily financial decisions, behavioral measurement data complement this by revealing time inconsistency in an abstract and hence arguably more foundational sense. Utilizing this combination of different measures provides a comprehensive perspective on the role of time inconsistency in households' financial behavior.

Our analysis starts by investigating the extent of overdraft usage in our sample. We find that it is substantial: 87% of households in our sample rely on overdrafts at least once in our sample period (on average, we observe each household for 336 days). Households use an overdraft facility for an average of 44% of the sample period, on average to the tune of 864 euro. Using the average realized interest rate on overdrafts in Germany in 2018 of around 8.26%, this amounts to estimated (unconditional) costs of approximately 32 euro per year. On the individual level, conditional on using overdrafts, persons have estimated yearly costs of 60 euro on average, ranging from 11 cents at the 10th percentile to 160 euro at the 90th percentile. We then take a closer look at our transaction-based measure of time inconsistency: paycheck sensitivity of immediate consumption expenditure. We find that the average household in our sample does indeed appear to be time-inconsistent, as immediate consumption falls by 14% within a week after the arrival of a paycheck. However, the extent of time inconsistency according to this measure displays substantial heterogeneity across households, with some being very time inconsistent and others not at all. Hence, in the next step we test whether this heterogeneity may also explain variation in financial decision-making with regard to overdraft usage.

Indeed, our central result reveals that paycheck sensitivity is systematically associated with overdraft usage and that the estimated effects are large. An increase of paycheck sensitivity by one standard deviation increases the probability of using overdrafts by 2.3 percentage points. In addition, paycheck sensitivity affects overdraft usage both at the extensive and the intensive margin. Not only are stronger paycheck sensitivities associated with a higher probability of using overdrafts in the first place, they are also associated with a greater share of time that an account was overdrawn within those people that use an overdraft facility.

These results provide evidence supporting our main conjecture, namely that financial mistakes in the form of overdraft usage are at least partially rooted in fundamental biases in decision-making, specifically in time inconsistency. Next, we utilize the behavioral measurement data, which measure time inconsistency in a fundamentally different and more abstract way, and check whether the association with overdraft usage survives. Ad-

ditionally, we compare this data to a survey measure of financial literacy, which is an alternative explanation for poor financial decision-making regularly mentioned in the literature (Hastings, Madrian, and Skimmyhorn, 2013). Indeed we find that a behavioral measure of time inconsistency is robustly correlated with overdraft usage, while financial literacy is virtually unrelated. On average, the proportion of time in which an overdraft facility is used is 8-17 percentage points higher for individuals classified as time inconsistent in our experiment. Thus, up to 39% of the average proportion of time in which an overdraft facility is used can be explained by time inconsistency. Overall, our results document the role that biases in decision-making in general, and time inconsistency in particular, play in poor financial decisions, as we find a robust empirical association using two conceptually different measures based on fundamentally different types of data.

Our paper contributes to different strands of the literature. First, we add to the general literature on household finance (Campbell, 2006; Beshears, Choi, Laibson, and Madrian, 2018; Gomes, Haliassos, and Ramadorai, 2020) and in particular on financial mistakes (e.g. Calvet, Campbell, and Sodini, 2007, 2009a,b). One can broadly distinguish two explanatory themes within this literature relevant to our study. Some papers investigate the role of financial literacy in explaining financial mistakes (see, e.g. Lusardi, 2008, or Hastings et al., 2013 for an overview and Stango and Zinman, 2014 for the specific case of overdrafts), while others examine behavioral biases and non-standard preferences to explain suboptimal financial decision-making (Thaler and Benartzi, 2004; Ashraf, Karlan, and Yin, 2006; Benartzi and Thaler, 2007; Meier and Sprenger, 2010; Benartzi and Thaler, 2013; Martinez, Meier, and Sprenger, 2017; Becker, Jaroszek, and Weber, 2017; Allcott, Kim, Taubinsky, and Zinman, 2021). Our paper predominantly addresses this second stream of literature, as we provide new evidence of time inconsistency as the key explanatory factor, using novel measurement techniques. The explicit combination of behavioral measures of time inconsistency with detailed expenditure data is, to the best of our knowledge, a rather unique feature of our study, only shared by Carvalho, Olafsson, and Silverman (2019), who focus more generally on decision-making quality.[3] with By additionally analyzing a survey-based measure for financial literacy, we also explicitly compare the two mentioned classes of explanations for financial mistakes and thereby also contribute to this general issue (see, e.g., Hastings and Mitchell, 2011).

Next, our study adds to the general literature on the importance, validity, and methodological aspects of behavioral measurement (Levitt and List, 2007; Falk and Heckman, 2009; Camerer, 2011; Al-Ubaydli and List, 2013; Gneezy and Imas, 2017). Our first contribution is regarding content. Behavioral measures of time preferences appear relevant in explaining financial mistakes. This adds to a growing list of studies showing links between experimentally elicited characteristics and corresponding field outcomes in general (see, for instance, Rustagi, Engel, and Kosfeld, 2010; Buser, Niederle, and Oosterbeek, 2014; Falk, Becker, Dohmen, Enke, Huffman, and Sunde, 2018) and for time preferences in particular (e.g. Meier and Sprenger, 2010; Sutter, Kocher, Glätzle-Rützler, and Trautmann, 2013; Castillo, Jordan, and Petrie, 2018; Backes-Gellner, Herz, Kosfeld, and Oswald, 2021).

[3]While there are other papers eliciting primary data and linking it to transaction-level data (Baker, Farrokhnia, Meyer, Pagel, and Yannelis, 2020; Coombs, Dube, Kluender, Naidu, and Stepner, 2020; Giglio, Maggiori, Stroebel, and Utkus, 2021), these papers do not feature incentivized measures.

Our second contribution is with respect to methodology. Recent years have seen quite an active debate about conceptual and operational issues of the behavioral measurement of time preferences (Andersen, Harrison, Lau, and Rutström, 2008; Andreoni and Sprenger, 2012a,b; Augenblick, Niederle, and Sprenger, 2015; Andreoni, Kuhn, and Sprenger, 2015; Cohen, Ericson, Laibson, and White, 2020). Our study complements this discussion by linking the transaction-based approach by Kuchler and Pagel (2021) to behavioral measures based on experimental protocols and showing that the conclusions drawn from both approaches appear consistent. Furthermore, as we employ different variants of behavioral measures for time inconsistency (choices regarding money or real-effort) within one setting and for the same participants, our results also provide a useful comparison in this regard.

Finally, on a broader level, our paper adds to the recently emerging literature strands that use data generated by fintech companies in academic research and which describe the effects of fintech companies on the financial system (Philippon, 2016; Buchak, Matvos, Piskorski, and Seru, 2018; Fuster, Plosser, Schnabl, and Vickery, 2019; Goldstein, Jiang, and Karolyi, 2019). Regarding the latter, the predictive power of our data-driven behavioral classifications based on account transactions indicates a promising avenue for the development of targeted policies to help prevent financial mistakes being made. Regarding the former, our study might serve as an example of how data generated by fintech companies provide novel possibilities to investigate the process of human decision-making more generally.

The remainder of the paper is structured as follows: In Section 2 we describe the setting in which our study takes place and the corresponding data we employ. Section 3 develops the key variables used in the analysis. Section 4 presents our main results, and Section 5 discusses them and concludes.

2 Setting and Data

2.1 The Setting

Our partner in providing the data is a German fintech company based in Berlin that, as well as offering other services, provides its clients access to their own credit score information. At the time of our data access, the company had roughly 40,000 registered clients and has grown further since. In order to provide clients with an individual score of their "financial fitness" and to make individualized recommendations for financial products (for which it is compensated via commission payments), the firm retrieves transaction data from its clients' bank accounts, and these data serve as the basis of our analysis. As another crucial feature for our study, the firm provides its users with a detailed classification of all their income and expenditure along many different dimensions to provide a convenient overview of their financial behavior and financial situation. The firm is set up as an online service provider, which gives us the possibility to invite clients to take part in behavioral experiments conveniently online.

Our partner makes use of a recent European directive on EU-wide payment services (PSD II). The intended effects of PSD II are to set a legal foundation for improving the market

for electronic payments within the EU and to reduce entry barriers to foster competition. Following the directive, new entrants offering services related to payments or payment data (including the management of personal finances, as in our case) can – with the consent of their clients – access previously proprietary data of their clients' bank accounts. Once a possible client registers and agrees to hand over her bank transaction data, she must confirm her identity by sending a copy of her personal ID or by identifying via her bank account. Once the registration process is complete, the respective client's bank is required to deliver the client's transaction data. In the case of our partner firm, the data is then categorized and analyzed in order to provide clients an overview of their financial situation and to suggest financial products in order to improve their creditworthiness.

2.2 Transaction Data

The transaction data we retrieve stem primarily from clients' checking accounts, which are still the predominant mode of electronic money and payment in Germany.[4] However, they also cover savings accounts and credit cards. In the final sample, we have 3,662 individuals from which we draw a random sub-sample of 2,749 clients, stratified by estimated paycheck sensitivity (see below) and gender. On average, individuals link 1.6 accounts with 483 transactions, which are observed for 336 days. The middle 98% of all transactions range between -790 euro and +1,959 euro, with an average transaction volume of 155 euro and an average value (including signs) of 2.91 euro. This implies that, on average, households slightly increase the balance on their accounts over our observation period. The observations in the 1%-tails of the distribution are comparatively large and only about 900 households do not have any transactions with amounts in the aggregated tails.

Before we access the data, each individual transaction is pre-classified by our partner firm into different spending and income categories. This categorization relies on the full set of information related to the transaction and employs a machine learning algorithm that is continously improved. Given this categorization, one can track individual expenditures for different types of goods over time. One obviously important category is cash withdrawals, as it is not clear at which point in time a cash withdrawal translates into actual consumption. However, fortunately only around 17% of all expenditure is attributable to cash withdrawals, which are on average about as large as the transactions for non-cash expenditure. We aggregate the remaining non-cash spending categories into several broader clusters: groceries, media and electronic devices, travel and mobility, restaurants, shopping, entry fees, and others. The respective average purchase volumes per transaction in these clusters are 28 euro for groceries, 37 euro for media, 57 euro for travel and mobility, 20 euro for restaurants, 51 euro for shopping, 23 euro for entry fees, and 121 euro for others. Table 1 provides an overview of the monthly average spending volumes per person.

In general, the individuals in our sample hold positive balances in their checking accounts. The average amount in an account at the end of the month is 757 euro, which is slightly lower than the average of 1,167 euro in savings accounts. However, this does not preclude

[4] On average, individuals have 405 transactions on checking accounts, compared to 78 for credit cards and 27 for savings accounts.

that people spend too much on aggregate: the average person regularly uses overdrafts on at least one of her accounts and regularly has a negative overall balance when considering all her linked accounts in aggregate.

3 Measurement

3.1 Measuring Time Inconsistency using Paycheck Sensitivities

Key Idea

Our goal is to classify individuals with respect to their degree of time inconsistency using transaction data. To do so, we build on the work by Kuchler and Pagel (2021), who also rely on transaction data from households' bank accounts. They argue that the reaction of consumption expenditure to incoming paychecks is informative regarding the respective household's time preferences. The intuition is that households who regularly display a decreasing consumption profile between paychecks are in fact deviating from the flatter consumption profile that would be optimal from an ex ante perspective and standard inter-temporal discounting. They show how a model with time-inconsistent (present-biased) preferences featuring a $\beta\delta$ discount factor, as in Laibson (1997), can explain these deviations using different values for delta. In contrast to "standard" preferences featuring exponential discounting, a stronger degree of present-bias (delta being smaller than 1) implies less consumption smoothing in the period between incoming paychecks (see also Shapiro, 2005). The empirically observable strength of the individual paycheck sensitivity can therefore be used as a measure for the respective individual's degree of time inconsistency.

Defining Paycycles and Sample Selection

To really interpret the consumption reaction to incoming paychecks as an expression of time preferences, one needs to rule out alternative explanations. An obvious and likely confounding factor is the information content of incoming paychecks. If their timing and amount are uncertain to an individual, receiving a paycheck might represent novel information to the decision-maker, as might the size of the paycheck. In this case, an increase in consumption spending as a reaction to the incoming paycheck might not be driven by time-inconsistent preferences but as a reaction to the new situation, which could be fully in line with standard exponential discounting.[5] To rule out falsely classifying these information effects as a manifestation of time inconsistency we therefore filter our sample to only include *regular* income payments that can be interpreted as neutral with respect to the information they contain for the respective household. We therefore apply the following procedures in selecting our final sample for the analysis.

Starting from an original sample of 22,988 individuals provided to us by our project partner, we keep the 16,340 for whom we observe the transactions on their linked accounts for at least 180 subsequent days.[6] We then define all incoming payments that are classified as

[5] For example, if a paycheck is substantially larger than previous ones, it seems reasonable that individuals update their beliefs about future payment streams and hence might rationally adapt their consumption profiles in a time consistent manner.

[6] See also Table 2 in the appendix.

salary payments and originate from the same counterparty as paychecks, leaving us with 12,205 individuals that receive at least one paycheck. Out of these paychecks, we drop all payments that are less than 10 euro, which excludes another 56 clients. The remaining 12,149 individuals receive payments from 20,990 different income streams.

To differentiate between irregular income streams (which could reflect payments for freelancing or commission-based work) and regular salaries, we assume that salary paychecks can either have a biweekly, monthly or quarterly periodicity. We therefore classify paychecks as biweekly if each paycheck arrives within a range of 8 to 19 days, as monthly if each payment arrives within a range of 20 to 39 days, and as quarterly if each paycheck arrives within a range of 75 to 107 days after the previous paycheck. The mean and median difference in days between individual payments is 30. In fact, only around 6% of the salaries (i.e. income streams) have an average interval between payment days of between 8 and 19 days, whereas almost 80% are between 20 and 39 days on average, making monthly paychecks the dominant source of income in the sample. In numbers, 299 people have at least one paycheck classified as biweekly, 7,928 people have at least one monthly paycheck and 86 people have a quarterly paycheck. Furthermore, 6,825 people also have paychecks that arrive at irregular frequencies. We drop all those individuals who receive more than 30% of their total income from irregular paychecks, leaving us with 7,373 individuals.

Next, we require individuals to receive all their paychecks for at least 5 consecutive months. We drop all individuals for whom this is not the case, which leaves us with 4,364 clients remaining in our sample.[7] Finally, we make sure that the clients in our sample receive the largest part of their income from these regular paychecks. Hence, we exclude all people who receive less than 70% of their total income (including all available categories of salary, rent, self employment, pension, and capital incomes) from their regular paychecks. The resulting sample consists of 3,662 individuals from which we draw a random sub-sample of 2,749 clients stratified by estimated paycheck sensitivity and gender for our final analysis.

Selecting Categories and Regression Design

We use paychecks as defined above to determine the timing of paycycles, i.e. the repeating periods between regularly incoming payments. Based on this, we can classify each transaction according to the time passed since the beginning of a paycycle, which serves as our main explanatory variable to measure paycheck sensitivities.

We regard expenditures as the dependent variable. However, simply taking into account all expenditure irrespective of its explicit use might severely bias our classification. For instance, "overspending" on durable goods at the beginning of a paycycle does not necessarily imply that the respective individual is time-inconsistent (see also Gelman, Kariv, Shapiro, Silverman, and Tadelis, 2014). In essence, as time inconsistency refers to preferences regarding consumption, the challenge is to focus on expenditure that can explicitly be interpreted as reflecting immediate consumption. We therefore consider expenditure on goods that one can reasonably assume are being consumed immediately. We define

[7] However, if an individual with several paychecks has one paycheck that is paid for less than 5 months and whose total amount paid is less than 5% of the total amount of the highest paycheck, we drop the small paycheck instead of the individual.

expenditure in the categories *restaurant, theater and cinema*, and *shopping* as reflecting immediate consumption, aggregate the respective expenditure at the daily level for each individual and estimate the following regression:

$$log(consumption_{it}) = \beta_0^i + \beta_1^i t^* + \gamma_m^i + \gamma_{dow}^i + u_{it} \quad , \ \forall i \tag{1}$$

where $consumption_{it}$ is the amount spent on immediate consumption goods by individual i on day t and γ_m and γ_{dow} are month and day-of-week fixed effects. t^* counts the days to the next salary payment and is defined as $t^* = T_k - t$,with T_k being the number of days between salary payment k and $k+1$ (so t^* counts down towards the next salary payment). The coefficient of t^*, β_1^i, shows whether expenditure on immediate consumption goods has a trend following the receipt of an income payment. Hence, a β_1^i deviating from zero reflects time inconsistency, with values higher than zero implying present-bias.[8] We will refer to β_1^i as "β immediate Consumption" in the regressions.

3.2 Measuring Time Inconsistency using Behavioral Experiments

To gather complementary measures of individual preferences and characteristics, we contact existing clients through our partner firm's user interface. This allows us to invite those individuals for whom we have transaction data to also participate in a supplementary online experiment. We invited our existing sample of 2,749 individuals via e-mail to participate in our online experiment in December 2018 and April 2019. We excluded those clients who do not allow our partner firm to send them e-mails that could be interpreted as advertisements.

Within the online experiment, we aim to measure two key characteristics for our analysis: time preferences and financial literacy. While we measure the latter using an established questionnaire described below, the question of how to measure time preferences via behavioral experiments is currently subject of an active debate in the literature (see Cohen et al., 2020). Traditionally, economists have relied on multiple price list methods (see Coller and Williams, 1999; Harrison, Lau, and Williams, 2002), in which individuals choose between a series of binary payment pairs at different points in time. However, these traditional methods do not appropriately account for utility curvature. Andersen et al. (2008) as well as Andreoni and Sprenger (2012a) propose different methodological improvements addressing this concern, namely double multiple price lists and convex time budgets, respectively. Finally, Augenblick et al. (2015) document the importance of controlling the actual timing of consumption by using intertemporal allocation choices over real-effort tasks instead of monetary payments.

To acknowledge the scope of existing measurement protocols, our experiment includes several variants that have recently been discussed and applied in the literature. The measure we primarily rely on in the analysis is most closely related to Andreoni and Sprenger (2012a) and runs over the course of two rounds with one week in between. In the first round, participants make three sets of decisions: In the first set they have to allocate monetary payments between the day of the experiment and exactly one week later ("week 0

[8] As t^* counts down, a positive value of β_1^i implies a downward sloping consumption pattern.

vs. week 1"). In the second set, the allocations are between the days one week and two weeks after the experiment ("week 1 vs. week 2"), and in the third set, between the day of the experiment and two weeks later ("week 0 vs. week 2"). In the second round of the experiment, participants only need to allocate money between the day of that round and one week later.

Within each of these four different sets of decisions, participants need to place five sliders within the interval from 0 to 20. Choosing the position 0 means allocating all money to the earlier date and no money to the later date of that decision. Hence, by moving the slider more to the right participants shift more money to the future at the cost of having less money at the respective earlier point in time. The comparison between different time horizons then reveals the structure of time preferences: In general, the further to the right a slider is positioned, the greater a person's level of patience. Time inconsistency is exhibited when there are differences in the implied level of patience for different points in time. Finally, the different sliders within one set of decisions represent different exchange rates between payments at the earlier and the later date, where the respective exchange rates are 1:0.95, 1:1, 1:1.11, 1:1.25, and 1:1.43. Figure 6 shows a screenshot of the experiment.

The motives underlying our design choices are as follows. First, we consider the use of sliders (and accordingly convex time budgets) instead of multiple price lists to be beneficial with respect to both, conceptual consistency (see the argument by Andreoni and Sprenger, 2012a) and operational ease for participants. Second, even though we generally agree with the arguments against allocating money instead of real effort over time, we opt to use the allocation of monetary payments as our primary measure: While we also ran the experiment using a real effort choice framework as in Augenblick et al. (2015), the share of decisions violating the law of demand is substantially larger here. In addition, the number of participants for whom we have such data is smaller. Nevertheless, we also discuss results based on this measure further below.

We run the experiment using Limesurvey. Participants can access the experiment by clicking on a link in an e-mail we send them through our partner's infrastructure. Overall, 112 individuals participated in our experiment.[9] To properly identify time inconsistency, it is important that any payments chosen to be made on the day of the decision itself are implemented immediately (see Balakrishnan, Haushofer, and Jakiela, 2020). To do so, we rely on instant transfers using PayPal for users who opt for this payment method. For all others, we directly transfer the money via online checking accounts and send a confirmation screenshot per e-mail immediately thereafter. While in the latter case, the money is not actually immediately available to our participants, we argue that the perceived inflow of money is already sufficient to allow time-inconsistent individuals to react.

To construct an individual measure of time inconsistency, we first calculate an individual's patience by taking the average slider position across all interest rates and time horizons, thus reflecting the general willingness to let forgo money at earlier points in time in order

[9] Due to attrition between the two rounds of the experiment, we do not have all the relevant variables that we subsequently use later in our analysis for all 112 individuals, but only for 82. However, we do run a robustness check of our main result using the full sample and only variables included therein.

to gain larger payments at later points in time. To measure time inconsistency based on this, we exploit the structure of our experiment in the following way. We compare slider positions for the same interest rate that refer to different points in time, but where the allocation decision is made over the same length of time. Accordingly, a decision is defined as time inconsistent if, for the same interest rate, the slider position is not the same for the allocation decisions of "week 0 vs. week 1" and of "week 1 vs. week 2".[10] We then measure the degree of participants' time inconsistency by taking the share of time-inconsistent decisions over all interest rates for each participant. In our estimations, we implement different ways of capturing time (in-)consistent behavior. First, we split participants into two groups of roughly equal size by labelling those with more than 20% of time-inconsistent decisions as time inconsistent (*Time-Inconsistent*). Second, we construct a refined measure (*Time-Inconsistent (refined)*), which takes the value of 1 if at least one allocation decision was time inconsistent. Lastly, we use the quasi-continuous measure of the proportion of participants' time-inconsistent choices (*Time-Inconsistent (continuous)*).

3.3 Measuring Financial Literacy

So far, we conjecture that the regular use of overdrafts is based on time-inconsistent preferences as a manifestation of individual biases in decision-making. An arguably similarly plausible explanation is considering differences in the general ability to manage personal finances, which could reflect underlying differences in information and education. In fact, a large body of literature exists that analyzes such effects on financial decision-making using the concept of "financial literacy" (Lusardi and Mitchell (2014)). To put a potential association of overdraft use and our preference-based measures into perspective, we additionally elicit individual financial literacy as a natural comparison.

There is substantial evidence documenting a correlation between financial literacy and a broad range of economic outcomes related to financial decision-making. For instance, Von Gaudecker (2015) shows that financial literacy is positively related to improved portfolio diversification, Van Rooij, Lusardi, and Alessie (2011) link financial literacy to stock market participation, and Lusardi and Tufano (2009) link a lack of financial literacy to excessive debt balances. Closely related to our study, Mottola (2013) documents a relation between low financial literacy and costly credit card behavior.

To assess financial literacy, we rely on the advanced financial literacy questions as introduced by Van Rooij et al. (2011). They argue that most individuals in existing studies do have some basic financial knowledge but typically lack more advanced knowledge of financial market instruments. Furthermore, they show that these aspects matter empirically. The corresponding questionnaire consists of 11 items, which all participants answer at the end of the first round of our online experiment.[11] To measure financial literacy we simply use the number of correct answers in our questionnaire (*Financially Literate*).

[10] We also compare allocation decisions of "week 1 vs. week 2" in the first round of the experiment with allocation decisions of "week 0 vs. week 1" in the second round of the experiment as a robustness check.

[11] See the Appendix for a list of the actual questions we use.

4 Results

4.1 The Extent of Overdraft Use

The majority of individuals in our sample use an overdraft at least once. Only 349 of 2,749 clients, i.e. around 13%, never use an overdraft in any of their accounts during our observation period.[12] In consumer surveys, the number of people who consider using an overdraft at all is around 50% and hence smaller, although around 80% of people report having access to an overdraft facility (Dick et al., 2012; Jannsen, Mendys-Kamphorst, and von Hinten Reed, 2014; ING-DiBa, 2015). However, as these are just survey answers, the real extent of overdraft use might also be higher. Indeed, banks report numbers indicating a more intensive use of overdrafts. In Germany, 20-29% of accounts on average are overdrawn at a given point in time, which could imply a significantly higher figure for the overall use of overdrafts (see Becker et al., 2017; Dick et al., 2012). In the Netherlands, 35% of accounts at surveyed banks were overdrawn at least once within a year, while only 44% of accounts have an overdraft facility, which implies that almost 80% of all accounts with an overdraft facility are overdrawn at some point in a given year (Jannsen et al., 2014).

Furthermore, the length of time in which overdrafts are used also appears quite long (see Table 3). The average individual in our data uses an overdraft facility (i.e. has an overdrawn account) for 182 days, which represents 44% of the average observation period. The corresponding overdrawn amount is also considerable, at an average of 864 euro. While this is arguably quite high, it is still below the amount reported in other papers (e.g. Becker et al., 2017, report an amount of 1,709 euro). These numbers reduce slightly when all the checking and savings accounts of a client are considered jointly. Over all accounts, the average person has a negative balance for 43% of their respective observation period. This reduction implies that some individuals have positive balances in one account, while being overdrawn in another. This most likely does not represent an optimal management of financial resources as interest rates on overdrafts are usually quite high and well above the rates for consumer loans (Dick et al., 2012).

Most importantly, these numbers refer to the average characteristics of our sample and mask substantial heterogeneity. For example, for clients who use overdrafts, the overdrawn amount in the first quartile is 135 euro or less, but more than 1,157 euro in the fourth quartile. It therefore seems natural to pose the question of whether there is a common factor able to explain some of this variation.

[12] This number reduces only slightly when we consider all accounts of an individual jointly, with 16% of the sample never displaying negative aggregate wealth over all their accounts.

4.2 The Reaction of Immediate Consumption to Incoming Paychecks

We consider differences in time inconsistency across households as an explanation for some of the variation of overdraft usage in our sample. We begin by exploring the distribution of estimated paycheck sensitivities of immediate consumption which serves as our empirical measure of time inconsistency.

Table 4 shows estimated individual paycheck sensitivities for different consumption categories averaged over all individuals in our sample. The coefficients are statistically significantly positive throughout. This implies that the average client has a downward sloping consumption pattern between paychecks, i.e. she systematically spends the more, the shorter the time that has passed since receiving the last paycheck. Interestingly, the sensitivity of spending on immediate consumption goods is only exceeded by cash withdrawals and other expenditure. For cash withdrawals, the strong effect might reflect a desire to hold a part of income in cash, as cash payments are widely used in Germany (Deutsche Bundesbank, 2014). For other expenditure, a potential explanation is that many large payments like rent or other recurring fees are often timed in accordance with, and hence shortly after, the receipt of income.

The extent of overspending is also economically relevant. For example, a value of 0.021 for immediate consumption goods means that on average, individuals' expenditure on immediate consumption goods decreases by 14.7% per week between paychecks. Using the setup of Kuchler and Pagel (2021) as an alternative specification,[13] we estimate that, on average, individuals spend 18.9% more on immediate consumption goods in the week after receiving a paycheck compared to other weeks. Figure 3 shows a non-parametric specification using individual dummy variables for each week after receiving a paycheck. It reveals a monotonous decline in consumption expenditures during the paycycle, which confirms this implicit assumption behind our approach of using a linear model.[14]

Figure 1 shows that the heterogeneity in estimated paycheck sensitivities across individuals is large. For immediate consumption, 31% of individuals have a negative estimated β_1^i. The distribution ranges from around -0.4 to 0.9. Figure 3 confirms the downward sloping consumption pattern. Furthermore, while the average paycheck sensitivity is strongly positive, there are many individuals whose estimated β_1^i is close to zero, which we interpret as them not being time inconsistent.

Fortunately, our data not only include individual transactions but also information on some personal characteristics, allowing us to explore their association with estimated paycheck sensitivities. Table 5 shows that relationship status, household size, age, and homeownership are statistically significantly correlated with the paycheck sensitivity of

[13] They regress consumption expenditures on a dummy which is one for the first week after receiving a paycheck. The corresponding coefficient therefore can be interpreted as the relative increase in spending in the week after receiving a paycheck as compared to any other week.

[14] Although figure 3 seems to imply a non-linear relationship, we still rely on a linear specification as this simplifies the interpretation later in the analysis.

"all spending", which is an aggregate of all expenditure categories.[15]
For the paycheck sensitivity of immediate consumption this is only the case for gender and, with marginal statistical significance, relationship status. A potential interpretation is that using refined spending categories helps to carve out variation in spending patterns that might be driven by personal characteristics other than time inconsistency. Using only immediate consumption would then make individual paycheck sensitivities a better proxy for a person's true time inconsistency. Nevertheless, since we still find significant correlates, we control for personal characteristics later in our analysis. We also apply the same regression to the three subcategories of immediate consumption (see columns 3 - 5). In general, the significant variables have the same sign and the results are by and large consistent. Taken together, we interpret the correlations of estimated paycheck sensitivities with other individual characteristics to be reassuring regarding the validity of our measure.

4.3 Can Paycheck Sensitivities explain the Use of Overdrafts?

Can estimated paycheck sensitivities explain suboptimal real financial decision-making? In Table 7, we investigate the relationship between paycheck sensitivities and measures of overdraft use. As a first, most simple outcome variable, a dummy variable is used which is one for people who use overdrafts at least once during our observation period and zero otherwise. This provides an indication of the extensive margin of overdraft use. Our preferred outcome measure is the share of time that an individual's account was overdrawn (i.e. the share of time in which an overdraft facility was used). Our arguments for this are as follows. While it can quite easily be rationalized that individuals sometimes use their overdraft facility for a short time, longer and/or more frequent overdraft spells arguably more likely reflect a structural problem in managing personal finances. In particular, using overdrafts is then typically dominated by taking out a consumer loan, as this would provide the necessary funds at lower cost.
The results generally show a strong association of paycheck sensitivity (i.e. β immediate Consumption) and the use of overdrafts: In column 1, the coefficient of the paycheck sensitivity of immediate consumption is positive and highly significant, implying that more time-inconsistent individuals (i.e. those with a stronger downward sloping consumption pattern between paychecks) are more likely to use overdrafts. This effect is also economically significant. If the sensitivity of expenditure on immediate consumption to receiving paychecks increases by one standard deviation (i.e. a more positive estimated individual coefficient β_1^i), it is associated with a 2.3% higher probability of using overdrafts. The effect is also robust to introducing personal characteristics as controls in column 2.

The strong link between overdrafts and paycheck sensitivity is not restricted to the simplest measure of overdraft use. It also applies when using the share of time that an individual's account was overdrawn as the dependent variable in column 3. The coefficient is positive and strongly significant, suggesting that individuals who behave in a more time-inconsistent manner also overdraw their bank account for an overall longer time period. The respective coefficient even slightly increases once control variables are added in column 4. In column 5, we consider the intensive margin by using only those

[15] See Table 6 for descriptive statistics of personal characteristics.

individuals who use overdraft facilities at least once. Again, the coefficient of paycheck sensitivity is positive and highly statistically significant. Hence, paycheck sensitivity can also explain the use of overdrafts at the intensive margin, supporting our result of a systematic association of time inconsistency and overdraft use.

Next, we test variations of paycheck sensitivities and alternative measures of overdraft use. An important concern is that individual credit constraints might actually spuriously create consumption patterns that are paycheck sensitive. An individual might overspend after receiving a paycheck to make up for missed consumption possibilities at the end of the previous period due to a lack of sufficient funds and credit constraints. To rule out our results being due to this effect, we therefore estimate individual paycheck sensitivities using only periods in which consumption in the first week after the receipt of a paycheck could have been afforded by the available funds at the end of the previous period. The available funds include the credit available in the overdraft facility, for which we estimate the maximum available overdraft amount from the size of peoples' paycheck.[16] Focusing only on periods where people could have afforded the post-paycheck consumption even before the arrival of the paycheck ensures that credit constraints do not bias the results, as people who can afford all their desired consumption are not credit constrained and hence do not have to postpone consumption.

Furthermore, we estimate paycheck sensitivities with a dummy for the first week after the receipt of a paycheck, as in Kuchler and Pagel (2021) and for various other measures of overdraft use, including the average and maximum size of an individual's overdraft use. The results in Tables A.1 and A.2 all support our main conclusion that there is a strong association between paycheck sensitivity and the use of overdrafts, irrespective of credit constraints and of the specific measure used in the regressions.

4.4 Does a Behavioral Measure of Time Inconsistency explain Overdraft Usage? Does a Survey Measure of Financial Literacy?

Our results so far document a robust association between a transaction-based measure of time inconsistency (paycheck sensitivity) and the extent of overdraft usage. We now test whether we can confirm this result using a complementary estimation strategy. We first use a behavioral measure of time inconsistency from our online experiment and then expand our perspective by adding a survey-based measure of financial literacy to explore its explanatory power as a comparison.

Before using these variables as explanatory factors in our analysis, we first investigate their general structure, beginning with participants' choices in the online experiment. Recall

[16] In Germany, a common rule at banks for calculating the maximum overdraft allowance is to allow overdrafts up to a value of three times a persons's the (monthly) income of a person. Hence, we estimate the maximum overdraft allowance as three times the average paycheck. For corroborative evidence for this, see the significant effect of the average paycheck amount on the average and maximum size of the overdraft in columns 5 and 6 of Table A.2.

that in the experiment, participants make decisions allocating monetary payments between earlier and later dates with varying implied interest rates and time periods between dates. Figure 4 shows that on average individuals allocate more money to later dates (i.e. "save") if interest rates increase, which provides some reassurance regarding the validity of our measure and the level of care participants took in the experiment. However, this does not preclude people from deviating from that pattern for individual decisions. In fact, almost 70% of participants make at least one time-inconsistent choice and 54% make more than two time-inconsistent choices. The average share of time-inconsistent choices is 47%.

Table 9 shows a set of regressions investigating the association between our central variable of interest – the extent of overdraft use as measured by the share of time in which an overdraft facility was used – and the individual measure of time inconsistency based on our behavioral experiment (*Time-Inconsistent*). Column 1 shows a statistically significant association in a simple uni-variate regression. The share of time in which an overdraft facility was used for individuals who are strongly time inconsistent is 18.4 percentage points higher than that of other participants. When adding controls in column 2, the effect remains statistically significant and even slightly increases in size.

An obvious concern could be that patience, i.e. the level of the individual discount rate, represents a relevant omitted variable in this setting, as it might at the same time be associated with time inconsistency as well as the general timing of consumption. To rule this out, in column 3 we include an individual measure of patience derived from our experiment by taking the average slider position of all decisions made by a given individual. This captures how much of the monetary payment she is on average willing to postpone to the future. Alternatively, in column 4 we employ a non-incentivized measure of patience, relying on self-reported survey answers.[17] The inclusion of either of these two additional variables does not reduce the association between time inconsistency and overdraft use. By contrast, in column 4, the coefficient becomes even stronger and statistically significant at the 1% level. According to this regression, time-inconsistent individuals' share of time with overdrawn accounts is 26 percentage points larger than that of others.

Next, we test whether our behavioral measure is still able to systematically predict overdraft use once we add our transaction-based measure of time inconsistency used in the full sample above. In column 5 we use the linear approach from our preferred specification, while in column 6 we include the estimate based on a dummy specification. The results show that the coefficients of the transaction-based measures of time inconsistency do have the correct signs and are comparable in size to Table 7. However, they are not estimated with sufficient precision in such a small sample to also show a statistically significant relation.[18] By contrast, the coefficients of our behavioral measure remain remarkably robust in terms of size and statistical precision. We consider this methodologically interesting

[17] In a series of questions, participants were asked to choose between different amounts they receive immediately or in 12 months. Using a staircase method we endogenously adapt for each given answer the upcoming next comparison as in Falk, Becker, Dohmen, Huffmann, and Sunde (2021).

[18] The standard error of the coefficient in column 3 of Table 7 is 0.156. Adjusting it for the smaller number of observations in the small experimental sample would imply a standard error of around 0.9. This is close to the standard errors estimated in Table 9 and would render the estimated coefficients insignficant in both tables.

in at least two ways. First, at least in our setting a behavioral measure of time inconsistency seems less noisy than one based on transaction data, as it is able to uncover a significant relation even in a rather small sample. Second, it underscores the relevance of complementary measurement methods as the correlation between these two conceptually different measures is rather small (0.03), indicating that they do indeed capture different behavioral manifestations of time inconsistency.

To keep the results of the different specifications in Table 9 as comparable as possible, we so far restricted the sample by using only the 82 observations for which all included variables are available. In column 7 we test whether our key result holds once we expand the sample to include the full set of experimental observations. While the size of the coefficient does indeed decline somewhat, it still remains statistically significant at the 10% level and economically meaningful in size.

As discussed above, the question of how to precisely measure time consistency in an experimental setting has not yet been conclusively answered. In Table 10 we therefore provide results using some alternative measures. In columns 1 and 2, we rely on the same data as before but use different classifications. In column 1, we already denote an individual as being time inconsistent if she makes at least one time-inconsistent choice. While this leads to a small drop in the point estimate, the association of time inconsistency and overdraft use still remains statistically significant at the 10% level. In column 2, we directly use the share of time-inconsistent choices as an explanatory variable. If anything, this makes the results marginally stronger than in the main analysis.

In column 3, we use an arguably even cleaner measure of time inconsistency than before. Instead of looking at differences in money allocated between different points in time that are equally far apart from each other ("week 0 vs. week 1" and of "week 1 vs. week 2"), we consider differences in decisions that are about the exact same dates, but just taken at different points in time ("week 1 vs. week 2" in the first round of the experiment and allocation decisions "week 0 vs. week 1" in the second round of the experiment). Although this leads to a further reduction of our sample size, the association between time inconsistency and overdraft use is still statistically significant at the 5% level.

In column 4 we use a measure of time inconsistency derived from choices over the allocation of real effort instead of money, as in Augenblick et al. (2015). While there is no statistically significant association of this measure with overdraft use, the coefficient at least has a positive sign, in line with our previous results. While our setting does not allow to provide a conclusive explanation for this, our preferred explanation is based on statistical power. First, the sample size for this regression is further reduced. Second, and more importantly, it seems that in our setting at least, participants make more noisy decisions in the real effort than in the money domain. When analyzing the number of "irrational" decisions by counting how often individuals violate the law of demand when reacting to changing interest rates, we note that this number is substantially higher in the real effort domain than in the monetary domain (3.26 vs 2.17).

Finally, we compare the association of our behavioral measure of time inconsistency with

overdraft use to that of a survey-based measure of financial literacy. In our sample, the average participant answers 7 out of 11 questions correctly, with a standard deviation of 2.5 correct answers. This is well in line with the literature: Van Rooij et al. (2011) reports for the exact same 11 questions an average of 6 correct answers. In Table 11 we re-run the same analysis as before while exchanging our behavioral measure of time inconsistency with this survey-based measure of financial literacy to provide a clean comparison of their relative explanatory power. As one can see across all specifications, the survey measure has no statistically significant association with overdraft use at all. In fact, the point estimates even consistently show the "wrong" sign, indicating that financially more literate individuals stay even longer in overdraft. Importantly, including the behavioral measure of time inconsistency and the survey measure of financial literacy at the same time in column 8 shows that the behavioral measure is economically and statistically highly significant, while the survey measure is not.

All in all, these results provide substantial support to our main conjecture that behavioral biases in general and time inconsistency in particular play a relevant role in explaining the frequent occurrence of suboptimal financial decision making – the use of overdrafts – by households. By contrast, financial literacy is not able to explain financial mistakes in our setting.

5 Discussion and Conclusion

In this paper we investigate the role of time inconsistency in explaining differences in financial mistakes, namely overdraft use. We use a unique data set combining bank account transaction data with behavioral and survey measures of time preferences and financial literacy, employing two complementary empirical strategies.

First, we construct a transaction-based measure – the paycheck sensitivity of immediate consumption – on the individual level, classifying individuals who systematically overspend on immediate consumption goods in reaction to incoming regular paychecks as time inconsistent. We find this measure to be statistically and economically significantly related to the probability and extent of overdraft use in our sample. Second, we run an online experiment to elicit a behavioral measure of time inconsistency and to obtain a survey measure of financial literacy within a smaller subgroup of participants in our sample. Even though these measures are derived following a different methodological paradigm, the respective analysis confirms our previous result. Again, time inconsistency has a strong and economically meaningful association with overdraft use. In contrast, financial literacy displays no robust effect.

We consider our results to be of interest for both academics as well as policy makers and practitioners. The consistent relation between different measures of time inconsistency and actual, "real" financial mistakes is informative from a methodological perspective but also enhances our understanding of financial and economic decision-making. In particular, the distinction between information/education-based (financial literacy) and preference-based (time inconsistency) explanations for poor financial decision-making appears crucial. Depending on the relative strength of these mechanisms the associated

policy response might differ widely: While preference-based explanations rather point to policies providing commitment devices as a promising approach (see, e.g., Thaler and Benartzi, 2004), information-based explanations call for educational and regulatory responses. In this sense, our results point to the former rather than the latter.

From a methodological and conceptual perspective it seems noteworthy that both measures of time inconsistency successfully predict relevant field behavior although they are almost uncorrelated. This hints at the possibility of them not capturing the same underlying construct and rather points to the existence of different facets of time inconsistency, raising the question whether time inconsistency should be treated as an universal, context-independent individual characteristic, or rather a more complex object consisting of different foundational mechanisms. The latter would mirror similar results from the literature, e.g. comparing the complementarity of psychological character traits and economic preferences (Becker, Deckers, Dohmen, Falk, and Kosse, 2012) or the domain-specificity of risk preferences (Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner, 2011).

Generally, future research should address also other settings and investigate the associations documented in our paper in order to further substantiate their robustness and in particular to get a better understanding of their potential heterogeneity. Overall, the relative importance of preference-based and information-based explanations for the effectiveness of policies aimed at improving financial decision-making still seems unclear. For example, Bertrand and Morse (2011), Carlin, Olafsson, and Pagel (2017), or Anderson and Robinson (2018), emphasize the role of information and attention, while studies like Meier and Sprenger (2012), Carvalho et al. (2019), Bu, Hanspal, Liao, and Liu (2021), Allcott et al. (2021), or Levi and Benartzi (2021) indicate that differences in biased preferences – specifically time preferences – matter. Hence, further research incorporating our methodological approach of integrating comparative measures of different mechanisms seems warranted.

References

Agarwal, S. and B. Mazumder (2013). Cognitive abilities and household financial decision making. *American Economic Journal: Applied Economics 5*(1), 193–207.

Al-Ubaydli, O. and J. A. List (2013). On the generalizability of experimental results in economics: With a response to Camerer. *NBER Working Paper 19666*.

Allcott, H., J. Kim, D. Taubinsky, and J. Zinman (2021). Are High-Interest Loans Predatory? Theory and Evidence from Payday Lending. *The Review of Economic Studies*.

Andersen, S., G. W. Harrison, M. I. Lau, and E. E. Rutström (2008). Eliciting risk and time preferences. *Econometrica 76*(3), 583–618.

Anderson, A. and D. T. Robinson (2018). Who feels the nudge? Knowledge, self-awareness and retirement savings decisions. *NBER Working Paper 25061*.

Andreoni, J., M. A. Kuhn, and C. Sprenger (2015). Measuring time preferences: A comparison of experimental methods. *Journal of Economic Behavior & Organization 116*, 451–464.

Andreoni, J. and C. Sprenger (2012a). Estimating time preferences from convex budgets. *American Economic Review 102*(7), 3333–56.

Andreoni, J. and C. Sprenger (2012b). Risk preferences are not time preferences. *American Economic Review 102*(7), 3357–76.

Ashraf, N., D. Karlan, and W. Yin (2006). Tying Odysseus to the mast: Evidence from a commitment savings product in the Philippines. *Quarterly Journal of Economics 121*(2), 635–672.

Augenblick, N., M. Niederle, and C. Sprenger (2015). Working over time: Dynamic inconsistency in real effort tasks. *Quarterly Journal of Economics 130*(3), 1067–1115.

Backes-Gellner, U., H. Herz, M. Kosfeld, and Y. Oswald (2021). Do preferences and biases predict life outcomes? evidence from education and labor market entry decisions. *European Economic Review 134*, 103709.

Baker, S. R., R. A. Farrokhnia, S. Meyer, M. Pagel, and C. Yannelis (2020). Income, liquidity, and the consumption response to the 2020 economic stimulus payments. Technical report, National Bureau of Economic Research.

Balakrishnan, U., J. Haushofer, and P. Jakiela (2020). How soon is now? evidence of present bias from convex time budget experiments. *Experimental Economics 23*(2), 294–321.

Becker, A., T. Deckers, T. Dohmen, A. Falk, and F. Kosse (2012). The relationship between economic preferences and psychological personality measures. *Annu. Rev. Econ. 4*(1), 453–478.

Becker, D. M., L. Jaroszek, and M. Weber (2017). Borrower heterogeneity and the (ir) rational demand for short-term credit. *Unpublished Manuscript*.

Benartzi, S. and R. H. Thaler (2007). Heuristics and biases in retirement savings behavior. *Journal of Economic Perspectives 21*(3), 81–104.

Benartzi, S. and R. H. Thaler (2013). Behavioral economics and the retirement savings crisis. *Science 339*(6124), 1152–1153.

Bertrand, M. and A. Morse (2011). Information disclosure, cognitive biases, and payday borrowing. *Journal of Finance 66*(6), 1865–1893.

Beshears, J., J. J. Choi, D. Laibson, and B. C. Madrian (2018). Behavioral household finance. In *Handbook of Behavioral Economics: Applications and Foundations 1*, Volume 1, pp. 177–276. Elsevier.

Bu, D., T. Hanspal, Y. Liao, and Y. Liu (2021). Cultivating self-control in fintech: Evidence from a field experiment on online consumer borrowing. *Journal of Financial and Quantitative Analysis*, 1–81.

Buchak, G., G. Matvos, T. Piskorski, and A. Seru (2018). Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics 130*(3), 453–483.

Buser, T., M. Niederle, and H. Oosterbeek (2014). Gender, competitiveness, and career choices. *Quarterly Journal of Economics 129*(3), 1409–1447.

Calvet, L. E., J. Y. Campbell, and P. Sodini (2007). Down or out: Assessing the welfare costs of household investment mistakes. *Journal of Political Economy 115*(5), 707–747.

Calvet, L. E., J. Y. Campbell, and P. Sodini (2009a). Fight or flight? Portfolio rebalancing by individual investors. *Quarterly Journal of Economics 124*(1), 301–348.

Calvet, L. E., J. Y. Campbell, and P. Sodini (2009b). Measuring the financial sophistication of households. *American Economic Review 99*(2), 393–98.

Camerer, C. (2011). The promise and success of lab-field generalizability in experimental economics: A critical reply to Levitt and List. *Unpublished Manuscript*.

Campbell, J. Y. (2006). Household finance. *Journal of Finance 61*(4), 1553–1604.

Carlin, B., A. Olafsson, and M. Pagel (2017). Fintech adoption across generations: Financial fitness in the information age. Technical report, National Bureau of Economic Research.

Carvalho, L., A. Olafsson, and D. Silverman (2019). Misfortune and mistake: The financial conditions and decision-making ability of high-cost loan borrowers. Technical report, National Bureau of Economic Research.

Castillo, M., J. L. Jordan, and R. Petrie (2018). Discount rates of children and high school graduation. *The Economic Journal 129*(619), 1153–1181.

Cohen, J., K. M. Ericson, D. Laibson, and J. M. White (2020). Measuring time preferences. *Journal of Economic Literature 58*(2), 299–347.

Coller, M. and M. B. Williams (1999). Eliciting individual discount rates. *Experimental Economics 2*(2), 107–127.

Coombs, K., A. Dube, R. Kluender, S. Naidu, and M. Stepner (2020). Effects of pandemic unemployment policies on consumption, savings, and incomes of workers: Evidence from linked survey-transactions data.

Deutsche Bundesbank (2014). Zahlungsverhalten in Deutschland 2014. *Dritte Studie über die Verwendung von Bargeld und unbaren Zahlungsinstrumenten.*

Dick, C., M. Knobloch, K. Al-Ulmaray, L. Jaroszek, M. Schröder, and A. Tiffe (2012). Studie zu Dispozinsen / Ratenkrediten. *Forschungsvorhaben zur Bereitstellung wissenschaftlicher Entscheidungshilfe für das Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (BMELV).*

Dohmen, T., A. Falk, D. Huffman, U. Sunde, J. Schupp, and G. G. Wagner (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the european economic association 9*(3), 522–550.

Falk, A., A. Becker, T. Dohmen, B. Enke, D. Huffman, and U. Sunde (2018). Global evidence on economic preferences. *Quarterly Journal of Economics 133*(4), 1645–1692.

Falk, A., A. Becker, T. Dohmen, D. Huffmann, and U. Sunde (2021). The preference survey module: A validated instrument for measuring risk, time, and social preferences. *Management Science, forthcoming.*

Falk, A. and J. J. Heckman (2009). Lab experiments are a major source of knowledge in the social sciences. *Science 326*(5952), 535–538.

Fuster, A., M. Plosser, P. Schnabl, and J. Vickery (2019). The role of technology in mortgage lending. *Review of Financial Studies 32*(5), 1854–1899.

Gathergood, J., N. Mahoney, N. Stewart, and J. Weber (2019). How do individuals repay their debt? The balance-matching heuristic. *American Economic Review 109*(3), 844–75.

Gelman, M., S. Kariv, M. D. Shapiro, D. Silverman, and S. Tadelis (2014). Harnessing naturally occurring data to measure the response of spending to income. *Science 345*(6193), 212–215.

Giglio, S., M. Maggiori, J. Stroebel, and S. Utkus (2021). The joint dynamics of investor beliefs and trading during the covid-19 crash. *Proceedings of the National Academy of Sciences 118*(4).

Gneezy, U. and A. Imas (2017). Lab in the field: Measuring preferences in the wild. In *Handbook of economic field experiments*, Volume 1, pp. 439–464. Elsevier.

Goldstein, I., W. Jiang, and G. A. Karolyi (2019). To fintech and beyond. *Unpublished Manuscript*.

Gomes, F., M. Haliassos, and T. Ramadorai (2020). Household finance. *Journal of Economic Literature, forthcoming*.

Harrison, G. W., M. I. Lau, and M. B. Williams (2002). Estimating individual discount rates in denmark: A field experiment. *American Economic Review 92*(5), 1606–1617.

Hastings, J. S., B. C. Madrian, and W. L. Skimmyhorn (2013). Financial literacy, financial education, and economic outcomes. *Annual Review of Economics 5*(1), 347–373.

Hastings, J. S. and O. S. Mitchell (2011). How financial literacy and impatience shape retirement wealth and investment behaviors. *Journal of Pension Economics & Finance*, 1–20.

ING-DiBa (2015). Kredit- und Dispo-Nutzung in Deutschland und Europa. *Umfrage in Zusammenarbeit mit Ipsos Marktforschung*.

Jannsen, M., E. Mendys-Kamphorst, and N. von Hinten Reed (2014). Overdrafts on personal current accounts: A study into market power. *Study carried out for the Netherlands Authority for Consumers and Markets*.

Kuchler, T. and M. Pagel (2021). Sticking to your plan: The role of present bias for credit card paydown. *Journal of Financial Economics 139*(2), 359–388.

Laibson, D. (1997). Golden eggs and hyperbolic discounting. *Quarterly Journal of Economics 112*(2), 443–478.

Levi, Y. and S. Benartzi (2021). Mind the app: Mobile access to financial information and consumer behavior.

Levitt, S. D. and J. A. List (2007). What do laboratory experiments measuring social preferences reveal about the real world? *Journal of Economic Perspectives 21*(2), 153–174.

Lusardi, A. (2008). Household saving behavior: The role of financial literacy, information, and financial education programs. *NBER Working Paper 13824*.

Lusardi, A. and O. S. Mitchell (2014). The economic importance of financial literacy: Theory and evidence. *Journal of economic literature 52*(1), 5–44.

Lusardi, A. and P. Tufano (2009). Debt literacy, financial experiences, and overindebtedness. *NBER Working Paper*.

Martinez, S.-K., S. Meier, and C. Sprenger (2017). Procrastination in the field: Evidence from tax filing. *Unpublished Manuscript*.

Meier, S. and C. Sprenger (2010). Present-biased preferences and credit card borrowing. *American Economic Journal: Applied Economics 2*(1), 193–210.

Meier, S. and C. D. Sprenger (2012). Time discounting predicts creditworthiness. *Psychological Science 23*(1), 56–58.

Mottola, G. R. (2013). In our best interest: Women, financial literacy, and credit card behavior. *Numeracy 6*(2).

O'Donoghue, T. and M. Rabin (1999). Doing it now or later. *American Economic Review 89*(1), 103–124.

Philippon, T. (2016). The fintech opportunity. *NBER Working Paper 22476*.

Rustagi, D., S. Engel, and M. Kosfeld (2010). Conditional cooperation and costly monitoring explain success in forest commons management. *Science 330*(6006), 961–965.

Shapiro, J. M. (2005). Is there a daily discount rate? Evidence from the food stamp nutrition cycle. *Journal of Public Economics 89*(2-3), 303–325.

Stango, V. and J. Zinman (2009). What do consumers really pay on their checking and credit card accounts? explicit, implicit, and avoidable costs. *American Economic Review 99*(2), 424–29.

Stango, V. and J. Zinman (2014). Limited and varying consumer attention: Evidence from shocks to the salience of bank overdraft fees. *The Review of Financial Studies 27*(4), 990–1030.

Sutter, M., M. G. Kocher, D. Glätzle-Rützler, and S. T. Trautmann (2013). Impatience and uncertainty: Experimental decisions predict adolescents' field behavior. *American Economic Review 103*(1), 510–31.

Thaler, R. H. and S. Benartzi (2004). Save more tomorrow^{TM}: Using behavioral economics to increase employee saving. *Journal of Political Economy 112*(S1), S164–S187.

Van Rooij, M., A. Lusardi, and R. Alessie (2011). Financial literacy and stock market participation. *Journal of Financial Economics 101*(2), 449–472.

Von Gaudecker, H.-M. (2015). How does household portfolio diversification vary with financial literacy and financial advice? *Journal of Finance*, 489–507.

Table 1: Descriptive Statistics on Spending

	count	mean	sd
Cash Withdrawals	2732	-616.82	584.72
Groceries	2538	-140.14	145.07
Media and Electronic Devices	2601	-138.43	402.75
Travel and Mobility	2575	-172.90	252.91
Restaurants	1868	-42.22	64.37
Shopping	2543	-116.96	198.09
Entry fees	2242	-60.27	99.81
Other	2749	-2191.06	9550.92

This table shows descriptive statistics for the average monthly spending per individual in specific spending categories.

Table 2: Waterfall Table of Sample Selection

Sample Selection	number of people
number of clients	40000
of which: access to bank account data	22988
of which: at least one checking account linked	22810
of which: all linked accouts observed for at least 180 days	16340
of which: receive any kind of income payment	14943
of which: receive salary payments	12205
of which: receive paycheck of more than 10 euro	12149
of which: receive less than 30% of income (salaries, pensions, benefits, rent) from irregular paychecks	7373
of which: receive all regular paychecks for at least 5 consecutive months	4364
of which: receive at least 70% of total income (salaries, pensions, benefits, rent, capital, trade income) from regular paychecks	3662
of which: random subsample stratified by gender and estimated paycheck sensitivity	2749
of which: participated in experiment	112
of which: answered all questions in the first round	82
of which: participated in both rounds of the experiment	75

Table 3: Descriptive Statistics on Overdraft Use

	count	mean	sd
Share of Time with overdrawn Accounts	2749	0.44	0.35
Days with overdrawn Accounts	2749	181.68	169.10
Number of Overdraft Spells	2749	7.38	6.63
Av. Length of Overdraft Spells	2749	40.17	90.25
Av. Size of Overdrafts	2749	864.25	1741.88
Max Size of Overdrafts	2749	1747.79	3621.01

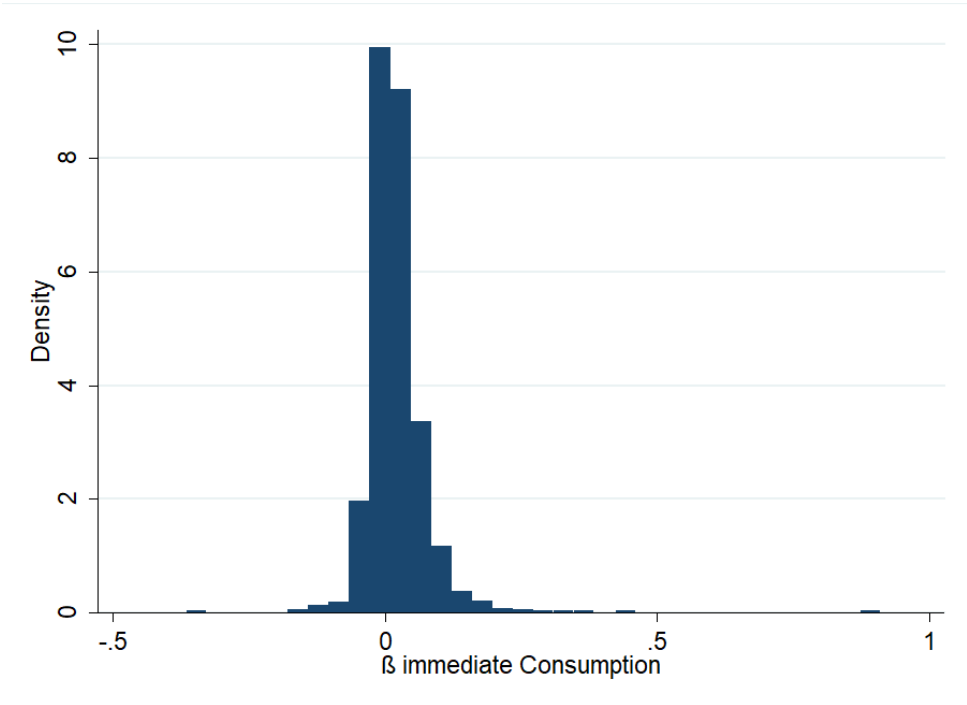
This table shows descriptive statistics for overdraft metrics. "Share of Time with overdrawn Accounts" (later called "Share Time" in the regression tables) is the number of days that a person's account was overdrawn (i.e. the person used an overdraft facility) divided by the total number of days the person is observed, "Days with overdrawn Accounts" shows the number of days that a person's account was overdrawn, "Number of Overdraft Spells" is the number of distinct periods in which a person's account was overdrawn, "Av. Length of Overdraft Spells" is the average length in days of the distinct overdraft spells, "Av. Size of Overdrafts" and "Max Size of Overdrafts" are the average and maximum sizes of the overdrafts in euro.

Table 4: Descriptive Statistics on Paycheck Sensitivities

	count	mean	sd
β all Spending***	2749	0.103	0.133
β Cash and Credit Card***	2749	0.046	0.121
β Housekeeping***	2749	0.010	0.038
β Media***	2749	0.008	0.034
β Other***	2749	0.136	0.128
β Travel***	2749	0.014	0.038
β Restaurants***	2749	0.002	0.013
β Shopping***	2749	0.018	0.041
β Theater and Cinema***	2749	0.004	0.028
β immediate Consumption***	2749	0.021	0.049

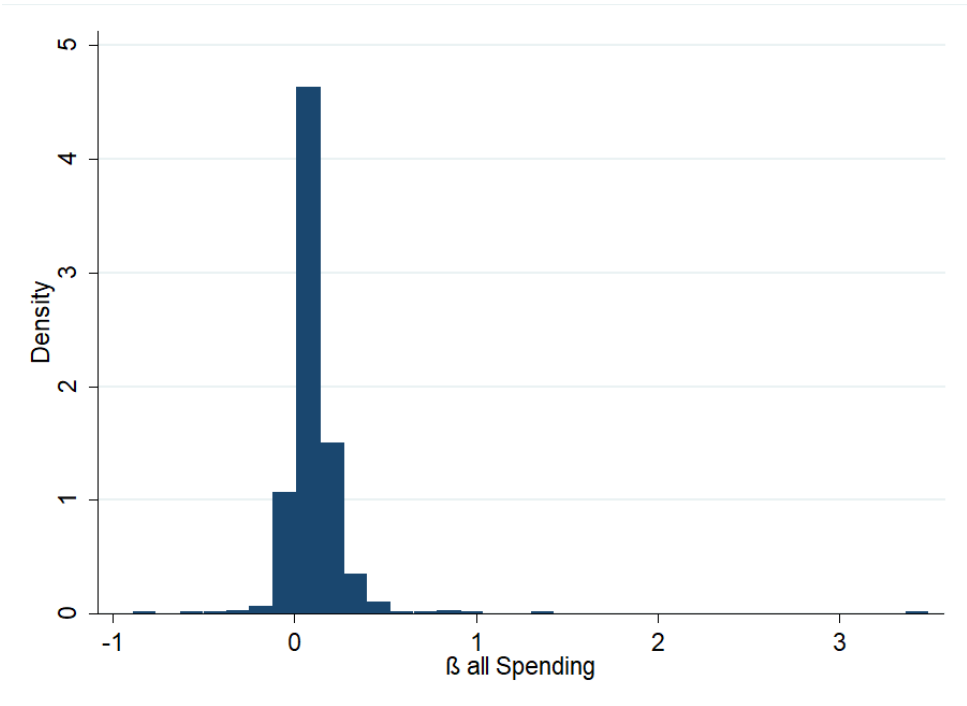
This table shows descriptive statistics for paycheck sensitivities for different spending categories. The sensitivities are the β_1^i obtained from estimating Equation 1, where the dependent variable is the natural logarithm of the daily spending amount for the respective spending category. "Cash and Credit Card" combines all cash withdrawals and credit card usage, "Housekeeping" includes spending in supermarkets and the like, "Media" covers spending on books, movies, newspapers, online services and comparable items, "Other" includes all spending categories not listed individually, "Travel" is spending on bus, train and airplane tickets, gasoline etc., and "immediate Consumption" is the combined spending in restaurants and bars (Restaurants), on shopping (Shopping) as well as on theater, cinema and other entry fees (Theater and Cinema). "All Spending" is an aggregate of all spending categories. ***, ** and * denote rejection in a simple t-test of the null hypothesis $\beta = 0$ at $p < 0.01$, $p < 0.05$ and $p < 0.1$, respectively.

Figure 1: Histogram of β for immediate Consumption



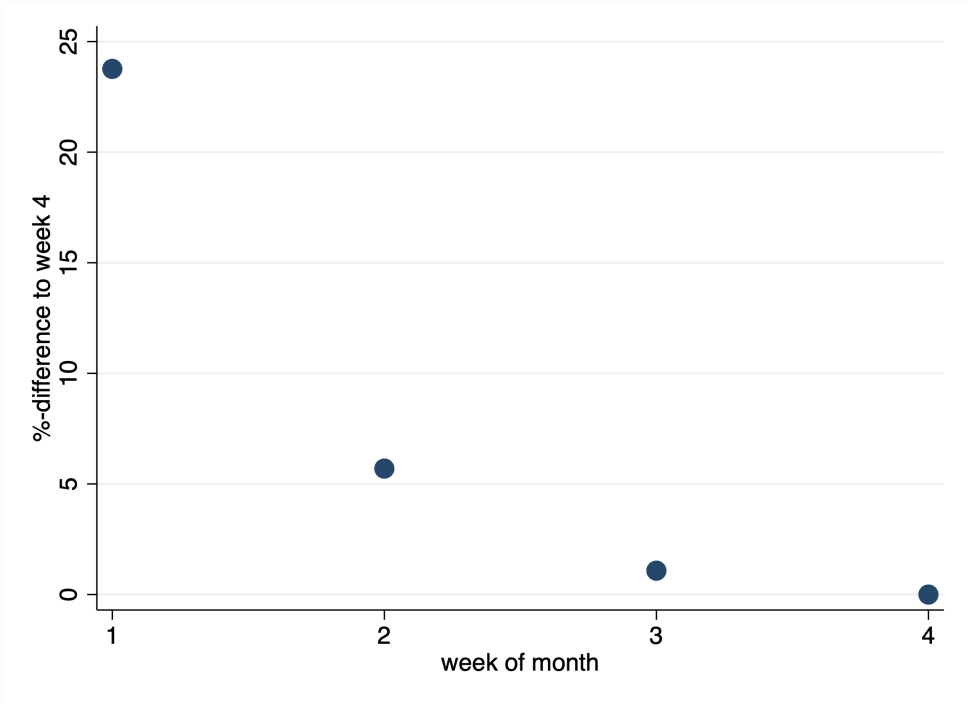
Notes: This graph shows a histogram of the paycheck sensitivity for immediate consumption goods for the individuals in our sample. The paycheck sensitivity is the β_1^i from Regression (1), with immediate consumption expenditure as the dependent variable.

Figure 2: Histogram of β for all Spending



Notes: This graph shows a histogram of the paycheck sensitivity for all spending categories for the individuals in our sample. The paycheck sensitivity is the β_1^i from Regression (1), with all consumption expenditure as the dependent variable (also called β immediate Consumption).

Figure 3: Paycheck Sensitivity: Average Monthly Consumption Pattern



Notes: This graph shows the average consumption pattern for immediate consumption goods in our sample. The pattern is derived from Regression (1), with immediate consumption expenditure as the dependent variable and dummies for weeks 1, 2, and 3 of the month instead of a linear trend. The average over all 2,749 individuals of each coefficient of the weekly dummies forms the consumption pattern.

Table 5: Personal Determinants of Paycheck Sensitivities: Multivariate Analysis

	(1)	(2)	(3)	(4)	(5)
	β all Spending	β immediate Consumption	β Restaurants	β Theater and Cinema	β Shopping
Log(Paycheck)	0.003	0.004	0.001	0.003**	0.001
	(0.006)	(0.002)	(0.001)	(0.001)	(0.002)
Sex	0.001	-0.011***	0.000	0.000	-0.012***
	(0.006)	(0.002)	(0.001)	(0.001)	(0.002)
Age	0.001*	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Relationship	0.027***	-0.006*	0.000	-0.005***	-0.001
	(0.010)	(0.003)	(0.001)	(0.002)	(0.003)
HH size	-0.012***	0.002	-0.000	0.001*	0.001
	(0.004)	(0.002)	(0.000)	(0.001)	(0.001)
Homeowner	-0.026***	-0.000	-0.001	-0.002	0.003
	(0.007)	(0.004)	(0.001)	(0.002)	(0.003)
Constant	0.061	0.006	-0.000	-0.015**	0.019
	(0.038)	(0.014)	(0.004)	(0.007)	(0.012)
Observations	2,731	2,731	2,731	2,731	2,731
R-squared	0.008	0.013	0.003	0.007	0.019

This table shows regressions of paycheck sensitivities for various spending categories on explanatory variables. The spending categories for which β is calculated are shown in the column titles. "Log(Paycheck)" is the natural logarithm of the average monthly paycheck, "Sex" equals one when a person is male, "Age" is a person's age in years, "Relationship" is a dummy indicating whether a person is in a long-term relationship, "HH size" indicate how many peple live in a person's household, "Homeowner" is a dummy for homeownership. ***, **, and * denote statistical significance at p< 0.01, 0.05, and 0.1, respectively.

Table 6: Descriptive Statistics on Characteristcs

	count	mean	sd
Sex	2731	0.70	0.46
Age	2731	32.58	8.48
HH size	2731	1.63	0.95
Relationship	2731	0.41	0.49
Homeowner	2731	0.06	0.23
Paycheck	2731	1868.04	1115.77

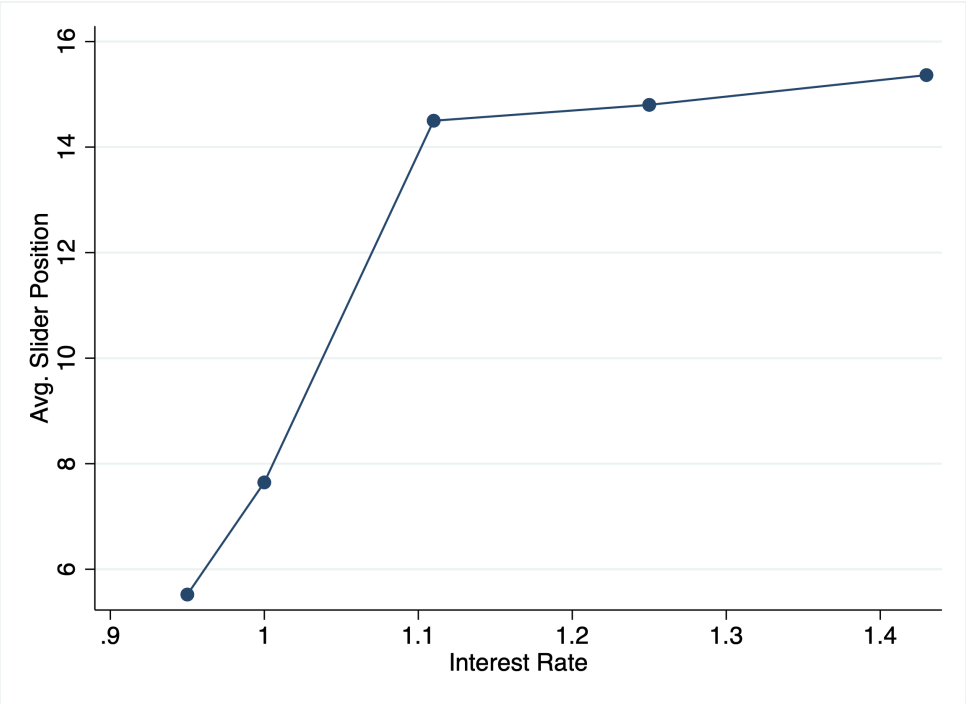
This table shows descriptive statistics for individual characteristics. "Sex" equals one when a person is male, "Age" is a person's age in years, "Relationship" is a dummy indicating whether a person is in a long-term relationship, "HH size" indicute how many people live in a person's household, "Homeowner" is a dummy for homeownership, "Paycheck" is the average monthly paycheck.

Table 7: Overdrafts: Multivariate Analysis

	(1) I[has Overdraft]	(2) I[has Overdraft]	(3) Share Time	(4) Share Time	(5) Share Time
β immediate Consumption	0.478***	0.474***	0.758***	0.767***	0.578***
	(0.113)	(0.112)	(0.156)	(0.155)	(0.149)
Log(Paycheck)		0.004		0.011	0.010
		(0.013)		(0.013)	(0.013)
Sex		0.001		0.013	0.014
		(0.014)		(0.015)	(0.015)
Age		-0.001		-0.000	0.000
		(0.001)		(0.001)	(0.001)
Relationship		-0.036		-0.008	0.011
		(0.023)		(0.022)	(0.022)
HH size		0.003		0.002	0.001
		(0.012)		(0.011)	(0.011)
Homeowner		0.068***		0.076***	0.045
		(0.022)		(0.029)	(0.029)
Constant	0.863***	0.861***	0.424***	0.338***	0.392***
	(0.007)	(0.089)	(0.007)	(0.091)	(0.093)
Observations	2,749	2,731	2,749	2,731	2,385
R-squared	0.005	0.010	0.012	0.015	0.010

This table shows regressions of two overdraft metrics on the β for immediate Consumption spending derived from estimating Equation 1 and explanatory variables. "I[has Overdraft]" is a dummy equal to one if a person ever uses an overdraft. "Share Time" is the share of time in which a person uses an overdraft facility / has overdrawn accounts. "Log(Paycheck)" is the natural logarithm of the average value of the paycheck income a person receives. "Sex" is equal to one when a person is male. "Age" is a person's age in years. "Relationship" is a dummy indicating whether a person is in a long-term relationship. "HH size" indicates how many people live in a person's household. "Homeowner" is a dummy for persons owning a home. In column 5, the sample is restricted to the intensive margin, i.e. those individuals for which I[has Overdraft] is equal to one. ***, ** and * denote statistical significance at p<0.01, p<0.05, and p<0.1, respectively.

Figure 4: Slider Positions by Interest Rates



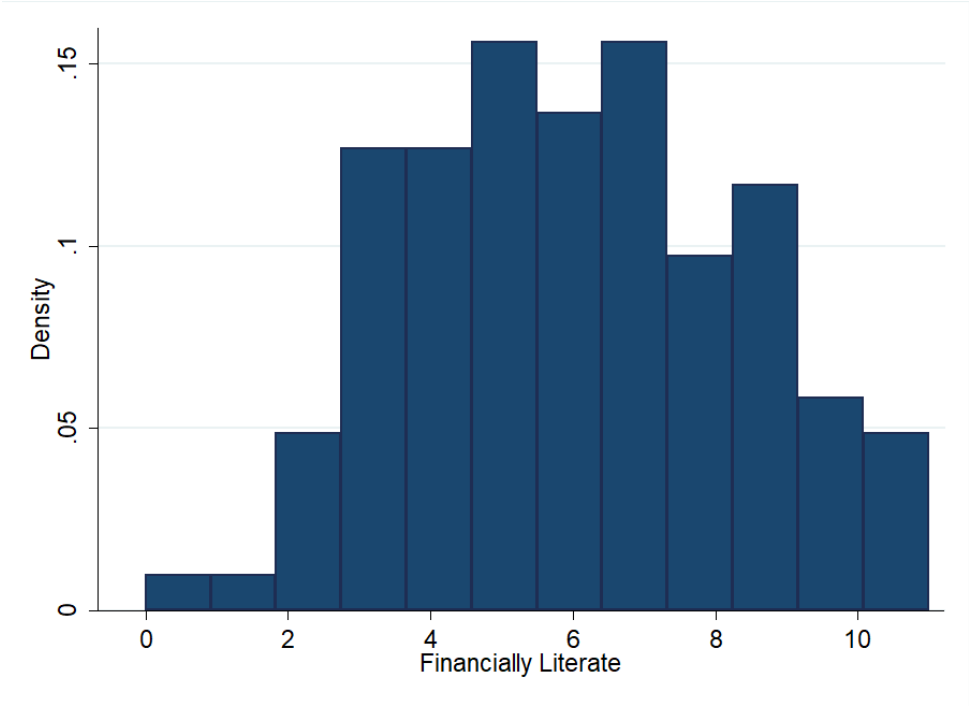
Notes: This graph shows the average slider position across all sets of both rounds of experiments in relation to the interest rate applied to the slider. Sliders ranged from 0 (allocate all money to the earlier date) to 20 (allocate all money to the later date). The interest rate represents the amount per slider step that could be gained by shifting money to the later date.

Table 8: Descriptive Statistics: Behavioral Measures and Financial Literacy

	count	mean	sd
Share Time	112	0.45	0.36
Sex	112	0.77	0.42
Age	112	33.71	8.83
HH size	112	1.51	0.75
Relationship	112	0.38	0.49
Homeowner	112	0.04	0.21
Paycheck	112	1918.99	1071.72
Time-Inconsistent	112	0.54	0.50
Time-Inconsistent (refined)	112	0.70	0.46
Time-Inconsistent (continuous)	112	0.47	0.40
Time-Inconsistent (2 periods)	75	0.47	0.50
Time-Inconsistent (real effort)	75	0.56	0.50
Financially Literate	112	6.08	2.53
Patience	112	0.57	0.20
Patience (self-rep.)	82	0.50	0.50
β immediate Consumption	112	0.02	0.03
β (dummy)	112	0.16	0.30

This table shows descriptive statistics for the experimental subset. "Share Time" is the share of time in which a person uses an overdraft facility. "Sex" equals one when a person is male, "Age" is a person's age in years, "Relationship" is a dummy indicating whether a person is in a long-term relationship, "HH size" indicates how many people live in a person's household, "Homeowner" is a dummy for homeowners, "Paycheck" is the average monthly paycheck. "Time-Inconsistent" is a dummy variable indicating persons with a share of time inconsistent choices above the median. "Time-Inconsistent (refined)" is a dummy indicating all persons that act in a time inconsistent manner in at least one of their choices. "Time-Inconsistent (continuous)" is a person's share of dynamically inconsistent choices. "Time-Inconsistent (2 periods)" is a median split (indicating above median time inconsistency) of the share of time inconsistent choices when the decision about the same time period is made on two different dates (i.e. on date 1, the decision about consumption in one and two week's time, and on date 2, which is one week later, the decision about consumption between that day and one week later). "Time-Inconsistent (real effort)" is a median split (indicating above median time inconsistency) of the share of time inconsistent choices about a real effort task, akin to the 2-period setting. "Financially Literate" is the number of correctly answered financial literacy questions, as listed in the appendix. "Patience" is the average slider position across all choices. "Patience (self-reported)" is a dummy indicating whether a person considers herself to be patient. "β immediate Consumption" is the linear measure of paycheck sensitivity for immediate consumption derived from estimating Equation 1. "β (dummy)" is derived from estimating Equation 1 for immediate consumption with a dummy variable indicating the first week after the arrival of a paycheck instead of a linear time trend.

Figure 5: Histogram of Financial Literacy



Notes: This graph shows a histogram of the variable Financially Literate for the individuals in our experimental sample. The score is the number of correctly answered questions as presented in the appendix.

Table 9: Financial Literacy vs. Time Inconsistency: Time Inconsistency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Baseline	Adding Controls	Controlling for Patience		Adding Paycheck Sensitivity		Extended Sample
Time-Inconsistent	0.184**	0.201**	0.219**	0.262***	0.219***	0.213**	0.127*
	(0.079)	(0.077)	(0.082)	(0.077)	(0.082)	(0.083)	(0.069)
Patience			0.219		0.151	0.145	-0.059
			(0.265)		(0.257)	(0.260)	(0.177)
Patience (self-rep.)				0.219***			
				(0.080)			
β immediate Cons.					1.470		0.824
					(1.095)		(1.000)
β (dummy)						0.076	
						(0.131)	
Constant	0.551***	1.517***	1.405***	1.471***	1.468***	1.409**	1.337***
	(0.053)	(0.494)	(0.530)	(0.474)	(0.530)	(0.533)	(0.486)
Controls	no	yes	yes	yes	yes	yes	yes
Observations	82	82	82	82	82	82	112
R-squared	0.064	0.214	0.218	0.287	0.237	0.221	0.108

This table shows regressions of the main overdraft metric, "Share Time", on the experimental measures for time inconsistency, β for immediate Consumption spending and explanatory variables. "Share Time" is the share of time in which a person uses an overdraft facility / has overdrawn accounts. "Time-Inconsistent" is a dummy variable indicating persons with a share of time inconsistent choices above the median. "Patience" is the average slider position across all choices. "Patience (self-reported)" is a dummy indicating whether a person considers herself to be patient. "β immediate Consumption" is the linear measure of paycheck sensitivity for immediate consumption derived from estimating Equation 1. "β (dummy)" is derived from estimating Equation 1 with a dummy variable indicating the first week after the arrival of a paycheck instead of a linear time trend. The following variables are added as controls (the same set as in previous tables): "Log(Paycheck)" is the natural logarithm of the average value of the paycheck income a person receives. "Sex" is equal to one when a person is male. "Age" is a person's age in years. "Relationship" is a dummy indicating whether a person is in a long-term relationship. "HH size" indicates how many people live in a person's household. "Homeowner" is a dummy for homeownership. For more information, please refer to Tables 5, 7, and 8. ***, **, and * denote statistical significance at p<0.01, p<0.05, and p<0.1, respectively.

Table 10: Financial Literacy vs. time inconsistency: Alternatives Measures of Time Inconsistency

	(1) Share TIme	(2) Share Time	(3) Share Time	(4) Share Time
Time-Inconsistent (refined)	0.160*			
	(0.086)			
Time-Inconsistent (continuous)		0.238**		
		(0.096)		
Time-Inconsistent (2 periods)			0.172**	
			(0.082)	
Time-Inconsistent (real effort)				0.111
				(0.088)
Constant	1.133**	1.324***	0.912*	1.301**
	(0.522)	(0.495)	(0.541)	(0.533)
Controls	yes	yes	yes	yes
Observations	82	82	75	75
R-squared	0.179	0.207	0.211	0.158

This table shows regressions of the main overdraft metric on alternative experimental measures for time inconsistency and explanatory variables. "Share Time" is the share of time in which a person uses an overdraft facility. "Time-Inconsistent (refined)" is a dummy indicating all persons that act in a time inconsistent manner in at least one of their choices. "Time-Inconsistent (continuous)" is a person's share of dynamically inconsistent choices. "Time-Inconsistent (2 periods)" is a median split (indicating above median time inconsistency) of the share of time inconsistent choices when the decision about the same time period is made on two different dates (i.e. on date 1, the decision about consumption in one and two week's time, and on date 2, which is one week later, the decision about consumption between that day and one week later). "Time-Inconsistent (real effort)" is a median split (indicating above median time inconsistency) of the share of time inconsistent choices about a real effort task, akin to the 2-period setting. The following variables are added as controls (the same set as in previous tables): "Log(Paycheck)" is the natural logarithm of the average value of the paycheck income a person receives. "Sex" is equal to one when a person is male. "Age" is a person's age in years. "Relationship" is a dummy indicating whether a person lives in a long-term relationship. "HH size" indicates how many people live in a person's household. "Homeowner" is a dummy for homeownership. For more information, please refer to Tables 7, 8, and 9. ***, **, and * denote statistical significance at p<0.01, p<0.05, and p<0.1, respectively.

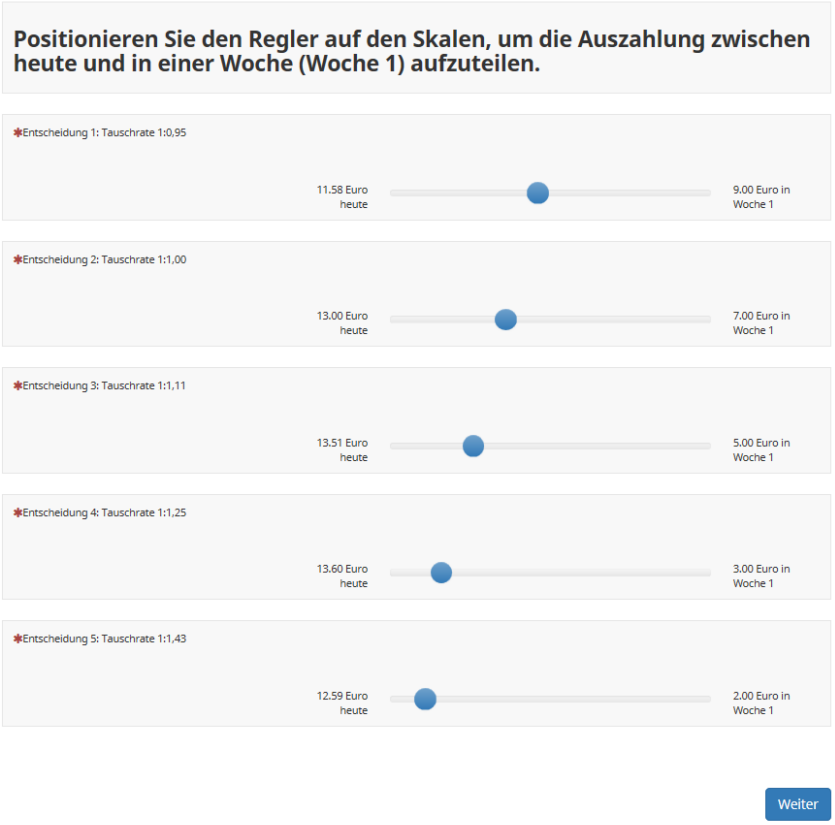
Table 11: Financial Literacy vs. Time Inconsistency: Financial Literacy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	Adding Controls	Controlling for Patience		Adding Paycheck Sensitivity		Extended Sample	Controlling for Time Inconsistency
Financially Literate	0.019	0.019	0.021	0.010	0.019	0.022	0.012	0.026
	(0.016)	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)	(0.015)	(0.017)
Patience			-0.092		-0.147	-0.155	-0.153	0.099
			(0.259)		(0.254)	(0.255)	(0.185)	(0.256)
Patience (self-rep.)				0.122				
				(0.088)				
β immediate Cons.					-1.341		-0.811	-1.318
					(1.143)		(1.013)	(1.088)
β (dummy)						0.127		
						(0.134)		
Time-Inconsistent								0.239***
								(0.082)
Constant	0.347***	1.231**	1.332**	1.260**	1.401**	1.330**	1.238**	1.290**
	(0.109)	(0.530)	(0.560)	(0.527)	(0.562)	(0.561)	(0.497)	(0.536)
Controls	no	yes	yes	yes	yes	yes	yes	yes
Observations	82	82	82	82	82	82	112	82
R-squared	0.018	0.155	0.159	0.177	0.175	0.169	0.085	0.263

This table shows regressions of the main overdraft metric, "Share Time", on a financial literacy measure, the experimental measure for time inconsistency, β for immediate Consumption spending and explanatory variables. "Share Time" is the share of time that a person has overdrawn accounts / the person uses an overdraft facility. "Financially Literate" is the number of correctly answered financial literacy questions, as depicted in the appendix. "Patienc" is the average slider position across all choices. "Patience (self-reported)" is a dummy indicating whether a person considers herself to be patient. "Time-Inconsistent" is a dummy variable indicating persons with a share of time inconsistent choices above the median. "β immediate Consumption" is the linear measure of paycheck sensitivity for immediate consumption derived from estimating Equation 1. "β (dummy)" is derived from Estimating equation 1 with a dummy variable indicating the first week after the arrival of a paycheck instead of a linear time trend. The following variables are added as controls (the same set as in previous tables): "Log(Paycheck)" is the natural logarithm of the average value of the paycheck income a person receives. "Sex" is equal to one when a person is male. "Age" is a person's age in years. "Relationship" is a dummy indicating whether a person lives in a long-term relationship. "HH size" indicates how many people live in a person's household. "Homeowner" is a dummy for homeownership. For more information, please refer to Tables 5, 7, and 9. ***, **, and * denote statistical significance at p<0.01, p<0.05, and p<0.1, respectively.

Online experiment

Figure 6: Screenshot of the Slider Task



Notes: This graph shows a screenshot of the slider task. The task is to allocate the monetary payoff between an earlier date (here: today) and a later date (here: one week later). Each slider represents a different interest rate that governs how much money has to be sacrificed to shift the payoff to the earlier date.
Translation: "Position the slider on the scales to divide the payout between today and in one week (week 1).
Decision 1: Exchange rate 1:0.95
11.58 Euro today – 9.00 Euro in week 1"

Financial Literacy Questionnaire

1. Which of the following statements describes the main function of the stock market? (i) The stock market helps to predict stock earnings; (ii) The stock market results in an increase in the price of stocks; (iii) The stock market brings people who want to buy stocks together with those who want to sell stocks; (iv) None of the above; (v) Do not know; (vi) Refusal.

2. Which of the following statements is correct? If somebody buys the stock of firm B in the stock market: (i) He owns a part of firm B; (ii) He has lent money to firm B; (iii) He is liable for firm B's debts; (iv) None of the above; (v) Do not know; (vi) Refusal.

3. Which of the following statements is correct? (i) Once one invests in a mutual fund, one cannot withdraw the money in the first year; (ii) Mutual funds can invest in several assets, for example invest in both stocks and bonds; (iii) Mutual funds pay a guaranteed rate of return which depends on their past performance; (iv) None of the above; (v) Do not know; (vi) Refusal.

4. Which of the following statements is correct? If somebody buys a bond of firm B: (i) He owns a part of firm B; (ii) He has lent money to firm B; (iii) He is liable for firm B's debts; (iv) None of the above; (v) Do not know; (vi) Refusal.

5. Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return? (i) Savings accounts; (ii) Bonds; (iii) Stocks; (iv) Do not know; (vi) Refusal.

6. Normally, which asset displays the highest fluctuations over time? (i) Savings accounts; (ii) Bonds; (iii) Stocks; (iv) Do not know; (v) Refusal.

7. When an investor spreads his money among different assets, does the risk of losing money: (i) Increase; (ii) Decrease; (iii) Stay the same; (iv) Do not know; (v) Refusal.

8. If you buy a 10-year bond, it means you cannot sell it after 5 years without incurring a major penalty. True or false? (i) True; (ii) False; (iii) Do not know; (iv) Refusal.

9. Stocks are normally riskier than bonds. True or false? (i) True; (ii) False; (iii) Do not know; (iv) Refusal.

10. Buying a company stock usually provides a safer return than a stock mutual fund. True or false? (i) True; (ii) False; (iii) Do not know; (iv) Refusal.

11. If the interest rate falls, what should happen to bond prices? (i) Rise; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) Do not know; (vi) Refusal.

A Appendix

Robustness Tables

Table A.1: Overdrafts: Robustness for alternative Betas

	(1) I[has Overdraft]	(2) I[has Overdraft]	(3) Share Time	(4) Share Time	(5) Share Time	(6) Share Time
β (credit unconstrained)	0.263***		0.378***		0.277***	
	(0.086)		(0.102)		(0.100)	
β (dummy)		0.061***		0.084***		0.060***
		(0.017)		(0.018)		(0.018)
Log(Paycheck)	0.006	0.002	0.014	0.008	0.012	0.008
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Sex	-0.003	0.001	0.006	0.012	0.009	0.013
	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)
Age	-0.001	-0.001	-0.000	-0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Relationship	-0.036	-0.036	-0.008	-0.007	0.011	0.012
	(0.023)	(0.023)	(0.022)	(0.022)	(0.022)	(0.022)
HH size	0.003	0.003	0.002	0.002	0.001	0.000
	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
Homeowner	0.067***	0.068***	0.075**	0.076**	0.044	0.044
	(0.022)	(0.022)	(0.029)	(0.030)	(0.029)	(0.029)
Constant	0.857***	0.872***	0.334***	0.354***	0.391***	0.406***
	(0.089)	(0.089)	(0.092)	(0.091)	(0.094)	(0.093)
Observations	2,731	2,731	2,731	2,731	2,385	2,385
R-squared	0.008	0.009	0.009	0.011	0.006	0.007

This table shows robustness tests for Table 7 for two alternative measures of β for immediate Consumption. On the left-hand side are two overdraft metrics: I[has overdraft] is an indicator for persons whose account is overdrawn at least once. "Share Time" is the share of time in which a person used an overdraft facility. "β (credit unconstrained)" is obtained from estimating Equation 1 only for those paycheck intervals where the person's account balances and available overdraft credit line (estimated as three times the average paycheck amount) before the arrival of the next paycheck was enough to cover the expenses in the first week after the arrival of the paycheck. "β (dummy)" is obtained from estimating Equation 1 with a dummy for the first week after the arrival of a paycheck instead of a linear time trend between two paychecks. "Log(Paycheck)" is the natural logarithm of the average value of the paycheck income a person receives. "Sex" is equal to one when a person is male. "Age" is a person's age in years. "Relationship" is a dummy indicating whether a person lives in a long-term relationship. "HH size" indicates how many people live in a person's household. "Homeowner" is a dummy for homeownership. In columns 5 and 6, the sample is restricted to the intensive margin, i.e. those individuals for which I[has Overdraft] is equal to one. For more information, please refer to Tables 5 and 7. ***, **, and * denote statistical significance at p<0.01, p<0.05, and p<0.1, respectively.

Table A.2: Overdrafts: Robustness for alternative Overdraft Metrics

	(1) Days	(2) Spells	(3) Av Length	(4) Av Size	(5) Max Size
β immediate Consumption	4.164***	1.279***	2.819***	2.441***	2.857***
	(0.780)	(0.397)	(0.539)	(0.935)	(0.986)
Log(Paycheck)	0.005	-0.003	-0.047	0.923***	0.962***
	(0.075)	(0.038)	(0.055)	(0.090)	(0.098)
Sex	0.090	-0.036	0.133**	0.127	0.126
	(0.086)	(0.043)	(0.062)	(0.104)	(0.111)
Age	-0.004	-0.005*	0.002	-0.009	-0.014**
	(0.005)	(0.003)	(0.004)	(0.006)	(0.007)
Relationship	-0.266**	-0.172***	-0.029	-0.608***	-0.667***
	(0.134)	(0.065)	(0.095)	(0.162)	(0.175)
HH size	0.086	0.082**	-0.043	0.199**	0.222**
	(0.071)	(0.035)	(0.048)	(0.086)	(0.094)
Homeowner	0.390**	-0.036	0.408***	1.168***	1.232***
	(0.156)	(0.080)	(0.126)	(0.189)	(0.206)
Constant	4.081***	1.838***	2.794***	-1.692***	-1.170*
	(0.530)	(0.264)	(0.386)	(0.622)	(0.683)
Observations	2,731	2,731	2,731	2,731	2,731
R-squared	0.015	0.009	0.015	0.072	0.068

This table shows regressions of various overdraft metrics on the β for immediate Consumption spending and explanatory variables. "Days" is the logged number of days that a person's account was overdrawn, "Spells" is the number of distinct periods a person used an overdraft facility, "Av Length" is the logged average length in days of the distinct overdraft periods, "Av Size" is the average size of the overdraft, "Max Size" is the maximum size of the overdraft. For all other variables, please refer to Tables 5 and 7. ***, **, and * denote statistical significance at p<0.01, p<0.05, and p<0.1, respectively.

Instructions

In the following, we present the instructions. We further provide original screenshots in German, with an English translation below each screen shot.

Experiment 1

Herzlich Willkommen und vielen Dank für Ihre Teilnahme an unserer Studie!

Das Experiment wird gemeinsam von [redacted] durchgeführt. Die Dauer des Experiments beträgt insgesamt nicht länger als **20 Minuten**. Im Experiment müssen Sie eine Reihe von Entscheidungen treffen. Bei diesen Entscheidungen geht es darum Geldbeträge zwischen verschiedenen Zeitpunkten aufzuteilen.

Wichtig:

Zwei dieser Entscheidungen werden wir am Ende zufällig auswählen und die entsprechenden Beträge an Sie auszahlen. So verdienen Sie durch Ihre Teilnahme echtes Geld! (Die Auszahlung erfolgt wahlweise direkt auf Ihren PayPal Account oder per Überweisung auf ein Girokonto Ihrer Wahl.)

Zum Start erhalten Sie als kleines Dankeschön für Ihre Teilnahme schon einmal **20 Euro**, aufgeteilt auf zwei Zahlungen à 10 Euro zu unterschiedlichen Zeitpunkten. Abhängig von den von Ihnen getroffenen Entscheidungen wächst dieser Betrag weiter an.

Wichtig:

All Ihre Daten und Angaben werden absolut vertraulich und gewissenhaft behandelt und nur zu Forschungszwecken verwendet. Insbesondere werden alle Daten im Rahmen der wissenschaftlichen Auswertung nur vollständig anonymisiert verarbeitet.

Mit Ihrer Teilnahme unterstützen Sie unsere aktuelle Forschung im Bereich Verhaltensökonomie und Finanzen. Wir arbeiten täglich daran besser zu verstehen, wie sich Menschen in wirtschaftlichen Situationen verhalten, um sie dabei zu unterstützen bessere Entscheidungen zu treffen. Ohne Leute wie Sie, die unsere Forschung durch Ihre Teilnahme an Experimenten wie diesem unterstützen, wäre unsere Arbeit nicht möglich - daher möchten wir uns jetzt schon einmal bei Ihnen ganz herzlich bedanken!

Wir, [redacted] stehen Ihnen als Leiter dieser Studie **jederzeit für Fragen zur Verfügung**. Schreiben Sie uns dafür am besten eine e-Mail an [redacted]

Welcome and thank you for participating in our study!

The experiment is being conducted jointly by X and Y. The duration of the experiment is no longer than **20 minutes** in total. In the experiment, you have to make a series of decisions. These decisions are about allocating amounts of money between different points in time.

Important:
We will randomly select two of these decisions at the end and pay out the corresponding amounts to you. This is how you earn real money through your participation! (The payout will be made either directly to your PayPal account or by bank transfer to a current account of your choice).

To start with, you will receive **20 euros** as a small thank you for your participation, divided into two payments of 10 euro each at different times. Depending on the decisions you make, this amount will continue to grow.

Important:
All your data and information will be treated absolutely confidentially and conscientiously and will only be used for research purposes. In particular, all data will only be processed completely anonymously within the framework of the scientific evaluation.

With your participation, you support our current research in the field of behavioural economics and finance. We work every day to better understand how people behave in economic situations to help them make better decisions. Without people like you, who support our research by participating in experiments like this, our work would not be possible - so we would like to thank you very much right now!

We, X and Y, as leaders of this study, are **always available to answer your questions**. Please send us an e-mail at XX@XX.XX or contact us by phone at XXX - XXXXX.

Anmeldung

*Das Experiment besteht aus zwei Runden. In jeder dieser Runden müssen Sie Entscheidungen darüber treffen, wie Sie Geld zwischen drei verschiedenen Zeitpunkten aufteilen.

Wichtig:

Zwischen der ersten und zweiten Runde muss exakt eine Wochen liegen. Wenn Sie also jetzt direkt mit der ersten Runde starten folgt die zweite Runde in genau einer Woche (die Uhrzeit ist dabei frei wählbar).

Wollen Sie **jetzt** direkt teilnehmen? Dann klicken Sie unten bitte auf „JETZT TEILNEHMEN".

- Sollten Sie jetzt direkt mit der ersten Runde starten senden wir Ihnen an diese Adresse in einer Woche Ihren Zugang zur zweiten Runde.

Wollen Sie lieber zu einem **späteren** Termin teilnehmen? Dann klicken Sie unten bitte auf „SPÄTER TEILNEHMEN".

- Sollten Sie erst zu einem späteren Termin starten wollen senden wir Ihnen an diese Adresse zum entsprechenden Termin Ihren Zugang zur ersten Runde und eine Woche später den Zugang zur zweiten Runde.

Auf der nächsten Seite können Sie Ihre Auszahlungsart (PayPal oder Überweisung) wählen. Damit wir Ihre Auszahlung durchführen können, müssen Sie dort die entsprechenden Angaben machen (PayPal-Daten oder Girokonto-Informationen).

Bitte wählen Sie eine der folgenden Antworten:

○ **JETZT** TEILNEHMEN

○ **SPÄTER** TEILNEHMEN

*Schließlich bitten wir Sie noch uns Ihre **E-Mail-Adresse** anzugeben:

Mit Ihrer Teilnahme an dieser Umfrage geben Sie uns Ihre Einverständniserklärung, die in der Umfrage erhobenen Daten mit anonymisierten Daten von bonify zu verknüpfen. Die wissenschaftliche Auswertung erfolgt nur auf Basis vollständig anonymisierter Daten.

Die von Ihnen hier angegebene E-Mail-Adresse sowie die von Ihnen später angegebenen Konto bzw. Paypal-Account-Informationen werden von uns nur zur administrativen Abwicklung der Umfrage sowie der Auszahlung gespeichert und zu keinem Zeitpunkt mit Ihren weiteren Umfragedaten oder personalisierten Daten von bonify verknüpft.

Bitte überprüfen Sie das Format Ihrer Antwort.

The experiment consists of two rounds. In each of these rounds you have to make decisions on how to allocate money between three different points in time.

Important:
There must be exactly one week between the first and second round. So if you start directly with the first round now, the second round will follow in exactly one week (the time is freely selectable).

Do you want to participate now? Then please click on "PARTICIPATE NOW" below.

- If you start with the first round **now**, we will send you your access to the second round to this address in one week.

Would you prefer to participate **at a later date**? Then please click on "PARTICIPATE LATER" below.

- If you would like to start at a later date, we will send your access to the first round to this address on the corresponding date and your access to the second round one week later.

On the next page you can choose your payment method (PayPal or bank transfer). In order for us to process your payout, you must provide the appropriate information there (PayPal data or current account information).
Please choose one of the following answers:

- PARTICIPATE NOW
- PARTICIPATE LATER

Finally, we ask you to provide us with your **e-mail address**:

By participating in this survey, you give us your consent to link the data collected in the survey with anonymised data from XXX. The scientific evaluation will only be carried out on the basis of completely anonymised data.

The e-mail address you provide here as well as the account or Paypal account information you provide later will only be stored by us for the administrative processing of the survey as well as the payment and will at no time be linked with your further survey data or personalised data from XXX.

Please check the format of your answer.

Auszahlung

*Ihre Auszahlung kann entweder via Paypal oder Banküberweisung stattfinden.

Bitte wählen Sie eine der folgenden Antworten:

- **Paypal**: Ich möchte meinen Gewinn per Paypal erhalten. Dafür wird der **Name**, die **E-Mail-Adresse** oder die **Telefonnummer** des Benutzerkontos benötigt.
- **Überweisung**: Ich möchte meine Auszahlung per Banküberweisung erhalten. Dafür wird der **Name** und die **IBAN** des Kontoinhabers benötigt.

Your payout can take place either via Paypal or bank transfer.
Please choose one of the following answers:

- **Paypal**: I would like to receive my payout via Paypal. This requires the account **name**, **e-mail address** or **phone number**.
- **Bank transfer**: I would like to receive my payout by bank transfer. The **name** and **IBAN** of the account holder are required for this.

Timeline

Zum Start erhalten Sie als kleines Dankeschön für Ihre Teilnahme schon einmal **20 Euro**, aufgeteilt auf zwei Zahlungen à 10 Euro zu unterschiedlichen Zeitpunkten. Diese beiden Zeitpunkte werden wie folgt festgelegt:

Sie müssen nun 15 Entscheidungen darüber treffen, wie Sie Geld zwischen drei verschiedenen Zeitpunkten aufteilen möchten. Diese Zeitpunkte sind:

- Erster Zeitpunkt (heute): Heute
- Zweiter Zeitpunkt (Woche 1): In einer Woche
- Dritter Zeitpunkt (Woche 2): In zwei Wochen

In jeder Entscheidung geht es jeweils um zwei dieser drei Zeitpunkte:

- In den ersten fünf Entscheidungen teilen Sie Geld zwischen heute und Woche 1 (in einer Woche) auf.
- In den zweiten fünf Entscheidungen teilen Sie Geld zwischen Woche 1 (in einer Woche) und Woche 2 (in zwei Wochen) auf.
- In den dritten fünf Entscheidungen teilen Sie Geld zwischen heute und Woche 2 (in zwei Wochen) auf.

Entsprechend erhalten Sie frühestens direkt heute und spätestens in zwei Wochen Ihre Auszahlungen direkt über die von Ihnen gewählte Zahlungsmethode (PayPal oder Überweisung).

Sobald Sie alle 15 Entscheidungen getroffen haben, werden wir eine dieser Entscheidungen zufällig auswählen. Die in dieser Entscheidung gewählten Auszahlungen werden dann von uns durchgeführt.

Wichtig:

Jede Ihrer 15 Entscheidungen wird mit gleicher Wahrscheinlichkeit zur tatsächlichen Auszahlung ausgewählt. Die beiden oben beschriebenen 10 Euro Zahlungen werden dann jeweils zu den beiden zufällig ausgewählten Zeitpunkten hinzu addiert. Sie bekommen also in jedem Fall 10 Euro zum früheren ausgewählten Zeitpunkt und 10 Euro zum später ausgewählten Zeitpunkt.

Sobald Sie die Umfrage abgeschlossen haben wird Ihre Auszahlung Ihnen überwiesen und per Screenshot an Ihre Email-Adresse bestätigt. Damit können Sie sich sicher sein, dass "heute" auch wirklich heute bedeutet.

To start with, you will receive a small thank-you gift of 20 Euros for your participation, divided into two payments of 10 Euro each at different points in time. These two points in time are determined as follows:

You now have to make 15 decisions on how you want to divide the money between three different points in time. These points in time are:

- First point in time (today): today
- Second point in time (week 1): in one week from today
- Third point in time (week 2): in two weeks from today

Each decision is about two of these three points in time:

- In the first five decisions, divide money between today and week 1 (one week from now).
- In the second five decisions, divide money between week 1 (in one week) and week 2 (in a fortnight).
- In the third five decisions, divide money between today and week 2 (in a fortnight).

Accordingly, you will receive your payouts directly via your chosen payment method (PayPal or bank transfer) at the earliest today and at the latest in a fortnight.

Once you have made all 15 choices, we will randomly select one of those choices. The payouts chosen in that decision will then be made by us.

Important:
Each of your 15 choices will be selected with equal probability for the actual payout. The two 10 euro payments described above are then added to the two randomly selected times. So in each case you will receive 10 euro at the earlier selected time and 10 euro at the later selected time.
As soon as you have completed the survey, your payment will be transferred to you and confirmed by screenshot to your e-mail address. This way you can be sure that 'today' really means today.

Beispiel

Auf den folgenden drei Seiten können Sie nun Ihre Entscheidungen treffen.

Jede Zeile stellt dabei eine einzelne Entscheidung dar, wie Sie Geld zwischen zwei verschiedenen Zeitpunkten aufteilen. Dabei stehen Ihnen jeweils zwei Zeitpunkte zur Verfügung - ein früherer und ein späterer. Indem Sie den Schieberegler verschieben können Sie Geld zwischen den beiden Zeitpunkten umverteilen.

Wichtig:

Auszahlungen zum früheren und zum späteren Zeitpunkt stehen im direkten Austausch zueinander: Wenn die frühere Auszahlung abnimmt, steigt im Gegenzug automatisch die spätere Auszahlung. Das Verhältnis, in dem diese Auszahlungen gegeneinander getauscht werden, wird anhand einer „Tauschrate“ angegeben.

Diese Tauschrate wird als ein Verhältnis 1 : *X* dargestellt. Dies bedeutet, dass wenn Sie die frühere Auszahlung um 1 EUR erhöhen, die zweite Auszahlung um X EUR fällt. Stellen Sie für jede Entscheidung den entsprechenden Schieberegler auf die Auszahlungskombination, die Ihnen am meisten zusagt.

Zum Beispiel: Nehmen Sie an, Sie entscheiden sich in der von uns ausbezahlten Entscheidung für 10,50 EUR zum früheren Zeitpunkt (heute) und 10,00 EUR zum späteren Zeitpunkt (in einer Woche, Woche 1). Dann erhalten Sie als Auszahlung heute 10,50 EUR zusätzlich zu Ihrer pauschalen Auszahlung von 10,00 EUR, also 20,50 EUR insgesamt. In Woche 1 würden Sie die 10,00 EUR zusätzlich zu den 10,00 EUR der zweiten pauschalen Auszahlung erhalten, d.h. 20,00 EUR insgesamt.

Sobald Sie alle 15 Entscheidungen getroffen haben werden wir eine dieser Entscheidungen zufällig auswählen. Die in dieser Entscheidung gewählten Auszahlungen werden dann von uns durchgeführt. Denken Sie daran, dass jede Entscheidung zufällig zur Umsetzung ausgewählt werden kann! **Sie sollten also jede der Entscheidungen so treffen, als ob sie es ist, die am Ende tatsächlich zählt!**

You can now make your decisions on the following three pages.

Each line represents a single decision on how to divide money between two different points in time. You have two points in time at your disposal - one earlier and one later. By moving the slider you can redistribute money between the two points in time.

Important:
Payouts at the earlier and later times are in direct exchange with each other: if the earlier payout decreases, the later payout automatically increases in return. The ratio in which these payouts are exchanged for each other is indicated by an ”exchange rate”.
This exchange rate is represented as a 1:X ratio. This means that if you increase the earlier payout by 1 EUR, the second payout will fall by X EUR. For each decision, set the corresponding slider to the payout combination that suits you most.

For example: For example: Suppose in the decision chosen by us you decide that we pay out 10.50 EUR at the earlier time (today) and 10.00 EUR at the later time (in a week, week 1). Then you would receive 10.50 EUR as a payout today in addition to your lump sum payout of 10.00 EUR, i.e. 20.50 EUR in total. In week 1 you would receive the 10.00 EUR in addition to the 10.00 EUR of the second lump sum payout, i.e. 20.00 EUR in total.

Once you have made all 15 decisions, we will randomly select one of these decisions. We will then make the payouts selected in that decision. Remember that each decision can be randomly selected for implementation! **So you should make each of the decisions as if it is the one that actually counts in the end!**

Slider1

Positionieren Sie den Regler auf den Skalen, um die Auszahlung zwischen heute und in einer Woche (Woche 1) aufzuteilen.

*Entscheidung 1: Tauschrate 1:0,95

heute 10 Woche 1

*Entscheidung 2: Tauschrate 1:1,00

heute 10 Woche 1

*Entscheidung 3: Tauschrate 1:1,11

heute 10 Woche 1

*Entscheidung 4: Tauschrate 1:1,25

heute 10 Woche 1

*Entscheidung 5: Tauschrate 1:1,43

heute 10 Woche 1

Position the slider on the scales to divide the payout between today and in one week (week 1).

- Decision 1: Exchange rate 1:0.95
- Decision 2: Exchange rate 1:1.00
- Decision 3: Exchange rate 1:1.11
- Decision 4: Exchange rate 1:1.25
- Decision 5: Exchange rate 1:1.43

Entscheidung 2

Herzlichen Dank für Ihre Antworten.

Die folgenden Entscheidungen beziehen sich auf Woche 1 und Woche 2.

Thank you very much for your answers.

The following decisions refer to week 1 and week 2.

Slider2_9

Positionieren Sie den Regler auf den Skalen, um die Auszahlung zwischen in einer Woche (Woche 1) und in zwei Wochen (Woche 2) aufzuteilen.

*Entscheidung 1: Tauschrate 1:0,95

Woche 1 10 Woche 2

*Entscheidung 2: Tauschrate 1:1,00

Woche 1 10 Woche 2

*Entscheidung 3: Tauschrate 1:1,11

Woche 1 10 Woche 2

*Entscheidung 4: Tauschrate 1:1,25

Woche 1 10 Woche 2

*Entscheidung 5: Tauschrate 1:1,43

Woche 1 10 Woche 2

Position the slider on the scales to split the payout between in one week (week 1) and in a fortnight (week 2).

- Decision 1: Exchange rate 1:0.95
- Decision 2: Exchange rate 1:1.00
- Decision 3: Exchange rate 1:1.11
- Decision 4: Exchange rate 1:1.25
- Decision 5: Exchange rate 1:1.43

Entscheidung 3

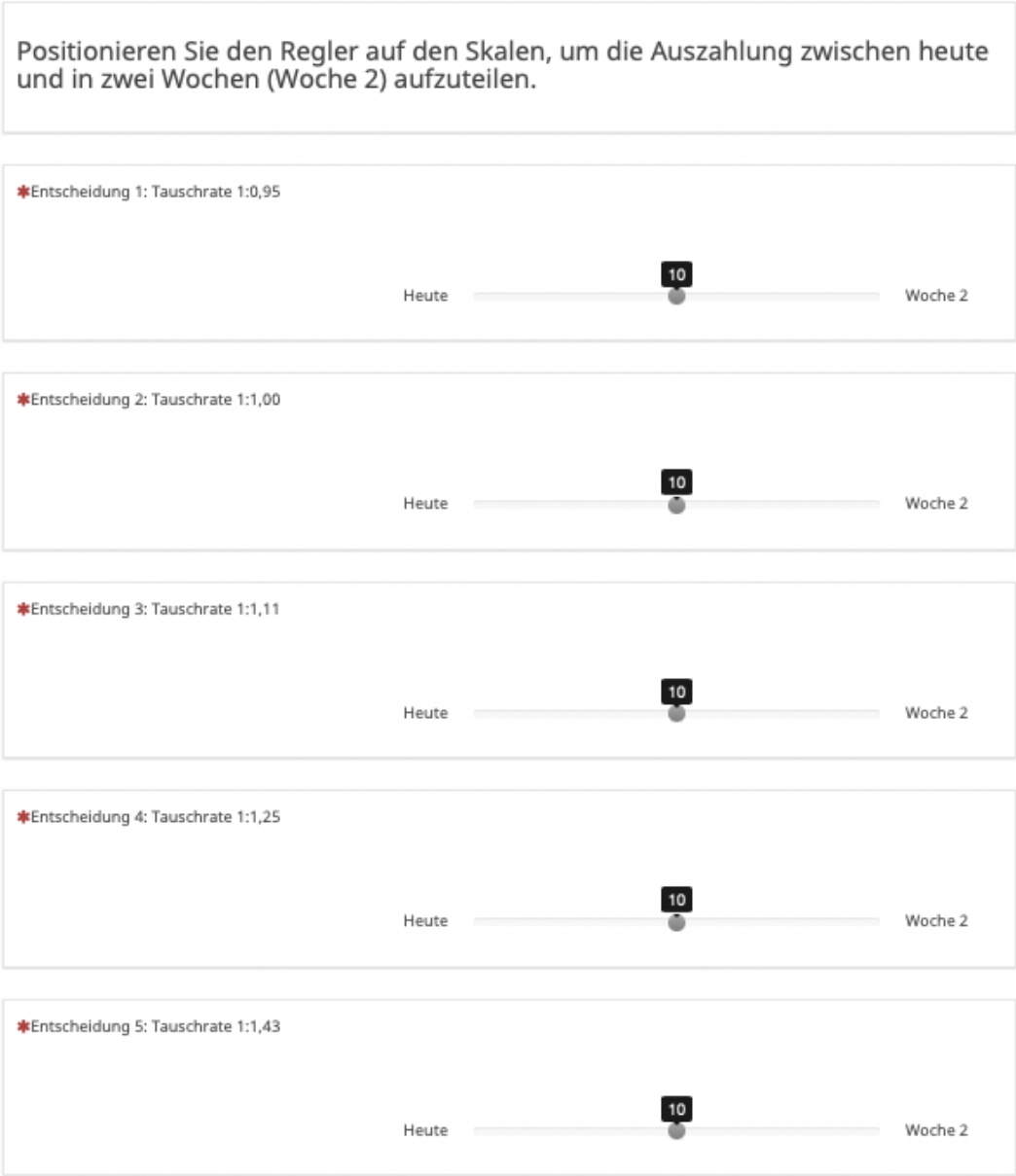
Herzlichen Dank für Ihre Antworten.

Die folgenden Entscheidungen beziehen sich auf heute und Woche 2.

Thank you very much for your replies.

The following decisions refer to today and week 2.

Slider3_9



Position the slider on the scales to split the payout between today and in a fortnight (week 2).

- Decision 1: Exchange rate 1:0.95
- Decision 2: Exchange rate 1:1.00
- Decision 3: Exchange rate 1:1.11
- Decision 4: Exchange rate 1:1.25
- Decision 5: Exchange rate 1:1.43

Questionnaire

Bitte beantworten Sie die folgenden Fragen.

*Bitte geben Sie Ihr Alter in Jahren ein.

Bitte geben Sie Ihr Geschlecht an.

Bitte wählen Sie eine der folgenden Antworten:

- Weiblich
- Männlich
- Keine Antwort

*Welche der folgenden Aussagen beschreibt die Hauptfunktion des Aktienmarkts?

Bitte wählen Sie eine der folgenden Antworten:

- Der Aktienmarkt hilft bei der Vorhersage der Aktienrenditen.
- Der Aktienmarkt führt zu einem Ansteigen der Aktienkurse.
- Der Aktienmarkt ist der Ort, an dem Käufer und Verkäufer von Aktien miteinander handeln können.
- Keine der bisherigen Antwortmöglichkeiten.
- Weiß ich nicht.
- Keine Antwort.

Please answer the following questions.

- Please enter your age in years.
- Please enter your gender.
  Please choose one of the following answers:
  - Female
  - Male
  - No answer
- Which of the following describes the main function of the stock market?
  Please choose one of the following answers:
  - The stock market helps in predicting stock returns.
  - The stock market causes stock prices to rise.
  - The stock market is the place where buyers and sellers of stocks can trade with each other.
  - None of the previous answer choices.
  - Don't know.
  - No answer.

*Welche der folgenden Aussagen ist richtig? Wenn jemand die Aktie von Firma B auf dem Aktienmarkt erwirbt:

Bitte wählen Sie eine der folgenden Antworten:

- Gehört ihm ein Teil von Firma B.
- Leiht er Firma B Geld.
- Haftet er für die Schulden von Firma B.
- Keine der bisherigen Antwortmöglichkeiten.
- Weiß ich nicht.
- Keine Antwort.

*Welche der folgenden Aussagen ist richtig?

Bitte wählen Sie eine der folgenden Antworten:

- Sobald jemand in einen Investmentfonds investiert hat, kann er sein Geld nicht während des ersten Jahres zurückbekommen.
- Investmentfonds können in mehrere Vermögensanlagen investieren, zum Beispiel in Aktien und Anleihen.
- Investmentfonds zahlen eine garantierte Rendite welche sich an vergangenen Renditen bemisst.
- Keine der bisherigen Antwortmöglichkeiten.
- Weiß ich nicht.
- Keine Antwort.

*Welche der folgenden Aussagen ist richtig? Wenn jemand die Anleihe von Firma B erwirbt:

Bitte wählen Sie eine der folgenden Antworten:

- Gehört ihm ein Teil von Firma B.
- Leiht er Firma B Geld.
- Haftet er für die Schulden von Firma B.
- Keine der bisherigen Antwortmöglichkeiten.
- Weiß ich nicht.
- Keine Antwort.

- Which of the following statements is correct? If someone buys the share of company B in the stock market:
  Please choose one of the following answers:
  - He owns part of company B.
  - He lends money to company B.
  - He is liable for the debts of company B.
  - None of the previous answer options.
  - Don't know.
  - No answer.
- Which of the following statements is correct?
  Please choose one of the following answers:
  - Once someone has invested in a mutual fund, they cannot get their money back during the first year.
  - Mutual funds can invest in several assets, for example, stocks and bonds.
  - Mutual funds pay a guaranteed return which is based on past returns.
  - None of the previous answer choices.

  - Don't know.
  - No answer.

- Which of the following statements is correct? If someone buys a bond from company B: Please choose one of the following answers:
  - He owns part of company B.
  - He lends money to company B.
  - He is liable for the debts of company B.
  - None of the previous answer options.
  - Don't know.
  - No answer.

*Betrachten Sie einen langen Zeitraum (zum Beispiel 10 oder 20 Jahre). Welche Vermögensanlagen bieten im Schnitt die höchsten Renditen?

Bitte wählen Sie eine der folgenden Antworten:

- Sparkonto;
- Anleihen;
- Aktien;
- Weiß ich nicht;
- Keine Antwort.

*Welche Vermögensanlagen verzeichnen normalerweise die höchsten Wertschwankungen?

Bitte wählen Sie eine der folgenden Antworten:

- Sparkonto;
- Anleihen;
- Aktien;
- Weiß ich nicht;
- Keine Antwort.

*Wenn ein Investor sein Geld in verschiedene Vermögenswerte investiert, wie verändert sich dann dessen Risiko, Geld zu verlieren?

Bitte wählen Sie eine der folgenden Antworten:

- Es steigt;
- Es sinkt;
- Es bleibt gleich;
- Weiß ich nicht;
- Keine Antwort.

- Consider a long period of time (for example, 10 or 20 years). Which asset investments offer the highest returns on average?
  Please choose one of the following answers:
  - Savings account;
  - Bonds;
  - Shares;
  - Don't know;
  - No answer.
- Which asset investments usually experience the highest fluctuations in value?
  Please choose one of the following answers:
  - Savings account;
  - Bonds;
  - Stocks;
  - I do not know;
  - No answer.
- If an investor invests his money in different assets, how does his risk of losing money change?
  Please choose one of the following answers:
  - It increases;

- It decreases;;
- It stays the same;
- I don't know;
- No answer.

*Wenn Sie eine zehnjährige Anleihe kaufen, bedeutet das, dass sie diese nicht nach 5 Jahren ohne erhebliche Verluste verkaufen können. Richtig oder Falsch?

Bitte wählen Sie eine der folgenden Antworten:

- Richtig;
- Falsch;
- Weiß ich nicht;
- Keine Antwort.

*Aktien sind normalerweise riskanter als Anleihen. Richtig oder Falsch?

Bitte wählen Sie eine der folgenden Antworten:

- Richtig;
- Falsch;
- Weiß ich nicht;
- Keine Antwort.

*Eine einzelne Aktie ist normalerweise weniger riskant als ein Aktienfonds. Richtig oder Falsch?

Bitte wählen Sie eine der folgenden Antworten:

- Richtig;
- Falsch;
- Weiß ich nicht;
- Keine Antwort.

*Wenn der Zinssatz fällt, was passiert dann mit den Preisen von Anleihen?

Bitte wählen Sie eine der folgenden Antworten:

- Sie steigen;
- Sie sinken;
- Sie bleiben gleich;
- Weiß ich nicht;
- Keine Antwort.

- If you buy a ten-year bond, it means that you cannot sell it after 5 years without incurring substantial losses. True or False?
  Please choose one of the following answers:
  - True;
  - False;
  - Don't know;
  - No answer.
- Stocks are usually riskier than bonds. True or False?
  Please choose one of the following answers:
  - True;
  - False;
  - Don't know;
  - No answer.

- An individual share is usually less risky than an equity fund. True or False?
  Please choose one of the following answers:
  - True;
  - False;
  - Don't know;
  - No answer.
- When the interest rate falls, what happens to the prices of bonds?
  Please choose one of the following answers:
  - They go up;
  - They go down;
  - They stay the same;
  - I don't know;
  - No answer.

Experiment 2

Herzlich Willkommen und vielen Dank für Ihre Teilnahme an unserer Studie!

Die Studie wird von der [redacted] Die Dauer der Studie beträgt in der Regel nicht länger als **30 Minuten**. In dieser Studie müssen Sie eine Reihe von Entscheidungen treffen sowie Aufgaben bearbeiten.

Wichtig:

Sie verdienen durch Ihre Teilnahme an dieser Studie 100 Euro! (Die Auszahlung erfolgt wahlweise direkt über Ihren PayPal Account oder per Überweisung auf ein Girokonto Ihrer Wahl.)

Mit Ihrer Teilnahme unterstützen Sie unsere aktuelle Forschung im Bereich Verhaltensökonomie und Finanzen. Wir arbeiten täglich daran besser zu verstehen, wie sich Menschen in wirtschaftlichen Situationen verhalten, um sie dabei zu unterstützen bessere Entscheidungen zu treffen. Ohne Leute wie Sie, die unsere Forschung durch Ihre Teilnahme an Studien wie diesen unterstützen, wäre unsere Arbeit nicht möglich - daher möchten wir uns jetzt schon einmal ganz herzlich bei Ihnen bedanken!

Wichtig:

All Ihre Daten und Angaben werden absolut vertraulich und gewissenhaft behandelt und nur zu Forschungszwecken verwendet. Insbesondere werden alle Daten im Rahmen der wissenschaftlichen Auswertung nur vollständig anonymisiert verarbeitet. Die Ergebnisse werden ausschließlich in anonymisierter Form, d.h. ohne Namen und Anschrift dargestellt. Das bedeutet: Niemand kann aus den Ergebnissen erkennen, von welcher Person diese Angaben gemacht worden sind.

Wir, [redacted] stehen Ihnen als Leiter dieser Studie **jederzeit für Fragen zur Verfügung**. Schreiben Sie uns dafür am besten eine e-Mail an [redacted] oder kontaktieren uns telefonisch unter [redacted].

Welcome and thank you for participating in our study!

The study is conducted by X. The duration of the study is usually no longer than 30 minutes. In this study, you will have to make a number of decisions as well as complete tasks.

Important:
You earn 100 euro by participating in this study! (You can choose to be paid directly via your PayPal account or by bank transfer to a current account of your choice).

With your participation you support our current research in the field of behavioural economics and finance. We work every day to better understand how people behave in economic situations to help them make better decisions. Without people like you supporting our research through your participation in studies like these, our work would not be possible - so we would like to thank you very much right now!

Important:
All your data and information will be treated absolutely confidentially and conscientiously and will only be used for research purposes. In particular, all data will only be processed completely anonymously within the framework of the scientific evaluation. The results are presented exclusively in anonymised form, i.e. without names and addresses. This means that no one can tell from the results which person provided the information.

We, X and Y, are available to answer your questions at any time. Please send us an e-mail at XX@XX.XX or contact us by phone at XXX - XXXX.

Timeline

Regeln für die Teilnahme an dieser Studie:

Ihre Teilnahme an dieser Studie erfordert, dass Sie an drei aufeinander folgenden Zeitpunkten jeweils online eine Reihe von Entscheidungen treffen. Der Zeitrahmen bewegt sich zwischen 10 Minuten und 30 Minuten pro Woche. Diese Zeitpunkte werden wie folgt festgelegt:

- Erster Zeitpunkt: **Heute, der** Heute
- Zweiter Zeitpunkt: **Heute in einer Woche, der** Heute in einer Woche, der Heute in einer Woche (frei wählbar zwischen 0.00 und 24.00)
- Dritter Zeitpunkt: **Heute in zwei Wochen, der Heute in einer Woche, der Heute in einer Woche** (frei wählbar zwischen 0.00 und 24.00)

Nach vollständiger Teilnahme an unserer Studie erhalten Sie 100€. Sollten Sie vor Ablauf der Studie Ihre Teilnahme beenden, erhalten Sie in zwei Wochen eine Auszahlung von 10€. Die Auszahlung erfolgt dabei direkt über die von Ihnen gewählte Zahlungsmethode (PayPal oder Überweisung), so wie Sie das bereits aus Ihrer bisherigen Teilnahme an unseren Studien kennen.

Wichtig:

Nachdem Sie Ihre Entscheidungen in Woche 2 getroffen haben, wird Ihre Auszahlung durchgeführt und eine Bestätigung an Ihre Email-Adresse versendet.

***Teilnehmen**

Bitte klicken Sie auf "Ja, jetzt teilnehmen", um jetzt mit der Studie zu beginnen. Die zweite und dritte Sitzung finden in diesem Fall genau eine bzw. zwei Wochen nach Ihrer erstmaligen Teilnahme an der Studie statt. Wenn Sie nicht jetzt direkt teilnehmen möchten, können Sie alternativ über den Link aus der Emaileinladung noch bis zum 16. Dezember 2019 an der Studie teilnehmen.

Sie erklären sich hiermit einverstanden, dass wir Ihre Angaben aus dieser Studie mit denen Ihrer vergangenen Teilnahme verknüpfen. Auch hier gilt, dass sämtliche Auswertungen in anonymisierter Form erfolgen.

Wie verknüpfen wir Ihre Daten?

Wir ordnen jeder an unserer Studie teilnehmenden e-Mail-Adresse eine zufällige Nummer zu. Diese Zuordnung wird separat von den von Ihnen gemachten Angaben aufbewahrt und ist stets von Ihren Angaben im Rahmen der Studie getrennt.

○ Ja, jetzt teilnehmen.

Rules for participating in this study:

Your participation in this study requires you to make a series of choices online at each of three consecutive points in time. The time frame ranges from 10 minutes to 30 minutes per week. These points in time are set as follows:

- First point in time: **Today**, the XX
- Second point in time: **Today in one week**, the XX, (freely selectable between 0.00 and 24.00)
- Third point in time: **Today in a fortnight**, the XX (freely selectable between 0.00 and 24.00)

After full participation in our study you will receive 100 euro. If you end your participation before the end of the study, you will receive a payout of 10 euro in a fortnight. The payout will be made directly via your chosen payment method (PayPal or bank transfer), as you already know from your previous participation in our studies.

Important:
After you have made your decisions in week 2, your payout will be made and a confirmation will be sent to your e-mail address.

Please click on "Yes, participate now" to start the study now. In this case, the second and third sessions will take place exactly one and two weeks respectively after your initial participation in the study. Alternatively, if you do not wish to participate directly now, you can still participate in the study until XX XX XXXX using the link from the e-mail invitation.
You hereby consent to us linking your details from this study with those from your past participation. Again, all analysis will be anonymous.
How do we link your data?
We assign a random number to each e-mail address participating in our study. This assignment is kept separate from the information you provide and is always kept separate from the information you provide as part of the study.

- Yes, participate now

Beispiel

Aufgaben:

- Sie müssen im Rahmen unserer Studie zu jedem der drei Zeitpunkte eine Reihe von Aufgaben erledigen.
- Sie treffen eine Reihe von Entscheidungen, **wie viele** Aufgaben Sie **wann** erledigen möchten. Eine Ihrer Entscheidungen wird dann zufällig ausgewählt und bestimmt dann wie viele Aufgaben Sie zu welchem Zeitpunkt tatsächlich erledigen müssen, um die Studie erfolgreich abzuschließen.
- Wichtig: In jedem Fall müssen Sie **an allen drei Zeitpunkten** zumindest einige Aufgaben erledigen. **Unabhängig davon**, wie Sie sich entscheiden, müssen Sie also in jedem Fall an allen drei Terminen teilnehmen!

Ihre Aufgabe besteht im „Transkribieren" griechischer Buchstaben: Eine griechische Zeichenfolge erscheint in der Transkriptions-Box auf Ihrem Bildschirm. Für jeden verschwommen dargestellten griechischen Buchstaben müssen Sie den entsprechend richtigen Buchstaben aus einer Liste auswählen und in das Fenster auf Ihrem Bildschirm eingeben. Damit die Aufgabe als erfüllt angesehen wird, müssen Sie 80% der Buchstaben korrekt auswählen.

Wichtig:

In jedem Fall müssen Sie an allen drei Zeitpunkten teilnehmen und zumindest einige Aufgaben erledigen. Unabhängig davon, wie Sie sich entscheiden, müssen Sie also in jedem Fall zu allen drei Terminen teilnehmen!

Tasks:

- You have to do a number of tasks at each of the three time points in our study.
- You make a series of decisions about how many tasks you want to complete and when. One of your choices will then be randomly selected and will then determine how many tasks you actually need to complete at what time in order to successfully complete the study.
- Important: In any case, you must complete at least some tasks at all three time points. So, regardless of what you decide, you will have to participate in all three dates in any case!

Your task is to "transcribe" Greek letters: A Greek string appears in the transcription box on your screen. For each blurred Greek letter, you have to choose the corresponding correct letter from a list and type it into the window on your screen. You must select 80% of the letters correctly for the task to be considered completed.

Important:
In any case, you must participate in all three time points and complete at least some tasks. So regardless of what you decide, you must participate at all three time points in any case!

Zeitplan

Der Zeitplan:

Zeitpunkt 1 (heute):

- Gleich werden wir Sie bitten fünf solcher Aufgaben zu absolvieren.
- Im Anschluss bitten wir Sie fünf Entscheidungen zu treffen: In diesen Entscheidungen werden Sie gebeten festzulegen, wie viele Aufgaben Sie an Zeitpunkt 2 und wie viele an Zeitpunkt 3 erledigen wollen.
- Beachten Sie, dass diese Aufgaben zusätzlich zu fünf Mindestaufgaben, die Sie in jedem Fall zu jedem Termin erledigen müssen, zu bearbeiten sind.

Zeitpunkt 2 (in einer Woche):

- In einer Woche schicken wir Ihnen eine weitere E-Mail. Darin bitten wir Sie, erneut fünf Entscheidungen zu treffen. Danach wird eine Ihrer insgesamt zehn Entscheidungen umgesetzt.
- Diese Aufgaben sind zusätzlich zu den fünf Mindestaufgaben, die Sie in jedem Fall zu jedem Termin erledigen müssen, zu bearbeiten.
- Wenn Sie nicht erneut teilnehmen oder die Aufgaben des zweiten Zeitpunkts nicht erledigen, können Sie die Studie nicht abschließen, und Sie erhalten nach Beendigung der Studie nur die Mindestauszahlung von 10 Euro.
- Damit Ihre Aufgaben zu Zeitpunkt 2 gezählt werden können, müssen Sie an diesem Tag bis um Mitternacht eingereicht werden.

Zeitpunkt 3 (in zwei Wochen):

- In zwei Wochen schicken wir Ihnen eine weitere E-Mail.
- In Zeitpunkt 3 müssen Sie entsprechend Ihrer vorherigen Entscheidung weiterhin Aufgaben bearbeiten zusätzlich zu den fünf Mindestaufgaben, die Sie in jedem Fall zu jedem Termin erledigen müssen.
- Wenn Sie nicht erneut teilnehmen oder die Aufgaben des dritten Zeitpunkts nicht erledigen, können Sie die Studie nicht abschließen, und Sie erhalten nur die Mindestauszahlung von 10 Euro.
- Damit Ihre Aufgaben zu Zeitpunkt 3 gezählt werden können, müssen sie an diesem Tag bis um Mitternacht eingereicht werden.

Nach erfolgreichem Abschluss der Studie überweisen wir Ihnen unverzüglich 100 Euro per PayPal oder Online-Überweisung – je nachdem welche Auszahlungsvariante Sie bevorzugen. Sollten Sie am zweiten oder dritten Zeitpunkt nicht teilgenommen haben, erhalten Sie zu diesem Zeitpunkt die Mindestauszahlung in Höhe von 10 Euro.

Timetable:

Time 1 (today):

- In a moment we will ask you to complete five such tasks.
- Then we will ask you to make five decisions: In these decisions you will be asked to determine how many tasks you will complete at Time 2 and how many at Time 3.
- Note that these tasks are in addition to five minimum tasks that you must complete at each time point.

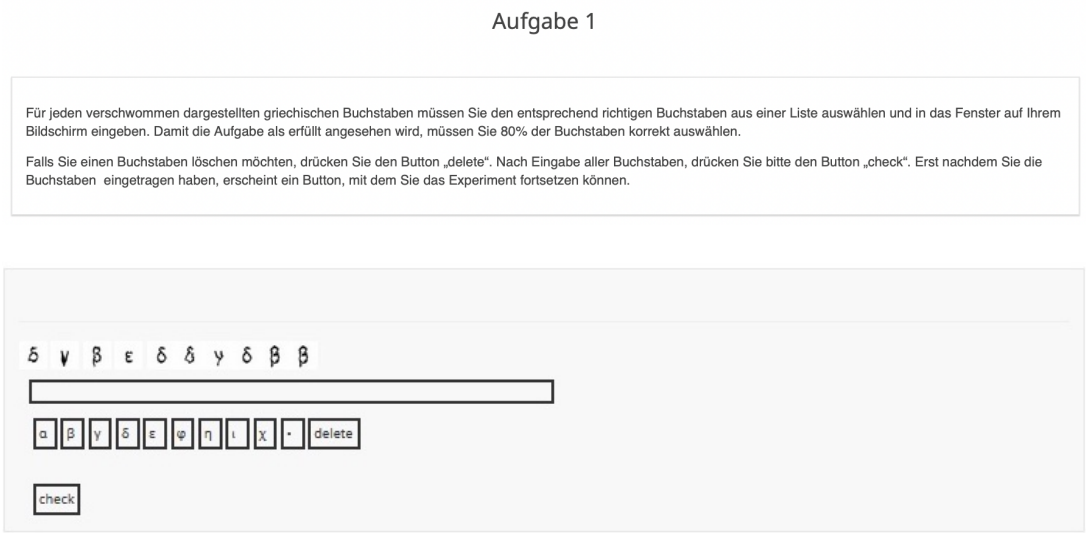
Time 2 (in one week):

- In a week's time, we will send you another e-mail. In it, we will ask you to make five decisions again. After that, one of your ten decisions in total will be implemented.
- These tasks are in addition to the five minimum tasks that you have to complete at each appointment.
- If you do not participate again or do not complete the tasks of the second time point, you will not be able to complete the study and you will only receive the minimum payout of 10 euro after completing the study.
- In order for your Time 2 tasks to be counted, they must be submitted by midnight on that day.

Time 3 (in a fortnight):

- In a fortnight, we will send you another e-mail.
- At Time 3, you must continue to complete tasks according to your previous decision in addition to the five minimum tasks you must complete at each deadline.
- If you do not participate again or do not complete the tasks of the third time point, you will not be able to complete the study and you will only receive the minimum payout of 10 euros.
- In order for your Time 3 tasks to be counted, they must be submitted by midnight on that day.

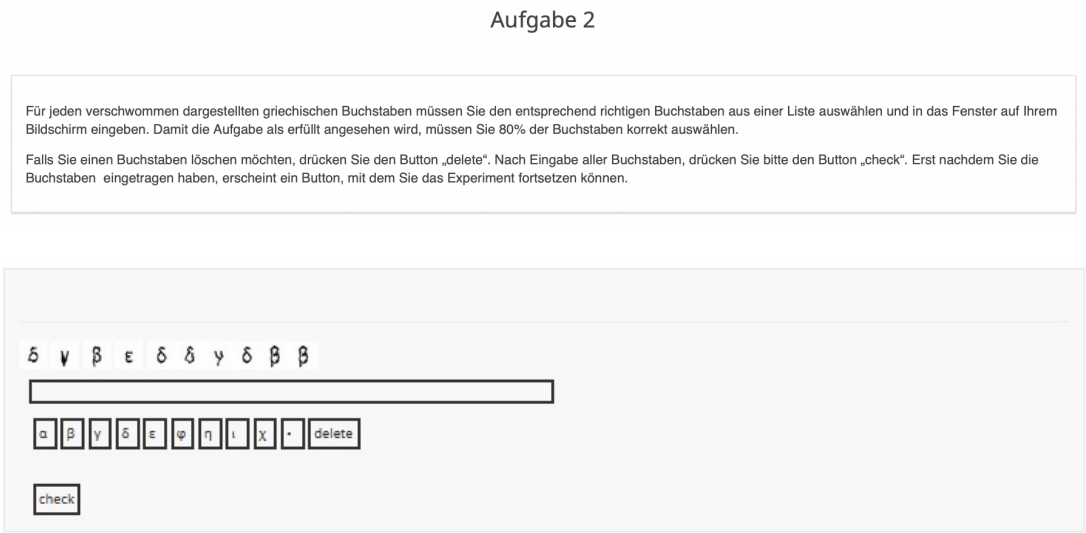
After successful completion of the study, we will immediately transfer 100 euro to you via PayPal or online bank transfer - depending on which payment option you prefer. If you did not participate on the second or third date, you will receive the minimum payout of 10 euro at that time.



Task 1

For each blurred Greek letter, you must select the corresponding correct letter from a list and type it into the window on your screen. For the task to be considered completed, you must select 80% of the letters correctly.

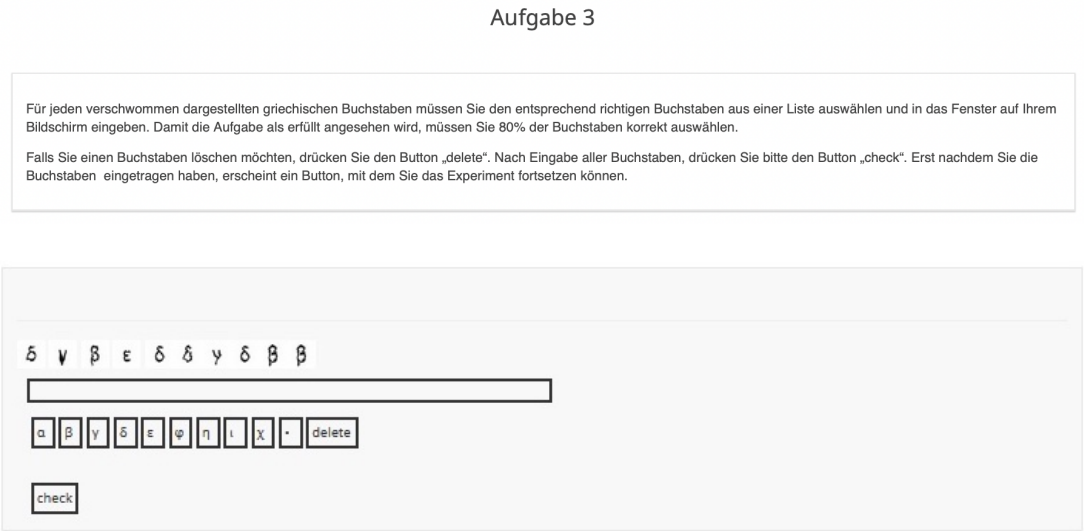
If you want to delete a letter, press the button "delete". After entering all letters, press the button "check". Only after you have entered the letters a button will appear with which you can continue the experiment.



Task 2

For each blurred Greek letter, you must select the corresponding correct letter from a list and type it into the window on your screen. For the task to be considered completed, you must select 80% of the letters correctly.

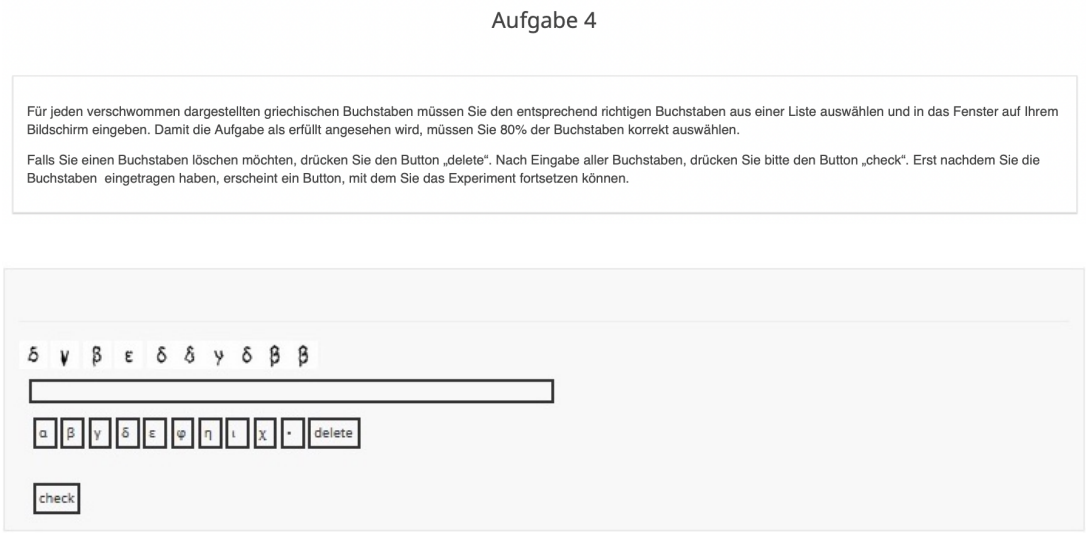
If you want to delete a letter, press the button ”delete”. After entering all letters, press the button ”check”. Only after you have entered the letters a button will appear with which you can continue the experiment.



Task 3

For each blurred Greek letter, you must select the corresponding correct letter from a list and type it into the window on your screen. For the task to be considered completed, you must select 80% of the letters correctly.

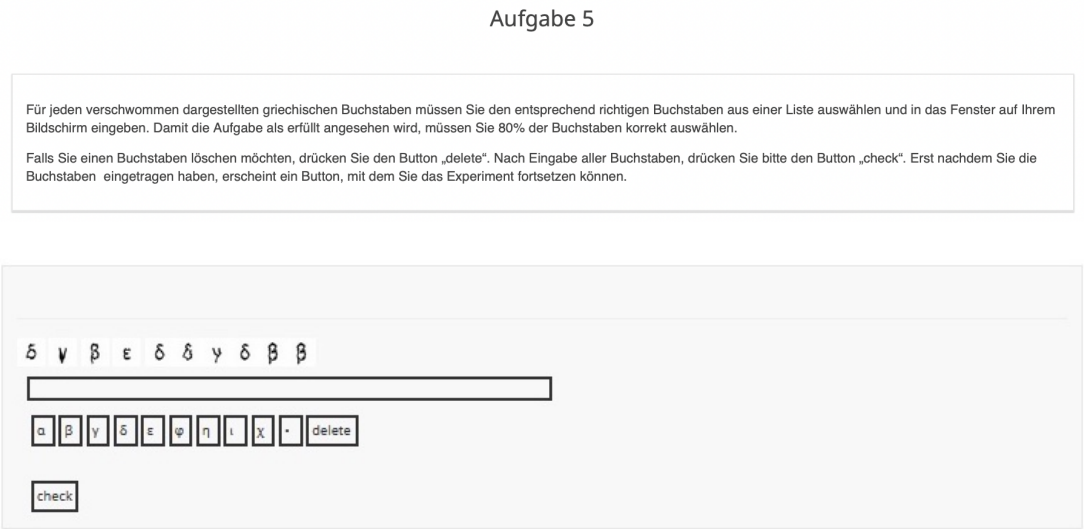
If you want to delete a letter, press the button "delete". After entering all letters, press the button "check". Only after you have entered the letters a button will appear with which you can continue the experiment.



Task 4

For each blurred Greek letter, you must select the corresponding correct letter from a list and type it into the window on your screen. For the task to be considered completed, you must select 80% of the letters correctly.

If you want to delete a letter, press the button ”delete”. After entering all letters, press the button ”check”. Only after you have entered the letters a button will appear with which you can continue the experiment.



Task 5

For each blurred Greek letter, you must select the corresponding correct letter from a list and type it into the window on your screen. For the task to be considered completed, you must select 80% of the letters correctly.

If you want to delete a letter, press the button ”delete”. After entering all letters, press the button ”check”. Only after you have entered the letters a button will appear with which you can continue the experiment.

Beispiel Slider

Auf der folgenden Seite können Sie nun Ihre Entscheidungen treffen:

Jede Zeile stellt dabei eine einzelne Entscheidung dar, wie Sie Aufgaben zwischen zwei verschiedenen Zeitpunkten aufteilen. Dabei stehen Ihnen zwei Zeitpunkte zur Verfügung - ein früherer und ein späterer. Indem Sie den Schieberegler verschieben, können Sie die Aufgaben zwischen den beiden Zeitpunkten umverteilen.

Wichtig:

Aufgaben zum früheren und zum späteren Zeitpunkt stehen im direkten Austausch zueinander: Wenn die frühere Aufgabe abnimmt, steigt im Gegenzug automatisch die Anzahl der späteren Aufgaben. Das Verhältnis, in dem diese Aufgaben gegeneinander getauscht werden, wird anhand einer „Tauschrate“ angegeben.

Diese Tauschrate wird als ein Verhältnis 1 : *X* dargestellt. Dies bedeutet, dass wenn Sie die früheren Aufgaben um 1 erhöhen, die spätere Anzahl an Aufgaben um X fällt. Stellen Sie für jede Entscheidung den entsprechenden Schieberegler auf die Aufgabenkombination, die Ihnen am meisten zusagt.

Auswahl der Entscheidung:

Heute treffen Sie 5 Allokationsentscheidungen für unterschiedliche Tauschraten. In einer Woche treffen Sie nochmals 5 Zuordnungsentscheidungen für unterschiedliche Tauschraten. Daher treffen Sie insgesamt 10 Allokationsentscheidungen, wann Sie Ihre Aufgaben erledigen möchten. Eine (zufällig ausgewählte) Entscheidung bestimmt anschließend die Aufteilung der tatsächlich zu erledigenden Arbeit.

Denken Sie daran, dass jede Entscheidung zufällig zur Umsetzung ausgewählt werden kann! **Sie sollten also jede der Entscheidungen so treffen, als ob sie es ist, die am Ende tatsächlich zählt!**

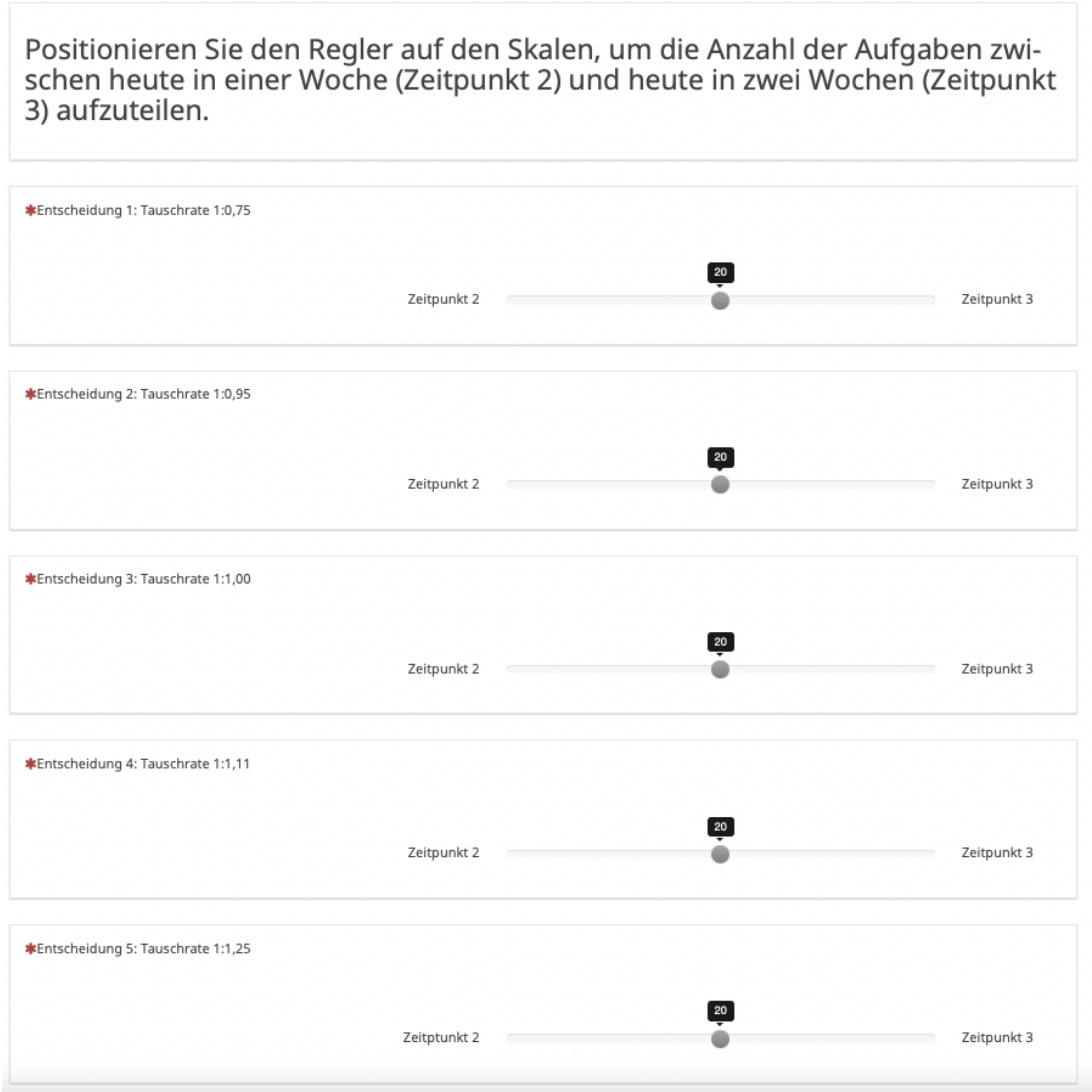
On the following page you can now make your decisions:

Each line represents a single decision on how to divide tasks between two different points in time. Two points in time are available to you - an earlier and a later one. By moving the slider, you can redistribute the tasks between the two points in time.

Important:
Tasks at the earlier and later time points are in direct exchange with each other: if the earlier task decreases, the number of later tasks automatically increases in return. The ratio in which these tasks are exchanged for each other is indicated by an "exchange rate". This exchange rate is represented as a 1 : X ratio. This means that if you increase the earlier tasks by 1, the later number of tasks will drop by X. For each decision, set the corresponding slider to the task combination that you like the most.

Selection of the decision:
Today you make 5 allocation decisions for different exchange rates. In one week, you make another 5 allocation decisions for different exchange rates. Therefore, you make a total of 10 allocation decisions about when to do your tasks. One (randomly selected) decision then determines the allocation of the actual work to be done.

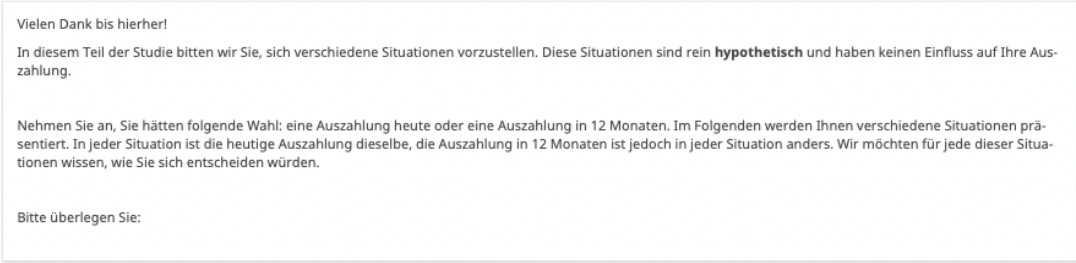
Remember that each decision can be randomly selected for implementation! **So you should make each of the decisions as if it is the one that actually counts in the end!**



Position the slider on the scales to divide the number of tasks between one week from today (time 2) and two weeks from today (time 3).

Decision 1: exchange rate 1:0,75

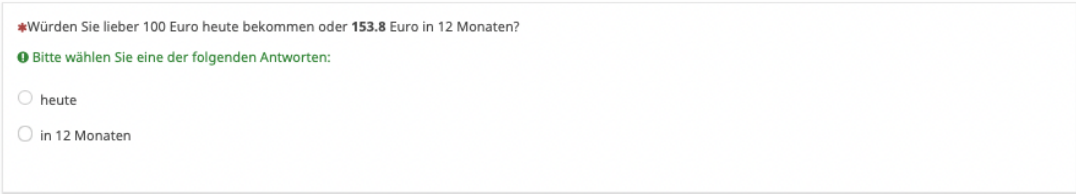
time 2 – time 3


Vielen Dank bis hierher!

In diesem Teil der Studie bitten wir Sie, sich verschiedene Situationen vorzustellen. Diese Situationen sind rein **hypothetisch** und haben keinen Einfluss auf Ihre Auszahlung.

Nehmen Sie an, Sie hätten folgende Wahl: eine Auszahlung heute oder eine Auszahlung in 12 Monaten. Im Folgenden werden Ihnen verschiedene Situationen präsentiert. In jeder Situation ist die heutige Auszahlung dieselbe, die Auszahlung in 12 Monaten ist jedoch in jeder Situation anders. Wir möchten für jede dieser Situationen wissen, wie Sie sich entscheiden würden.

Bitte überlegen Sie:


*Würden Sie lieber 100 Euro heute bekommen oder **153.8** Euro in 12 Monaten?

Bitte wählen Sie eine der folgenden Antworten:

heute

in 12 Monaten

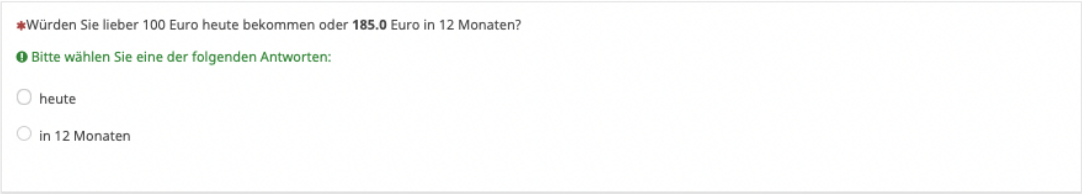
Thank you so far!

In this part of the study, we ask you to imagine different situations. These situations are purely hypothetical and have no influence on your payout.

Suppose you had the following choice: a payout today or a payout in 12 months. Below you will be presented with different situations. In each situation, the payout today is the same, but the payout in 12 months is different in each situation. For each of these situations, we would like to know what you would choose.

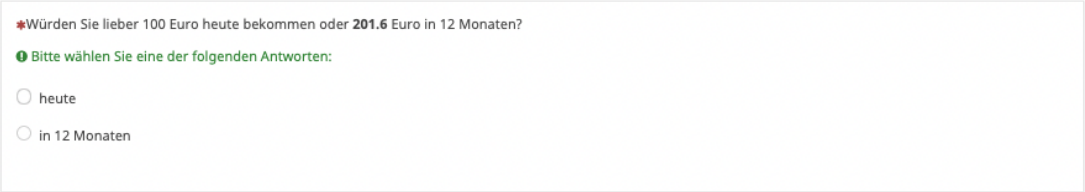
Please consider:
(Please note that the following screens presented are for a person always selecting "today".)
Would you rather get 100 euro today or 153.8 euro in 12 months?
Please choose one of the following answers:

- today
- in 12 months



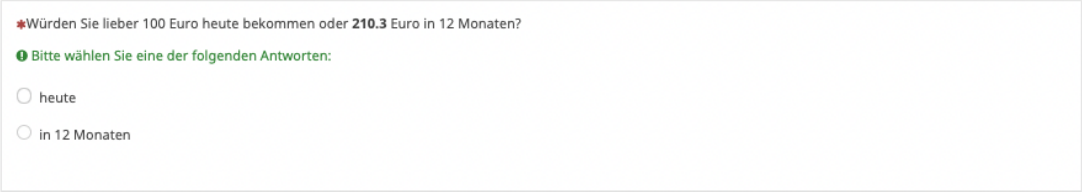
Would you rather get 100 euro today or 185.0 euro in 12 months?
Please choose one of the following answers:

- today
- in 12 months



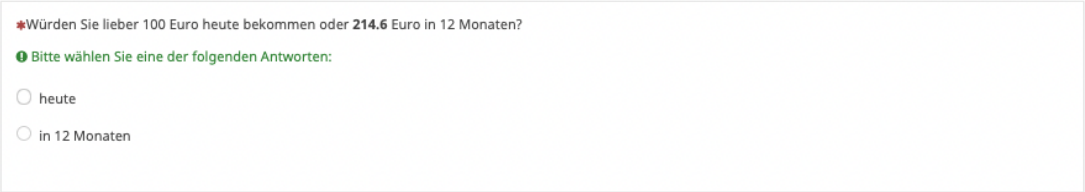
Would you rather get 100 euro today or 201.6 euro in 12 months?
Please choose one of the following answers:

- today
- in 12 months



Would you rather get 100 euro today or 210.3 euro in 12 months?
Please choose one of the following answers:

- today
- in 12 months



Would you rather get 100 euro today or 214.6 euro in 12 months?
Please choose one of the following answers:

- today
- in 12 months

Questionnaire

Bitte beantworten Sie die folgenden Fragen so wahrheitsgemäß wie möglich.

*Sind Sie im Vergleich zu anderen im Allgemeinen bereit, heute auf etwas zu verzichten, um in der Zukunft davon zu profitieren, oder sind Sie im Vergleich zu anderen dazu nicht bereit?

Bitte klicken Sie Ihre Antwort auf der Skala an, wobei der Wert 0 bedeutet "gar nicht bereit", und der Wert 10 bedeutet "sehr bereit". Mit den Werten dazwischen können Sie Ihre Einschätzung abstufen.

	0 - Gar nicht bereit	1	2	3	4	5	6	7	8	9	10 - Sehr bereit
	○	○	○	○	○	○	○	○	○	○	○

*Wie schätzen Sie sich persönlich ein: Sind Sie im Allgemeinen ein Mensch, der ungeduldig ist oder der immer sehr viel Geduld aufbringt?

Antworten Sie bitte anhand der folgenden Skala, wobei der Wert 0 bedeutet "sehr ungeduldig" und der Wert 10 "sehr geduldig". Mit den Werten dazwischen können Sie Ihre Einschätzung abstufen.

	0 - Sehr ungeduldig	1	2	3	4	5	6	7	8	9	10 - Sehr geduldig
	○	○	○	○	○	○	○	○	○	○	○

*Sind Sie im Allgemeinen ein Mensch, der lange überlegt und nachdenkt, bevor er handelt, also gar nicht impulsiv ist? Oder sind Sie ein Mensch, der ohne lange zu überlegen handelt, also sehr impulsiv ist?

Antworten Sie bitte anhand der folgenden Skala, wobei der Wert 0 bedeutet "gar nicht impulsiv" und der Wert 10 "sehr impulsiv". Mit den Werten dazwischen können Sie Ihre Einschätzung abstufen.

	0 - Gar nicht impulsiv	1	2	3	4	5	6	7	8	9	10 - Sehr impulsiv
	○	○	○	○	○	○	○	○	○	○	○

*Welches ist der höchste Bildungsabschluss, den Sie besitzen?

Bitte wählen Sie eine der folgenden Antworten:

- ○ Hauptschulabschluss
- ○ Realschulabschluss
- ○ Lehre
- ○ Abitur
- ○ Hochschulabschluss
- ○ Promotion
- ○ Sonstiges

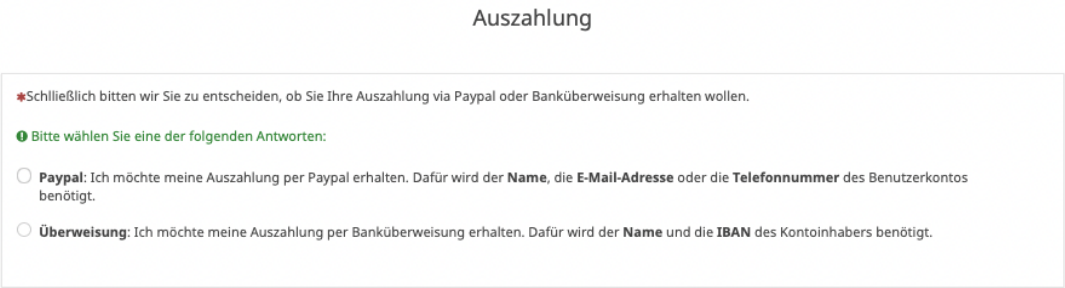
Questionnaire

Please answer the following questions as truthfully as possible.

- Compared to others, are you generally willing to give up something today in order to benefit from it in the future, or are you not willing to do so? Please tick your answer on the scale, where a value of 0 means "not at all willing" and a value of 10 means "very willing". You can use the values in between to grade your assessment.
- How do you personally rate yourself: Are you generally a person who is impatient or who is always very patient? Please answer using the following scale, where the value 0 means "very impatient" and the value 10 means "very patient". You can use the values in between to grade your assessment.
- Are you generally a person who thinks long and hard before acting, i.e. not impulsive at all? Or are you a person who acts without thinking long, i.e. very impulsive? Please answer using the

following scale, where the value 0 means "not at all impulsive" and the value 10 means "very impulsive". You can use the values in between to grade your assessment.

- What is the highest educational qualification you have? Please choose one of the following answers:
  - junior highschool
  - secondary high school
  - Apprenticeship
  - A-levels
  - University degree
  - Doctorate
  - Other



Payment

Finally, we ask you to decide whether you want to receive your payout via Paypal or bank transfer. Please choose one of the following answers:

- **Paypal**: I would like to receive my payout via Paypal. This requires the account **name**, **e-mail address** or **phone number**.
- **Bank transfer**: I would like to receive my payout by bank transfer. The **name** and **IBAN** of the account holder are required for this.