Measuring time preferences and anticipation: a lab experiment*

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November 23, 2015

Abstract

Several biases related to time preferences, in particular present and future biases, have important consequences on economic decisions. Present bias concerns individuals' self-control problem. Future bias can be defined as the anticipatory emotions individuals feel in the period preceding the consequences of their decision. Individual's acumen for anticipating also has economics consequences. The individual aware of his bias seeks to constrain his action to overcome the consequences of his bias. Whereas a naive individual does not anticipate his bias and might choose the wrong commitment or the wrong action plan. This paper proposes a methodology for eliciting anticipation of time preferences using a lab experiment. Though extensive literature exists on the measurement of time preferences and related biases, scant attention has been given to the elicitation of the anticipation of these biases. Thus, this paper reports on a lab experiment in two rounds with the same subjects. The second round elicits their time preferences regarding the temporal allocation of monetary rewards, whereas the first round elicits their anticipation of their allocation choices. I find that even though a majority of the participants can not be considered as biased and accurately anticipate their time preferences, when they are biased, both present- or future-biased participants tend to be naive about their bias, i.e., they underestimate their bias.

Keywords: Time inconsistencies ; naïveté; anticipation ; Convex Time Budget

JEL Classification Numbers: C91, D12, D91

*The most recent version of this paper can be found here. This work was supported by the French National Research Agency, through the program Investissements d'Avenir, ANR-10LABX_93-01. I would like to express my gratitude to Nicolas Jacquemet for his supervision and support during the realization of this paper. I thank for valuable comments and discussions Jean-Marc Tallon, Daniel Martin, Marie-Claire Villeval, Marc Willinger, Mohammed Abdellaoui, Anett John, David Laibson, Matthew Rabin, James Andreoni and Tomasz Strzalecki as well as the participants of the 2014 SABE conference, the 2014 and 2015 ASFEE conference, the 2015 AFSE conference and the 2015 IMEBESS conference.

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Introduction

Why do people enroll at gym and then never go to the gym? Two behavioral biases are responsible. First, people are present-biased if they have a self-control problem. They tend to postpone immediate costly activity, even if doing so will be more costly in the future or acting now could yield future benefits. So, for example, when present-biased people are deciding whether to go to the gym, they always postpone. Second, people can be naive about their present bias if they underestimate it. When they sign up for an annual membership, they are convinced they will go to the gym regularly. In other words, they do not anticipate their self-control problem. Only the combination of these two biases can explain this behavior. Indeed, if people were sophisticated, i.e., if they perfectly anticipated their self-control problem, they would not sign up for this subscription. The combination of these two biases also explains two contradictory facts: high credit-card borrowing and illiquid wealth accumulation (Laibson, Repetto and Tobacman (2007)). By choosing their illiquid assets, present-biased and naive people do not accurately anticipate their inability to resist the temptation of immediate consumption and thus, they contract costly short-term loans. Up til now, the experimental literature has focused mostly on eliciting present bias and, too little has been done to elicit naiveté bias. Thus, this paper aims to elicit, through a lab experiment, the accuracy of participants' ability to anticipate their own potential bias.

Everyone is inherently impatient. Economists have long considered that a decision-maker exponentially discounts her future utilities (Samuelson (1937)). Her relative preference for utility sooner date than later is always the same across time, provided that intervals between the two dates remain constant. Because her preferences are constant across time, she is time-consistent. However, this specification of time preferences alone can't explained some observed behaviors, such as those elicited in the two following studies. In one experimental study (Thaler (1981)), the participants exhibit decreasing impatience over time. In the other (Loewenstein (1987)), respondents to a survey are willing to pay relatively more to be kissed by their favorite movie star (or to avoid an electric shock) in the future rather than immediately. This behavior can't be explained by an exponential model unless negative discount rates are considered. Instead, in line with Bentham (1879) and Jevons (1905), Loewenstein explains these results by utility of anticipation: "anticipal pleasure" or "anticipal pain". The participants in Thaler and Loewenstein are time-inconsistent – they do not make the same decision if the immediate present is involved. In Thaler, they are present-biased; that is, they give stronger relative weight to the early utility. In Loewenstein, they are future-biased; that is, they value waiting and are more patient. Present-biased preferences are often meant to capture self-control problems, so empirical evidence for present bias is easy to find[1] and can have important consequences for some industries (casinos, gym clubs, credit-card companies) and for welfare.

It is important to distinguish whether people are able to anticipate their bias. In this paper, we adopt the terminology of O'Donoghue and Rabin (2001): when people are time-inconsistent, they are either *sophisticated* if they are perfectly aware of their bias (i.e., they can anticipate their bias when making a decision that involves the immediate present) or *naive* if they wrongly believe they will make this decision as if they were time-consistent. We can also consider that people can be *partially naive* (i.e., they can anticipate their bias but not its importance). Thus naiveté bias can have different, more important consequences than the time-inconsistency bias. Indeed, when sophisticated decision-makers look for commitments to have their hands tied, the naive ones fail to choose the right commitment. Moreover, through a wrong anticipation of future decisions, the naiveté bias can affect economic interactions. In a theoretical paper, DellaVigna and Malmendier (2004) show that as long as consumers are sophisticated, their present bias will have no effect on consumption levels, firms' profit, or social welfare. Firms have incentives to provide a perfect commitment to sophisticated present-biased consumers (i.e., firms set their prices such that they consume as often as if they were time-consistent). However naive consumers can't able to accurately anticipate their consumption decisions. Thus the degree of naiveté not only implies allocation inefficiencies but also can also be exploited by a monopoly, which take advantage of a fictive surplus, which are wrongly anticipated by naive consumers.

While time preferences and time-inconsistency biases are covered in a large number of empirical or experimental studies (Thaler (1981); Benhabib, Bisin and Schotter (2010); Andreoni and Sprenger (2012a); Andersen et al. (2008a)), relatively few papers have empirically or experimentally investigated the naiveté bias. Few empirical papers measure degree of naiveté (DellaVigna and Malmendier (2006); Skiba and Tobacman (2008); Acland and Levy (2015)). However, in real world situations, other factors might explain what seems to be a wrong anticipation of the future decision. For example, DellaVigna and Malmendier (2006) find that 80% of the people who buy an annual gym membership pay more than they would have paid per visit. They attribute this to the naiveté of consumers. Yet, other factors could, in part, explain this behavior. For example, one can imagine that people also derive utility by belonging to a sport club. Thus they are willing to pay more to be member of the club than they would pay for simply "dropping in" from time to time. One advantage of experimental studies is that they can be designed to capture only the part of the decision driven by naiveté bias. However, existing experimental studies mostly only investigate the existence of

[1]Overconsumption of addictive goods (e.g., gambling, drugs, alcohol, cigarettes) or procrastination to avoid immediate costs, even if the costs will be much higher in the future (e.g., writing a paper, doing administrative duties, going to the gym), are good examples of the effects of lake of self-control.

the naiveté bias through commitment choices (Ariely and Wertenbroch (2002)). They show that naiveté exists because participants can't choose the right commitment for themselves. To the best of my knowledge, only a single current working paper, by Augenblick and Rabin (n.d), investigates and quantifies the degree of naiveté bias using anticipation choices.

Thereby, this paper aims to measure naiveté bias through a lab experiment which is conducted in two rounds. During the second round, following the method of Andreoni and Sprenger (2012a), I give participants the opportunity to allocate a monetary budget between two dates to elicit their time preferences. I use different timing for the allocation. Comparing allocations made when the immediate present is involved with allocations made when only future dates are involved highlights potential time-inconsistency biases. What is new is that, in the first round, I simply ask the same participants to anticipate what their future allocations will be. The participants lose nothing by wrongly anticipating their future decisions. In other words, they can't commit themselves. Thus, the simple comparison between what they anticipate choosing and their actual decisions allows us to elicit their degree of naiveté.

I investigate, in a first step, if uniform and general behavior emerges when I aggregate the participants' decisions. I find there no general pattern for either time inconsistency or for the accuracy of the anticipation at the aggregate level. This finding can be explained by heterogeneity. Thus, in a second step, I study whether the characteristics of the decisions such as the delay lengths can be a source of heterogeneity. Indeed, Sayman and Öncüler (2009) and Takeuchi (2011) find evidence for future bias, but only for shorter delays. I find that the participants' time-inconsistency biases and their anticipation accuracy depend on the delay length between the two allocation dates. For shorter delays, participants exhibit no bias, but they tend to overestimate their sooner demand when the immediate present is involved. Conversely, for longer delay lengths, participants tend to be future-biased but accurately anticipate their bias.

The aggregate analysis can also hide behavioral heterogeneity among individuals. Participants may have different behaviors, which will offset each other once I aggregate the analysis. Indeed, I can distinguish different profiles of participants. First, time-consistent participants exhibit no bias and accurately anticipate their time preferences. Second, time-inconsistent participants can be present-biased or future-biased. Among the biased participants, I can distinguish two types of participants: sophisticated participants, who are aware of their bias and, the naives ones, who underestimate their bias.

I investigate in two steps the heterogeneity of participants. First, I assume that the participants' time-inconsistency bias and the anticipation accuracy of their decision are driven by their cognitive abilities. Indeed, Frederick (2005) develops a test to measure the cognitive abilities of the participants of his lab experiment. He shows that participants' test score make varying their choices for time-preferences elicitation tasks. Using the same test, I categorize the participants based on their test score. I find that for participants with lower cognitive abilities, it is unclear whether we can consider them biased, but if they are, they are also naive. Participants with the highest cognitive abilities tend to be present-biased, but they are also sophisticated, since they accurately anticipate their bias. Participants with middling scores on the cognitive test are time-consistent and they fall into two categories: *medium-low* participants, who accurately anticipate their time preferences, and *medium-high*, who anticipate to be future-biased. The behavior of medium-high participants is puzzling, as far as, the traditional theory on time-inconsistency bias is concerned. One interpretation is that these participants do not consider the money itself as tempting but rather as a means for buying temptation goods, thus delaying monetary rewards when the immediate present is involved, may be a way to commit themselves. Then, these participants wrongly anticipate they are going to commit when in fact they fail to do so. This raises interesting questions about time-preferences elicitation using monetary rewards, which I discuss at the end of the paper.

Finally, I investigate the participants' behavior at the individual level. I find that most of the participants are time-consistent and accurately anticipate their time preferences but that a large proportion of the biased participants are also naive. In addition, a substantial proportion of participants overestimate their future bias or anticipate they will be future-biased while in fact they are not. Together, these participants anticipate committing themselves by delaying monetary rewards when the decision involves the immediate present, while they fail to do so.

This paper proceeds as follows. Section 1 introduces the experiment design. Section 2 reviews the theoretical model. The analysis of the participants' decisions follows in Section 3. The paper ends with discussions and concluding remarks in Section 4.

1 Experimental design and procedures

1.1 Design of the experiment

The experiment proceeds over two rounds, with the same participants. The second round elicit participants' time preferences, whereas the first round elicits the anticipation of these preferences. To measure participants' time-preferences, I use Andreoni and Sprenger (2012a)'s Convex Time Budget (CTB) method, and then I adapt this method to measure their anticipation.

Elicitation of participants' time preferences and time-inconsistency biases During the second round, participants have to distribute several budgets of 20 tokens between two dates. A token has different values in euros on whether it is allocated to the sooner date or to the later date. Let a_t be the value of one token allocated to the earlier date t and a_{t+k} be the value of one token allocated to the later date with k representing periods after the earlier date. P is defined the gross rate between the values of the sooner token and the later one. Thus, for each allocation, participants have a monetary budget constraint m such that

$$Px_t + x_{t+k} = m$$

with $x_t = a_t n_t$ the total amount of monetary reward allocated to the sooner date (n_t, the number of sooner tokens) and $x_{t+k} = a_{t+k} n_{t+k}$ the monetary reward allocated to the later date (n_{t+k}, the number of later tokens).[2] While the later date ($t + k$) is always by definition in the future, the sooner date (t) can be in the present or in the future. The comparison between the allocations involving the immediate present ($t = 0$) and the other ones identifies preferences reversals. Participants exhibit present bias if they allocate more tokens to the sooner date when the decision involves the immediate present compared to the decision with the same characteristics involving two dates in the future. Conversely, participants are future-biased if they allocate more tokens to the sooner date when the decision involves only future dates.

The CTB method of Andreoni and Sprenger (2012a) is now well-established to elicit time preferences (Giné et al. (2012); Kuhn, Kuhn and Villeval (2014); Ashton (2014); Augenblick, Niederle and Sprenger (2015); Andreoni, Kuhn and Sprenger (2015)). The main advantage of this method is the possibility of interior allocations. Indeed, traditionally in line with Thaler (1981)'s study, time preferences were elicited using binary choices. Instead of distributing their budget, participants had to choose between a monetary reward at a sooner date or one at a later date. This method forced to consider a linear intertemporal utility function. Consequently, the elicited discount rates were very high and the present bias was overestimated (cf. literature review on the elicitation of time preferences of Frederick, Loewenstein and O'donoghue (2002)). Another alternative method is introduced by Andersen et al. (2008a). They first elicit the participants' degrees of risk aversion to measure the curvature of their utility function. Then, they incorporate this parameter to the intertemporal utility function of the participants to elicit their discount rates and their time-inconsistency bias.[3] Thus, by using this method, they assert that the curvature of the intertemporal utility function is explained only by risk preferences. However, the interpretation of the curvature of the intertemporal utility function is a matter of debate in the literature (Cheung (2015b)). Hence, the CTB method enable us to consider the curvature of the intertemporal utility function without making assumption about its interpretation.

[2]Therefore $m = 20a_{t+k} = 20Pa_t$ $P = \frac{a_{t+k}}{a_t}$.

[3]They use the method of Harrison et al. (2005*b*). Each individual has to make binary choices for both Holt and Laury (2002) lotteries and Coller and Williams (1999) temporal decisions.

Elicitation of participants' anticipation During the first round, the same participants are asked to anticipate how they believe they will choose to divide their budget at a projection date. The projection date is the one in the second round. For example, the instructions stated: 'Imagine you are on the day June 10, if the tokens worth 0.98€ the same day and 1€ three weeks after this day, please indicate how you think you will distribute the 20 tokens this day." The anticipated budget repartitions have the same characteristics as those in the second round. The comparision between the anticipated repartition and the one with the same characteristics made during the second round reveals whether participants accurately anticipate their time preferences.

1.2 Implementation of the experiment

This experiment was conducted at the LEEP.[4] I run the first round in May 2014, and the second two weeks later on June 2014. This delay between the two rounds is long enough for participants to forget their answer but short enough not to lose too many participants. In order to compare decisions, I scheduled the two rounds on the same day of the week (Tuesdays) at the same hour of the day. For the first round, 95 participants showed up but only 75 (79%) came back for the second round. The sample of participants is composed of 80% students between 18 and 26 years old.[5]

CTB Parameters At each round participants have to make 40 allocations. During the first round, participants anticipate what their choice will for 40 allocations and during the second round they choose the same 40 allocations.[6] I implement a (2 x 5) design with two sooner dates $t = (0, 35)$ days and for each, five delays $k = (21, 35, 49, 70, 105)$ days to determine the later date. The value of the later token (a_{t+k}) is always 1€, whereas the value of the sooner tokens a_t is between 0.7€ and 1.02€.[7] Thus the value of the token allocated to the sooner date can be smaller, equal to or higher than the one allocated to the later one. I denote *smaller-sooner allocations* as the allocations for which the value of the token allocated to the sooner date is smaller, *larger-sooner allocations* as the ones for which the value of the sooner token is higher, and *equal-sooner allocations* as the ones for which the value of the token is the same whether the token is allocated to the sooner date or to the later one. Among the 40 allocations, there are three larger-sooner allocations, two equal ones, and 35 smaller-sooner allocations. The entire set of decisions can be found in the appendix in table 6.

[4]Paris Experimental Economics Laboratory (LEEP), Maison des Sciences Economiques, 106-112 boulevard de l'hôpital, 75013 Paris.

[5]The other participants are unemployed (5%) or employees (10%) who are between 26 and 37 years old.

[6]Screenshots of decisions participants have to make in for both rounds can be found in the appendix.

[7]$P \in [0.98, 1.42]$

The allocation decisions are grouped four per page. Each page displays a sooner date, a delay, and four different gross interests P between the value of the sooner token and the later one.[8] The order of the allocation decisions was not randomized. If this decision has obvious drawbacks, it also has advantages. Choosing the best allocation regarding their preferences can be difficult for participants and particularly when mentally computing the discount rates. I choose not to provide information about the associated annual effective rate (AER) because I believe participants do not have this information when they make everyday decisions. However, proposing the decisions in a certain order (increasing AER by pages and increasing delays over pages) gives participants a frame of references and helps them avoid too many inconsistencies (monotonicity violation) in the allocation choices. Given the purpose of this experiment, it is not a major issue that participants take relative decisions. The most important is that the comparability of the decisions remains consistent in order to elicit time inconsistency and the accuracy of the anticipation. One important drawback of not randomizing the allocation decisions one might be concerned about is that participants may get bored and pay less attention to the last decisions. Two elements about this issue however, are reassuring. First, if the participants were bored for the last decisions, then they would have been in hurry to respond. Though the response time of participants rapidly decreases after the first allocation decisions, it is constant (see figure 5). Second, if the participants are bored, one might consider that participants will be more likely to choose corner allocations over interior solutions. If we consider as references the two allocations of the middle of the round, then no evidence exists that the choice of interior solutions is less likely for the last allocations or more likely for the first ones (see table 7).

Questionnaire and Cognitive Reflection Test Finally at the margin of the allocation choices, participants have to answer to the Cognitive Reflection Test (CRT).[9] It is proposed to the participants both at the end of the first round and at the second round after they choose all the allocations. Frederick (2005) designs the CRT to measure cognitive abilities of participants. It assesses the ability of participants to choose a reflective and deliberative correct answer rather than a spontaneous wrong answer. In his book, Kahneman (2011) sums up how the main behavioral biases can be explain by the use of "system 1" (the spontaneous and intuitive thinking) rather than "system 2" (the most reflective one). Moreover, Frederick (2005) finds that participants of a lab experiment who score differently to this test also give different answers to elicitation tasks for time and risk preferences. The participants of the lab experiment of Kuhn,

[8]Since for each combination of sooner date and delays the values of P are not necessarily the same, I present in the Appendix (table 5), the average values of the sooner tokens and the annual effective rates (AER) by delays and sooner date.

[9]This test is composed by three questions presented in the appendix.

Kuhn and Villeval (2014) who have the highest CRT score are also less likely to exhibit present bias.

Then, at the end of the second round, I propose a questionnaire in order to obtain socio-demographic characteristics of the participants but also some of their attitudes which can be explained by time-inconsistency bias and naïveté (sport, alcohol, smoking, saving).

Payment Two types of payment are implemented: a participation one and another one to incentivize the participants. One decision is drawn among all the allocations participants have to make (even the anticipated ones) at the end of the second round. For this experiment, the method of payment is very important. The participants must not perceive different transaction costs and different risks between the different payment dates, in particular compared to when the sooner allocation date is "Today". [10] Moreover, it is desirable the subjects do not decide to allocate all the tokens in one date in order to avoid several payment dates. For these purposes, I use a series of extents adapted from those of Andreoni and Sprenger (2012a)'s study. First, I pay them using Paypal money transfers. This method is similar to wire transfers used in other studies (Andersen et al. (2008a); Kuhn, Kuhn and Villeval (2014)) but there is several more advantages.[11] The Paypal transfer is almost immediate instead of one day lag. Moreover it is sufficient to have an email address in order to make the transfer instead of a bank account identity. In addition to being easier, it increases confidence in the payment and it avoids to loose people who are skeptical about giving bank details. Then, the participation payment is split into two. At each payment dates determined by the allocation drawn, they receive 5€ in addition of the amount they decided to allocate to each date. This extent avoids participants to be tempted to allocate all the tokens to one date. Finally, when the payment allocation is drawn. I give them an acknowledgment of debt where I pledge to them to pay the corresponding amounts they chose at the corresponding dates of the payment allocation drawn. This paper is also a reminder for the amounts and dates of payment and it contains all the information about me in order to contact me. The payment procedure also encourage them to come back to the second session. They only receive 5€ in cash at the first round for their participation and they are told in "welcome" instruction[12] that they will receive at least 24€ if they come back to the second round (10€ more for their participation and 14€ minimum from their decision). The average payment received by people who participated to the all experiment is 34,32€ (15€ of participation and 19,32€ from the

[10]Usually, authors of studies about time preferences used front end delay in order to avoid this problem (cf discussion in Harrison and Lau (2005)). However, this method is not relevant with the purpose of this experiment,i.e., eliciting time-inconsistency bias and naïveté one.

[11]Ashton (2014) also uses Paypal transfers.

[12]This instruction can be found in the appendix (in french).

allocation decision drawn).

2 Model

In order to represent the participants' time-preferences and to take into consideration their potential time-inconsistency bias, I use the (β, δ) model (Phelps and Pollak (1968); O'Donoghue and Rabin (1999); Laibson (1997); Akerlof (1991)). The general utility at one period is the sum of the utility at this period and the discounted utilities of the other periods. However, at the traditional long-term discount rate δ which depends on the delay between the reference period and the utility period, a short-term discount rate β is added. It follows the utility function at period 0:

$$U_0 = u_0 + \sum_t \beta \delta^t u_t.$$

By giving a different relative weight to the immediate utility, the short-term discount rate captures the time-inconsistency bias. In the case of this experiment, this rate is involved only if the sooner date of allocation is "Today". If $\beta < 1$, participants attribute higher relative weight to the immediate gratification rather the future one, they are present-biased. On the contrary if $\beta > 1$, participants attribute lower relative weight to the immediate gratification, they are future-biased.

Following O'Donoghue and Rabin (2001), individuals may have wrong belief about their time-inconsistency problem. In other words, they anticipate their future utility using their belief on the short-term discount rate rather than the real one. In period 0, they anticipate that their utility of period 1 is

$$U_1 = u_1 + \sum_t \hat{\beta} \delta^t u_t.$$

If $\hat{\beta}$ is different from β the individuals wrongly predict their future time preferences. When $\hat{\beta} = 1 (\neq \beta)$, the individuals are totally naive. On the contrary, they are totally aware of their bias, i.e., sophisticated if $\hat{\beta} = \beta$. Thus if $\hat{\beta} \in [\beta; 1]$ when the participants are present-biased or if $\hat{\beta} \in [1; \beta]$ when they are future-biased, then they underestimate their bias, they are naive.

Thereby, by considering that the participants of this experiment have (β, δ) preferences then their utility by choosing the allocation (x_t, x_{t+k}) during the second round is

$$U_t(x_t, x_{t+k}) = u(x_t + \omega_t) + \beta^{t_0} \delta^k u(x_{t+k} + \omega_{t+k}) \tag{1}$$

with t_0, an indicator for whether $t = 0$ (i.e., the sooner date is "Today"). ω_t represents the Stone and Geary parameters for background consumption at the period t. The rewards of this experiment are monetary and the utility function is not consider as linear. Thus, in order to take into account the real change in utility the participants derive from the monetary rewards of the experiment, it might be necessary to take into account the level of consumption outside the experiment. $u(x)$ is the utility function for each period. The utility function is not necessarily linear. I assume u is a CRRA function: $u(x) = \frac{x^{\alpha}}{\alpha}$. α represents the concavity degree of the utility function. If $\alpha = 1$ the function is linear and if $\alpha < 1$ it is concave. The concavity of the utility function can be explained by the degree of risk aversion and/or the decreasing of the marginal utility derived from wealth. Moreover for time preferences, α is directly related to the intertemporal substitution elasticity since this elasticity is equal to $\frac{1}{1-\alpha}$. In this experiment the intertemporal substitution elasticity captures how much the relative demand of later tokens compared to the one of sooner tokens (x_{t+k}/x_t) vary after a change in relative price P.

During the first round, subjects have to project themselves to a future date λ and declare what is the allocation ($x_{t,\lambda}, x_{t+k,\lambda}$) they think they will choose. Their predicted utility function in λ depends on their belief on their short-term discount rate,

$$U_{t,\lambda}(x_{t,\lambda}, x_{t+k,\lambda}) = u(x_{t,\lambda} + \omega_t) + \hat{\beta}^{t_0}\delta^k u(x_{t+k,\lambda} + \omega_{t+k}) \tag{2}$$

with t_0 an indicator for whether $t = 0$ (i.e., the sooner date corresponds to the projection date). Equations (1) and (2) are the same if the immediate present is not involved ($t \neq 0$) since the short-term discount rate does not play a role in the decision. For simplification, if we denote (x_t, x_{t+k}) the chosen allocations during the second round and the first round, the general formula of the utility function is

$$U(x_t, x_{t+k}) = \begin{cases} u(x_t + \omega_t) + \hat{\beta}\delta^k u(x_{t+k} + \omega_{t+k}) & \text{if } R_1 = 1 \text{ and } t = 0 \\ u(x_t + \omega_t) + \beta\delta^k u(x_{t+k} + \omega_{t+k}) & \text{if } R_2 = 1 \text{ and } t = 0 \\ u(x_t + \omega_t) + \delta^k u(x_{t+k} + \omega_{t+k}) & \text{if } t \neq 0 \end{cases} . \tag{3}$$

$R_1 = 1$ if the allocations are anticipated during the first round and 0 otherwise. $R_2 = 1$ if the allocations are chosen during the second round and 0 otherwise. The purpose of this experiment is to elicit if time-inconsistent participants are aware of their inconsistencies. Thus, I will be focused on the estimation of the short-run discount rate β and the anticipated one $\hat{\beta}$ but I will also need to elicit the long-term discount rate δ and the degree of curvature of the utility function α. The participants of the experiment choose their allocations by maximizing their utility function (3) subject to the budget constraint,

$$Px_t + x_{t+k} = M$$

The tangency condition is given by

$$\frac{x_t + \omega_t}{x_{t+k} + \omega_{t+k}} = \left[\hat{\beta}^{R_1 t_0} \beta^{R_2 t_0} \delta^k P\right]^{1/\alpha - 1} \tag{4}$$

Moreover, the demand function for the monetary amount allocated to the sooner date (the sooner demand) is

$$\begin{aligned} x_t \quad = \quad & \Big[\frac{(\hat{\beta}\delta^k P)^{(\frac{1}{\alpha-1})}(M + \omega_{t+k}) - \omega_t}{1 + P(\hat{\beta}\delta^k P)^{(\frac{1}{\alpha-1})}}\Big] R_1 t^0 + \Big[\frac{(\beta\delta^k P)^{(\frac{1}{\alpha-1})}(M + \omega_{t+k}) - \omega_t}{1 + P(\beta\delta^k P)^{(\frac{1}{\alpha-1})}}\Big] R_2 t^0 \\ & + \Big[\frac{(\delta^k P)^{(\frac{1}{\alpha-1})}(M + \omega_{t+k}) - \omega_t}{1 + P(\delta^k P)^{(\frac{1}{\alpha-1})}}\Big](1 - t^0) \end{aligned} \tag{5}$$

For this experiment, I consider the participants anticipate and choose the allocations by maximizing their utility function specified as above subject to the token budget constraint. Then the differences between the anticipated allocations during the first round and the chosen allocations during the second round are only due to a wrong belief on the short-term discount rate. In other words, I assume the characteristics of the utility function, both the temporal components of the utility function δ and β[13] and the shape of the period utility function α are constant between the two rounds. One can argue that preferences may be unstable across time driven by exogenous shocks (changes in life expectancy, age, incomes, psychological shocks ...) and so the differences between the anticipated and real allocation decisions could be also explained by these shocks. However, with the design of this experiment and the small period between the two rounds, it is reasonable to consider that the happening of such shocks is unlikely. Moreover, it remains unclear in the literature if the preferences are unstable across time. There is neither evidence that the temporal components of the preferences (δ and β) vary across time or are influenced by income shocks nor evidence for the instability of the risk preferences if we consider that there are an indicator for α. First, Meier and Sprenger (2015), using a longitudinal study, found the elicited distributions of the discount rates and the present-bias degrees are not different across the two years of the study. Balakrishnan, Haushofer and Jakiela (2015) also found no evidence for a link between present bias and liquidity constraint which can explain the willingness to have immediate monetary rewards. Second, while risk preferences are not necessarily stable across different designs,[14] there is no evidence that there are

[13] I assume that the short-term discount rate is wrongly anticipated by the participants but not that it varies.

[14] For example, risk preferences can change du to a framing effect (Tversky (1969)) or changes in elicitation procedures (Bostic, Herrnstein and Luce (1990)).

unstable across time with the same design and the same participants (see longitudinal studies of Baucells and Villasís (2010); Andersen et al. (2008b); Harrison et al. (2005*a*)).

3 Analysis

I investigate the general participants' behavior through their allocation choices. This overall behavior brings indications about their time preferences, the shape of their utility function and the anticipation of these preferences. Next, I more formally estimate the parameters of the utility function at the aggregate level and at the individual one to test for the presence of time-inconsistency biases and naivety.

3.1 Overall behavior

I investigate the overall behavior in four subsections. First, I study the possibility that participants do not discount future and use as decision criterion the maximization of the monetary rewards. If these participants also accurately anticipate this decision strategy, they are not interesting for the purpose of this study. Second, the study of the choice of corner or interior solutions by participants provides informations about the shape of their utility function. Third, the comparison between the demand for sooner tokens when the immediate present is involved and the one when it is not highlights potential time-inconsistency bias. Last, the difference between the anticipated allocations and the ones chosen during the second round documents the anticipation accuracy.

3.1.1 Choice criterion: only the biggest reward ?

The value of the token allocated to the sooner date can be lower, higher or equal to the one of the token allocated to the later date. The purpose of this choice is to verify that none of the participants has negative discount rates or only maximizes their payment without considering the delay length, in other words if they do not discount their future utility. If participants choose to allocate all their tokens to the later date for all the decisions, then they exhibit negative discount rates. If they allocate all their tokens to the date for which the value of the tokens is the highest and are indifferent to the repartition of the tokens between the two dates when the value of the tokens is the same then they maximize their payment without considering time. They do not discount the future. Participants who both maximize their payoffs and anticipate it are not interesting in for the purpose of this study.

While none among the 75 participants decide to allocate all their tokens to the later date for all the decisions, during the second round a third (25 participants) allocate their token in order to maximize their payment. They choose an impatient solution for the larger-sooner allocations (i.e. they allocate all the tokens to the early date), a patient solution for the smaller-sooner allocations (i.e. they allocate all the tokens to the later date) and are indifferent to the tokens repartition between the early date and the later one for the equal allocations. More interesting, only half of (12 participants) them perfectly anticipate their allocations. In other words, they know that they will not discount their future utility.[15]

Two results are interesting. First, half of the participants do not discount and choose to maximize their payment. This number is surprisingly high. Beside the maximization strategy, this result can be explained by the fact that these participants have a discount rate lower than the minimum proposed which is 7%. Second, only a half of them anticipate it. The fact that some of them do not anticipate it might be evidence for learning effect. By maximizing their payoffs instead of allocating tokens randomly, participants have a strategy they can better understand. But we can also consider this is evidence for present bias and naivety. Whereas their long-term discount rate is equal to 0, their short-term discount rate is lower than 1 and they are totally naive about it.

For the remainder of the analysis, if not stated otherwise, I remove the 12 participants which did not discount and anticipate it perfectly. Their behavior are not interesting for the purpose of the study. They do not bring us any information.

3.1.2 Corner and interior allocations

The participants' choice to always allocate all their tokens to one date or to distribute their budget between the two dates determine if their utility function is linear or not. Indeed if they have linear utility function, the only criterion to allocate tokens is their discount rates. They allocate all their tokens to the date on which the weighted value of the tokens is higher. However, if they have a concave utility function, then the decreasing marginal utility of monetary rewards for one period may lead them to distribute tokens on the two dates.

I denote corner allocation the ones for which the participants allocate all their tokens in one date. There can be impatient allocations, all the tokens are allocated to the sooner date or patient ones, all of the tokens are allocated to the later date. The allocation is interior if the participant allocates tokens on both dates. At the aggregate level, 36% of the allocations are patient ones, 29% are impatient ones and 35% are interior allocations. The repartition of the allocations at the individual level is summarized in Table 1. Only 19% of the participants choose any interior allocation. In other words

[15]If we really consider that they are indifferent for the equal allocations, then 5 more participants anticipate their decisions well. However, it can also be interpreted as a wrong anticipation. All these participants follow the same pattern, they do not anticipate they will allocate all the tokens to the early date for the equal allocations.

Table 1: Overview of the participant allocations by categories

	Interior All.	Impatient All.	Patient All.
Median	16	11	24
Mean	28	23	29
Percentage of individuals with			
- None	19.05%	9.52%	23.81%
- All	7.94%	1.59% (1 part.)	0%

we can consider that these participants have a linear utility function. On the contrary 81% of participants among those who discount choose at least one interior allocation. Then, it is important to introduce a parameter in order to measure the curvature of this function not to overestimate the long-term discount rate or the present bias. Also, only one participant chooses always the same allocation. He always allocates his tokens to the sooner date.

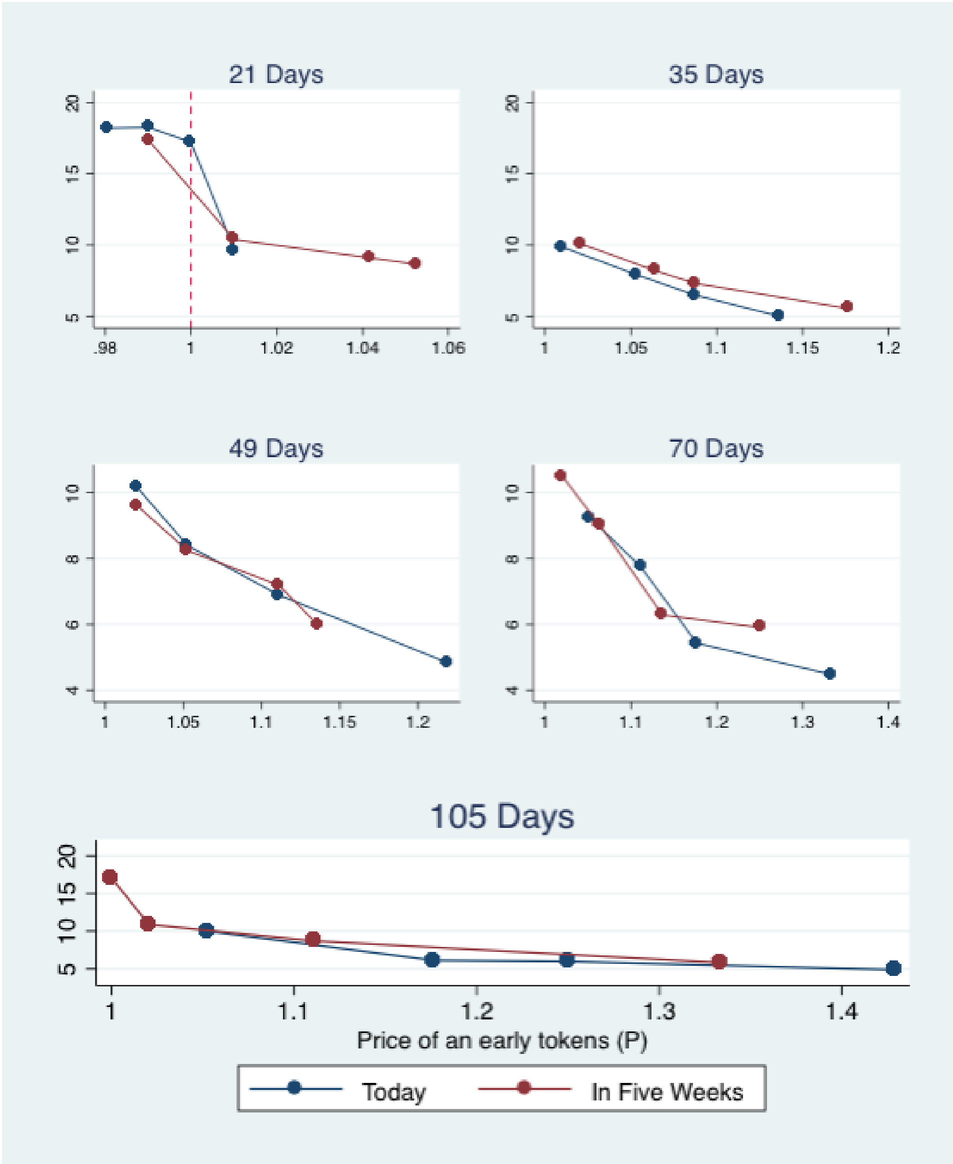
3.1.3 Demand functions for the sooner tokens

Time-inconsistencies biases are involved when the immediate present is involved. If the participants are present-biased, the demand for sooner tokens (and so the number of tokens allocated to the sooner date) is higher when the early date involves the immediate present (the payment date is "Today") than when it is a future date. On the contrary, if the participants are future-biased, the number for sooner tokens is lower when the early payment date involves the immediate present. Figure 6 plots the number of tokens allocated to the earlier payoff date during the second round as a function of interest rates by delay lengths. The blue line represents the sooner demand when it involves the immediate present whereas the red one represents the sooner demand when only future dates are involved in the token repartition. The graphs suggests that there is no obvious evidence for time-inconsistency biases. Only for the small delay of 35 days between the two payment dates, the demand for sooner tokens is slightly higher when the early date is in the future ("In five weeks"). This suggests evidence of a low future bias for this delay. Furthermore, it is interesting to notice that the shape of the demand functions vary across delays.

3.1.4 Anticipation of the sooner demand

Total anticipation I am focused on the anticipation of the sooner demand. To see how well participants anticipate their time-preferences and moreover their potential time-inconsistencies, it is interesting to both characterize the participants' anticipation of the sooner demand and the anticipated allocations. The participant on average underestimates his sooner demand if the total number of tokens he anticipates to allocate to the sooner dates is lower than the total number he actually allocates to these dates

Figure 1: Comparison Early Payments (Round 2)

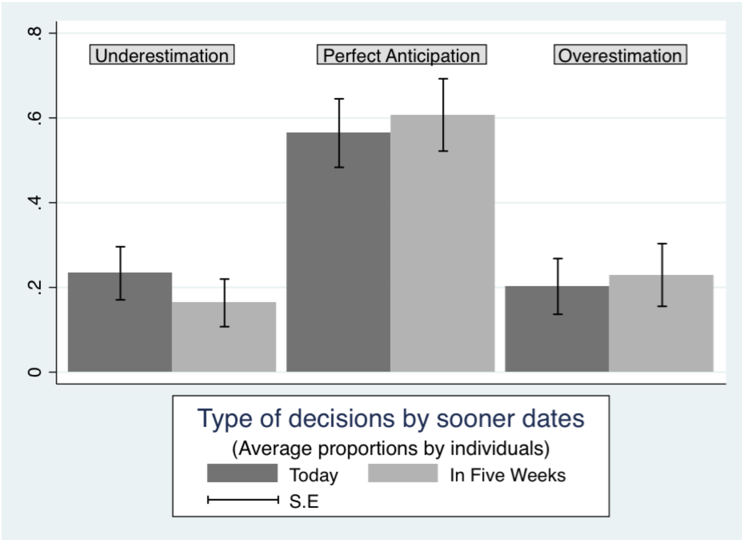


during the second round. On the contrary, if the total numbers of sooner tokens he anticipates is higher than the total ones he chooses during the second, then he overestimates his sooner demand on average. He perfectly estimates his sooner demand on average if the total number of anticipated sooner tokens is the same than the total he chooses during the second round. In the same way, the allocation is underestimated (respectively overestimated) by the participant if the number of tokens he anticipates to allocate to the sooner date is lower (resp. higher) than the sooner tokens number he chooses during the second round for the allocation with the same characteristics. The allocation is perfectly-estimated by the participant if he anticipates to allocate the same number of tokens than he chooses during the second round for this allocation. Table 2 presents in the first column the percentage of participants who on average underestimate, overestimate or perfectly anticipate their sooner demand and in the

Table 2: Anticipation of the Sooner Demand

	Percentage of participants	**Percentage of allocations**
Underestimation	52.38%	19.84%
Perfect Estimation	1.59%	58.57%
Overestimation	46.03%	21.59%

Figure 2: Anticipation Early Payments by sooner date

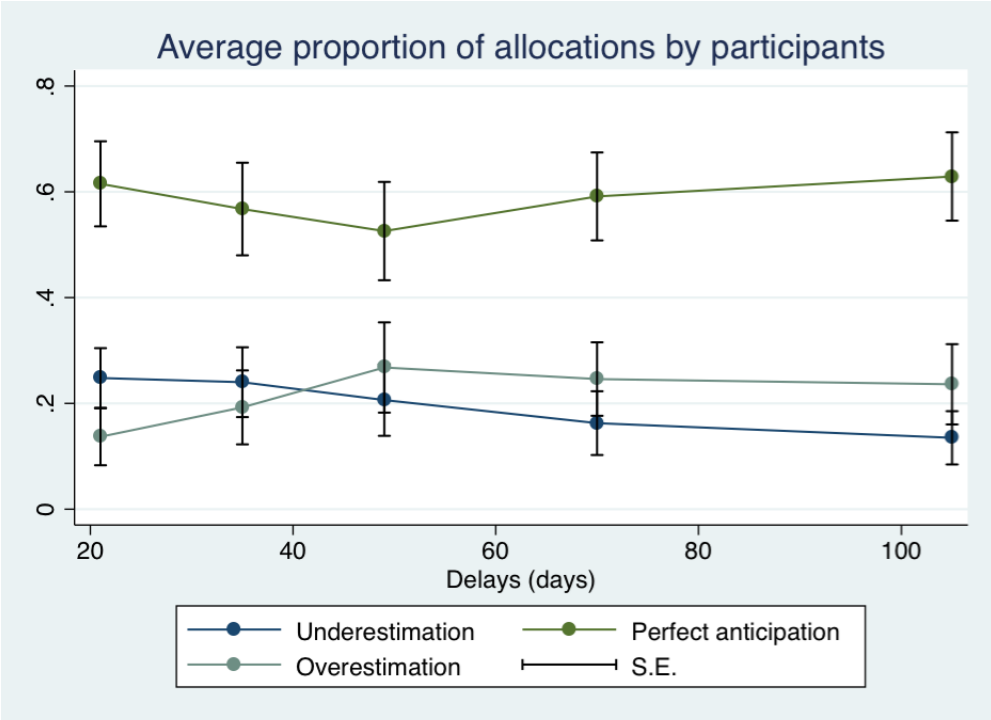


second column the average percentage of underestimated, overestimated or perfectly-estimated allocations. The allocations are in majority perfectly-anticipated but only 1 participant[16] perfectly anticipates his sooner demand. He chooses to allocate all the tokens to the sooner date for all the decisions and perfectly anticipates it. On average a participant underestimates 8 allocations and overestimates 9 (on 40). However only the estimation of the utility function parameters will be useful to determine if the wrong anticipation is due to the ignorance of their bias or simply to anticipation errors.

Anticipation when the sooner date is "Today" versus when it is "In five weeks" If participants exhibit a time-inconsistency bias and are ignorant of their bias then the number of underestimated or overestimated allocations will differ whether or not the earlier date involves the immediate present. Figure 2 presents the average proportion of each type of allocation by participant and by sooner date. The proportion of underestimated allocations is significantly higher when the sooner date is "Today" (One tail mean-comparison Wald test: p-value<0.05) whereas the average proportion of perfectly-anticipated or overestimated allocations is not significantly different. This result is consistent with the fact that participants tend to underestimate their willing-

[16] I remind that here we only consider the participant who discount or do not discount but did not anticipate it.

Figure 3: Anticipation Early Payments by delays



ness to obtain an immediate gratification.

Accuracy of the anticipation by delays between payment dates Figure 3 represents the average proportion of each type of anticipated allocations by participants for each delay lengths (for both sooner dates). The average proportion of perfectly-anticipated allocation is constant for each delay length between the two payments date (ANOVA: p-value=0.45). However, the average proportion of underestimated allocation decreases when the length of the delay increases (Page's trend test:[17] p-value<0.05) whereas the average proportion of overestimated increases (Page's trend test: p-value<0.1). Two possible effects can explain this findings. First, participants do not expect their willingness of immediate gratification is so high for small delays. For small delays they might believe they will be able to wait and increase their payment. This is evidence for naivety and underestimation of present bias. Second, on the contrary for larger delays they underestimate their capacity to be patient.

Two main results emerge from the analysis of the descriptive statistics. First, it is not clear that the sooner demand of the participants is higher or lower whether the immediate present is involved. Thus there is no evidence for present or future bias. Second,

[17]The Page's trend test (Page (1963)) tests for the orderings of variable across treatments. Its null hypothesis is that all orderings of the proportion of underestimated allocation across delay length are equally likely against the longer the delay is and the lower the proportion of underestimated allocation is.

the analysis of the anticipation of the sooner demand highlights that the anticipation accuracy of the sooner demand depend on both whether the immediate present is involved and the lengths of the delay. But there might be noise in the anticipation and through the analysis of the descriptive statistics it is not possible to disentangle the noise with a real wrong anticipation of the sooner demand. To go further, it is necessary to estimate the parameters of the utility function.

3.2 Parameters Estimation

3.2.1 Estimation strategy

One main issue is raised for the estimation of the utility function parameters. The observation are censored for corner solutions. If the participant choose to allocate all his tokens to one date, then the observations only provide threshold for the parameters.

Andreoni and Sprenger (2012a) propose two strategies to identify the parameters of the utility function. For their first technique they take the log of the tangency condition (4):

$$ln(\frac{x_t + \omega_t}{x_{t+k} + \omega_{t+k}}) = \frac{ln(\hat{\beta})}{\alpha - 1} R_1 t^0 + \frac{ln(\beta)}{\alpha - 1} R_2 t^0 + \frac{ln(\delta)}{\alpha - 1} t + \frac{1}{\alpha - 1} ln(P)$$

The main advantages of this technique is that the equation is linear and so easily estimated. Also, through a Two-limit Tobit maximum likelihood regression can be implemented to take into consideration the censoring observations. However its weaknesses are that the background consumption ω_t and ω_{t+1} must be known since they cannot be estimated and the consumption must be strictly positive such that the log is well-defined. Thus if we do not know the background consumption parameters and we set them to be 0 then the function is not defined for corner solutions.

The second technique is to estimate the sooner demand function (5),

$$\begin{aligned} x_t \quad = \quad & \Big[\frac{(\hat{\beta}\delta^k P)^{(\frac{1}{\alpha-1})}(M + \omega_{t+k}) - \omega_t}{1 + P(\hat{\beta}\delta^k P)^{(\frac{1}{\alpha-1})}}\Big] R_1 t^0 + \Big[\frac{(\beta\delta^k P)^{(\frac{1}{\alpha-1})}(M + \omega_{t+k}) - \omega_t}{1 + P(\beta\delta^k P)^{(\frac{1}{\alpha-1})}}\Big] R_2 t^0 \\ & + \Big[\frac{(\delta^k P)^{(\frac{1}{\alpha-1})}(M + \omega_{t+k}) - \omega_t}{1 + P(\delta^k P)^{(\frac{1}{\alpha-1})}}\Big](1 - t^0) \end{aligned}$$

using non least squares (NLS). The weakness of this method is that it cannot account for the censored data but its strength is that can estimate the value of the background consumption parameters.

α is estimated through the variation of the gross rate interest P, δ through the variation of the delay length between the two payment dates k. In addition, the timing of the sooner date allows us to elicit β for the allocations of the second round and $\hat{\beta}$ for the allocations during the first round. In the next subsections, I use the latter strategy to estimate the value of the different parameters of the utility function.

Moreover, several specifications are considered. In a first time, all the allocation decisions are considered. In a second time, only the smaller-sooner ones, i.e., when the value of the sooner token is lower than the value of the later one, are considered for two reasons. First, because the allocation decisions dropped are also the ones with a higher proportion of corner solutions and we saw that the NLS strategy do not account well for the corners solutions. Second, one can consider that the behavior is different when the value of sooner tokens is higher from when this value is lower. Thus it allows me to take into consideration this possible difference.

Next, I consider several values for the background consumption parameters ω_t and ω_{t+k}. First, one can consider that the individuals engage in narrow bracketing (Rabin and Weizsacker (2009)), i.e., they only decide one decision by one decision without considering anything else. Thus the background consumption parameters are equal to 0 for both periods. They can also engage in narrow bracketing but only because they are only focus on the lab experiment. Since the monetary rewards associated to the decisions come in addition to the participation fees for each date, it might be correct to consider the background consumption parameters are equal to the participation fees (5€). Then, I estimate the background consumption parameters by considering first that it varies across periods and second it is constant across periods. Finally, in order to take into consideration heterogeneity among participants, I set the background parameters to be equal to the self-reported daily expenditure at both periods.

3.2.2 Aggregate-level estimation

To formally test if the participants exhibit time-inconsistency biases and accurately anticipate their time preferences, I estimate Equation (5), pooling the allocation decisions from all subjects.[18]

In column 1 through 5 of table 8, all the allocation decisions are considered to estimate the parameters of the utility function. In column 1, the background consumption parameters are assumed to be equal to 0. The estimated daily discount factor δ is 0.9993 (and significantly different from 1 (p-value<0.01)) and the annual rate[19] is estimated at 29% (significantly different from 0 (p-value<0.01)). Moreover, I estimate a short-term discount rate β, representative of the time-inconsistency bias, of 0.983. It is significantly different from 1 at 95% of confidence which is evidence for present bias. However, on average, the participants anticipate their short-term discount rate

[18] In all specifications, standard errors are clustered at the subject level.
[19] $AR = \delta^{-365} - 1$

well since $\hat{\beta}$ is not significantly different from β (p-value=0.28). Finally, the degree of curvature of the utility function α is significantly different from 1 (p-value<0.01) and estimated at 0.911. On average, the participants don't have a linear utility function.

In column 2, the background consumption parameters are set equal to the participation fees. The estimated parameters are very close to the ones in column 1 though α decreases to 0.83. β is significantly different and lower than 1 at a 95% of confidence level and $\hat{\beta}$ is not significantly different from β (p-value=0.31).

In column 3, the background consumption parameters are set to take into consideration the heterogeneity of the participants. At both periods, they are equal to the self-reported daily expenditure. For this specification, again, β is significantly different and lower than 1 (p-value<0.05) as $\hat{\beta}$ is not different from β (p-value=0.324). The estimated value of α, 0.622, is lower and the estimated annual rate higher, 38,55%.

In column 4, the background consumption parameter are considered being different at the two periods and are estimated. The estimated value of β is not significantly different from 1 anymore (p-value=0.937). However, $\hat{\beta}$ is significantly different and higher than β (p-value<0.05). α jumps to 0.976 and the annual rate decreases to 3.57%. Thus there is no more evidence for present bias but interestingly it suggests that the participants overestimate their short-term discount rate and anticipate to be future biased while they can be considered as time-consistent. Also, the estimated values of the background consumption is not the same across periods. The estimated value of the background consumption for the second payment date is significantly different and higher than the one for the first payment date (p-value<0.001). Furthermore, the value of the first background consumption is negative.

In column 5, the values of the background consumption parameters are estimated but are restricted to be the same across period. I estimate more similar parameters as in column 1, 2 or 3, though the estimated α is 0.975. The estimated β is 0.987 and it significantly different from 1 (p-value<0.01) and again $\hat{\beta}$ is not significantly different from β (p-value=0.246).

In column 6 through 10, only the smaller-sooner allocation decisions are considered and I estimate the value of the parameters of the utility function for a range of different values of background consumption. For these specification, though the estimated value of $\hat{\beta}$ is still not significantly different from β, β is estimated significantly different but higher than 1 for most of the assumptions on the background consumption (p-value<0.05 for columns 5, 6 and 7 and p-value<0.1 for column 10). As when all the allocations were considered, β is not significantly from 0 by estimating different value of background consumption across periods. Moreover, the annual rate is not significantly different from 0 for columns 6, 7 and 8. Finally, the estimated value of α is lower if we only consider the sooner-smaller allocations.

In a nutshell, the estimation of the time-inconsistency bias is not stable across the specifications. It can be not significantly different from 1, significantly different and higher than 1 (evidence for future bias) or significantly different and lower than 1 (evidence for present bias). These estimation suggest two findings. First, there is no general pattern for the time-inconsistency bias. Second, the aggregate-level estimation is not a good measure to determine if participants are biased and if they accurately anticipate their bias. Indeed, there can be some heterogeneity among participants. Some participants can be present-biased and others future-biased. Additionally, if both of them underestimate their bias, i.e., future-biased participants underestimate their short-term discount rate and present-biased ones overestimate it, on average the difference between $\hat{\beta}$ and β might not be significantly different from 0. These findings may also reflect the limitation of the NLS approach since the five allocations dropped for the estimation in columns 6 through 10 are also the ones with the higher number of corner solutions.

3.2.3 Heterogeneity

At the aggregate level by pooling the allocation decisions from all subjects and all delay lenghts, we consider that the preferences are homogeneous. This assumption may raise issues if there are heterogeneity and, as we saw, particularly for the elicitation of the anticipation accuracy. Thus, I consider two sources of heterogeneity. First, the characteristics of the decisions such as the delay lengths can be a source of heterogeneity. Sayman and Öncüler (2009) and Takeuchi (2011) find evidence for future bias but only for shorter delays. Second, before estimating the parameters at the individual level, as an intermediate step, I consider different classes of participants. Their cognitive abilities can be an indicator of these classes and can determine the parameters of their intertemporal utility function.

Delay lengths From the previous section, Figure 6 compare the demand for sooner tokens when the early payment is "Today" with when it is "In five week". Only for the second delay length (of 35 days) participants seem to exhibit a time-inconsistency bias (see figure 6). Moreover, in Figure 3 the proportions of underestimated and overestimated allocations vary across delay lengths and particularly for the three first delays lengths. Thus, three classes of delays can be distinguished to consider heterogeneity: the short-delay class, when the delay between the two payment dates is 21 days (*SD*); the medium-delay class with delay length of 35 days (*MD*) and the long-delay class, for delays of 49, 70 and 105 days between the two payment dates (*LD*).

For identification matters, I assume the long-term discount rate δ constant across delays and consider that both the short-term discount rate β (as well as its anticipation $\hat{\beta}$) and the degree of curvature of the utility function α may vary. The estimation of the different parameters of the utility function through the ten same specifications as previously are presented in Table 9. The annual long-term discount rate is estimated between 25% and 60% but not always significantly different from 0 (col.7 and col.8). Moreover, α is always significantly different and lower than 1. Individuals have on average a concave utility function for all the delay lengths.

To study the time-inconsistency bias and its anticipation, only the short-term discount rate and on its anticipation are of interest. For shorter delay lengths (SD and MD), the time-inconsistency biases are not stable across specifications. I estimate significant present bias for the shorter delay length (SD) but only for the two first specifications (all decisions and $\omega_t = \omega_{t+k} = 0$ (col.1) or $\omega_t = \omega_{t+k} = 5$ (col.2)) thus it is not robust. For medium delay lengths (MD), participants tend to be future-biased (col.1, col.2 and col.4) but it is not robust across specification models. For longer delay lengths (LD), participants tend to be future-biased, β is significantly different and higher than one and this result is robust for almost all the specifications. It cannot be considered significantly different from one only when the background consumption is estimated (col.5, col.9 and col.10). Furthermore the participants tend to underestimate their short-term discount rate for the shorter delay lengths (SD and MD) as $\hat{\beta}$ is significantly different and higher than β. However, for longer delays (LD), they accurately anticipate their short-term discount, $\hat{\beta}$ is not significantly different from β and this result is robust across specifications.

Thereby, there is heterogeneity among delay lengths. Participants are more likely to be future-biased for longer delay lengths but they also tend to accurately anticipate their bias. For shorter delays, on the contrary, participants tend to be unbiased but they are more likely to overestimate their short-term discount rate. One way to explain the overestimation of their short-term discount rate even if participants are time-consistent, is the ambiguous role of money. Using money to elicit time-inconsistency biases have limits. Money may not be considered as tempting but only as an instrument to buy temptation goods. Thus, participants can use it as a commitment device. In that case, participants may appear to be future-biased while they only delay the monetary rewards to tied their hands not to buy temptation goods. Furthermore, they may anticipate to commit themselves by delaying the monetary rewards but then they do not succeed in doing it. Thereby they are naive but about their ability to commit.

Another result is interesting by allowing the parameters of the time preferences to change across delay lengths. The estimated value of the curvature degree of the utility function α decreases when the delay length increases. Table 10 represents the p-value associated to the pairwise equality test of α by delay lengths. To determine if the values of α are significantly different the threshold probability of the null hypothesis rejection need to be adjusted using the Bonferroni correction. To avoid the underestimation of the probability of making a type-I error because of multiple tests, the significance level is divided by the number of tests (for 3 tests, the two variables are significantly different at 5% for a p-value lower than 0.05/3=0.0167). By considering all the allocations, the value of α for the shortest delay length is always larger and significantly different from the value of the α for larger delays. For the medium delay length, the value of α is larger than the one for larger delay and the difference is only not significant when the estimated value of the background consumption is constraint to be the same at the two payment dates (col.5). When only the smaller-sooner allocations are considered, the significance of the difference between the value of α for the shortest delay length and the larger ones is not stable. However, for the shortest delay length (21 days between the two payment dates), half of the allocation decisions are dropped since they involve a higher value of the token at the sooner payment date. Then, the estimation of the parameters for this delay is less precise. Yet, by comparing the value of α for the medium delay length and the one for the larger delay lengths, these values are always significantly different. The utility function of participants are less concave for shorter delay (i.e., α is higher). Since this result does not concern the main purpose of this article, it will be discussed in the last section.

Cognitive abilities At the end of each round, participants answer the Frederick (2005)'s three-questions Cognitive Reflection Test (CRT). Following their answers, I construct 5 classes of cognitive abilities regarding their score during both the first round and the second one. In a first class, I consider the participants who give no correct answer to the first CRT neither to the second CRT (LCRT).[20] The second class is composed of participants who have no correct answer to the first CRT but improve their score by responding well at one or more questions to the second CRT (LLCRT). In a third class, I bring participants who accurately answer to 1 or 2 questions of the first CRT and do the same to the second CRT and those who answer to 1 question of the first CRT well and do better to the second CRT (MCRT). The fourth class is composed by participants who accurately answer to 2 questions of the first CRT and to 3 of the second CRT (HLCRT) and finally, the fifth class is composed by those who correctly answer to all the questions of both the first CRT and the second one (PCRT).[21]

Table 12 presents the different estimated values of the parameters by cognitive classes according to the same previous assumptions on the background consumption and Table 13 presents the estimated value of the background consumption. First, the value(s) of the estimated background consumption as well as the estimated values of α when the background consumption is estimated can be considered as outliers (col.4, col.9 and col.10). However, Augenblick, Niederle and Sprenger (2015) suggest that

[20] I also consider in this class the one participant who gives one right answer to the first CRT but none to the second CRT

[21] Table 11 summarizes how the cognitive classes are constructed and the number of participants for each class.

thought the value of the background consumption affect the value of the curvature of the utility function, the discounting parameters may not be affected.[22] β and $\hat{\beta}$ are the most interesting variables and in this case, even with outliners of background consumption and of α, the range of the estimated values of β and $\hat{\beta}$ are reasonable enough to be considered.

Evidence for heterogeneity among participants emerge from the parameters estimation by cognitive class. The participants of the lowest class tend to be future-biased and to be naive about their bias but only when the smaller-sooner allocations are considered. For the participants who belong to the two next classes, the parameter estimation is not stable but they seem to accurately anticipate their time preference and not to exhibit time-inconsistency bias. For the HLCRT class, while they are not biased, they overestimate their short-term discount rate. Thus, they anticipate they will be more likely to delay monetary rewards when the allocation involves the immediate present. While it is not possible to assume they overestimate their short-term discount because they are naive about their present bias, one interpretation is that they want to commit themselves in order to overcome the consequences of their bias and finally fail to commit. The participants who belong to highest cognitive class accurately anticipate their short-term discount rate. They are also present-biased when all the allocations are considered.

To sum up, participants with a low level of cognitive abilities tend to be naive when they exhibit present bias or future bias whereas the participants with the highest cognitive abilities may be present-biased but they accurately anticipate it.

Thereby, there is two sources of heterogeneity which affect time-inconsistency bias and its anticipation: the delay lengths between the two payment dates but also, across participants, as the preliminary step to introduce heterogeneity through cognitive classes has been convincing. Moreover considering the heterogeneity put forwards that the aggregate estimation level is not relevant to study whether a time-inconsistent participant is also aware of his bias. Only the comparison between the individual parameter for time-inconsistency bias and the one for the anticipation makes sense. It is then possible to go further by estimating the individual parameters

3.2.4 Individual-level estimation

I estimate the utility function parameters at the individual level. For the sake of clarity, I estimate α, δ, β and $\hat{\beta}$ by only controlling for self-reported background consumption ($\omega_t = \omega_{t+k} = \omega_i$). However, two specifications are considered: keeping all

[22] See also the detailed discussion of the use of different background parameters by Andreoni and Sprenger (2012a).

Table 3: Proportion of individuals with temporal bias and linear utility (Self-reported average daily consumption)

	All decisions	Decisions $a_t < 1$
Present Bias	0.26	0.08
Futur Bias	0.03	0.20
No bias	0.71	0.72
Underestimation of β	0.12	0.14
Overestimation of β	0.27	0.29
Insignificant difference	0.61	0.57
Concave utility	0.93	0.78
Linear utility	0.07	0.22
N Participants	59	51

the allocations or only the smaller-sooner allocations. Indeed these specifications are the ones for which the more differences appear.[23]

Table 16 summarizes the estimated values of the parameters of the subjects' time preferences.[24]. For both specifications, the average values of the short-term discount rate is above one and the average anticipated short-term discount rate is lower than the real one. Figure 7 represents the distribution of the estimated short-term discount rate β and the accuracy of the anticipation $\hat{\beta} - \beta$.

The same differences as previously are found whether only the smaller-sooner allocations or all the allocations are considered. First, the estimated value of α is lower, i.e., the utility function of the participants is more concave in the first case. Second, for the first specification, more participants have a short-term discount rate lower than 1 while for the second specification, most of them have a short-term discount rate higher than one. Yet in both cases the estimated values of β are highly concentrated around one. In Figure 7, we also see that the estimated anticipation accuracy ($\hat{\beta} - \beta$) is highly concentrated around 0. Thus, to decide whether the individuals are time-inconsistent and do not accurately anticipate their short-term discount rate, it is necessary to test if β is statistically different from 1 and $\hat{\beta}$ statically different from β for each individual.

Table 3 represents the proportion of individuals who can be considered as present-biased (if $\beta < 1$ and the p-value of the null-hypothesis: $\beta = 1$ is lower than 0.1), future-biased (if $\beta > 1$ and the p-value of the null-hypothesis: $\beta = 1$ is lower than 0.1) and unbiased (if the p-value of the null-hypothesis: $\beta = 1$ is higher than 0.1). A majority of the participants are time-consistent in both cases. The value of β is not significantly

[23]I remove 3 participants when I consider all the allocations decisions because I estimate outlier values of parameters (AR>5 000 and $\alpha < -20$). Moreover, I remove 11 participants when I consider only the sooner-smaller allocations because I am not enable to estimate individual parameters for 6 subjects and the estimated values of the parameters for 5 subjects are outliers.

[24]The details values of the parameters estimated by considering all the allocations are presented in Table 14 whereas the ones estimated by considering only the sooner-smaller allocation are presented in Table 15.

different from 1 for 71% (respectively 72%) of the remaining participants if we consider all the decisions (respectively only the smaller-sooner decisions). Thus in both cases, the same proportion of individual can be considered as time-inconsistent. However, the proportion of present-biased subjects and the one of future-biased subjects are not the same whether I consider all the decisions or only the smaller-sooner decisions. The proportion of participants who can be considered as future-biased is much higher in the latter case (20% vs 3%) on the contrary of those who can be considered as present-biased (8% vs 26%). Table 17 represents the proportion of participants who exhibit bias when all the decisions are considered compared to when only the smaller-sooner ones are. It is even clearer that some participants tend to be less future-biased when the value of the token at the sooner date is equal or higher than the value of the token at the later date.

The majority of participants exhibit no bias in both specifications. However, the participants tend to have a higher short-term discount rate when only the smaller-sooner allocations are considered. One way to explain this finding goes as follows: the participant is willing to delay the monetary rewards to commit himself when the decision involves the immediate present at a constant long-term discount rate for the sooner-smaller allocations. However, he is not willing to pay for this commitment. For the removed decisions, he has to renounce to some monetary rewards to commit since the value of the token at the later date is lower than the one at the sooner date. This finding is consistent with previous studies where participants are not willing to pay for a commitment device even if they take it when it is free (Augenblick, Niederle and Sprenger (2015)).

Table 3 also summarizes the proportion of individual who underestimate, overestimate or accurately anticipate their short-term discount rate. A majority of the participants anticipates their short-term discount rate well and among those who do not accurately anticipate their β, a higher proportion overestimate it. However, the anticipation accuracy of the short-term discount rate can only be interpreted by considering the temporal bias of the participant.

Table 4 represents the proportion of unbiased or biased participants who underestimate, accurately anticipate or overestimate their short-term discount rate.[25] None of the present-biased participants overestimate their bias. On the contrary, they tend to underestimate it by overestimating their short-term discount rate: 67% of them if all the decisions are considered and 50% if only the sooner-smaller allocations are considered. Moreover, among the future-biased participants, 50% (all decisions) or 40% (decisions $a_t < 1$) tend to underestimate their bias (by underestimating their short-term discount rate). Only 0 (all decisions) or 10% (decisions $a_t < 1$) overestimate their

[25]Figure 8 represents the proportion of participants by bias and anticipation accuracy of the short-term discount rate.

Table 4: Anticipation accuracy of the short-term discount rate by biases (Self-reported average daily consumption)

	All decisions		
	Underestimation $\hat{\beta} < \beta$	Insignificant difference $\hat{\beta} = \beta$	Overestimation $\hat{\beta} > \beta$
Future bias ($\beta > 1$)	50%	50%	0%
No bias ($\beta = 1$)	14%	71%	14%
Present bias ($\beta < 1$)	0%	33%	67%
Total	12%	61%	27%

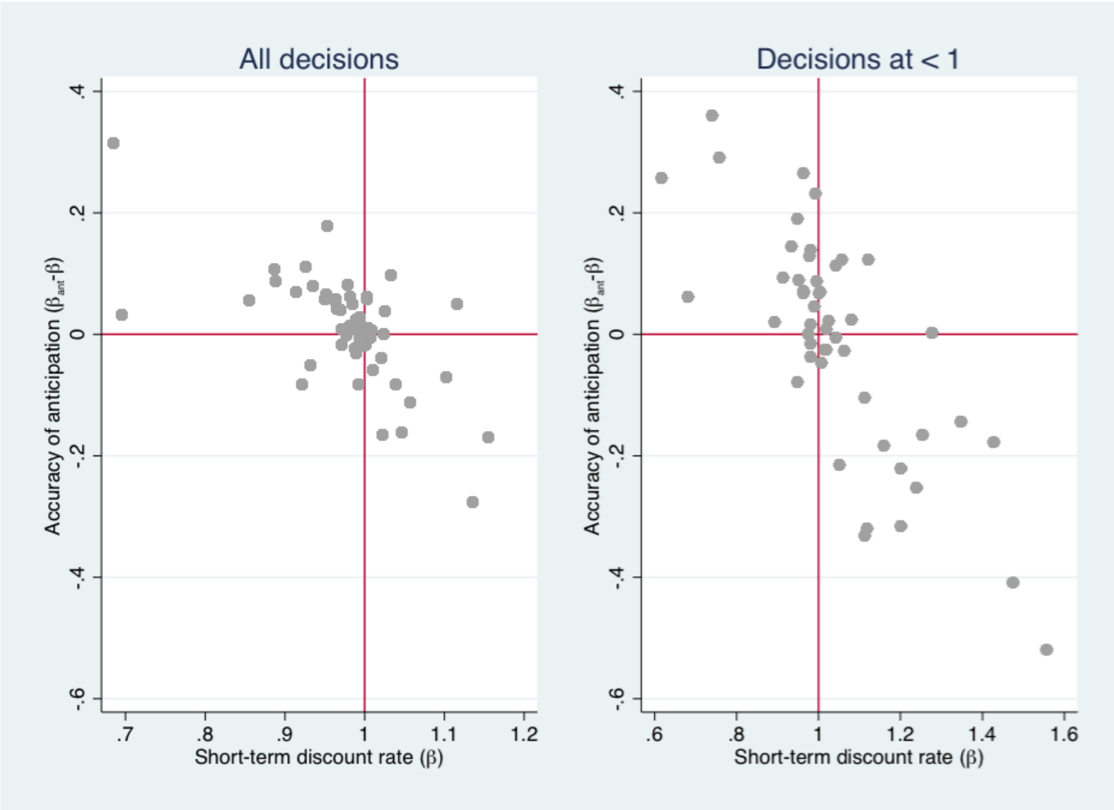
	Decisions $a_t < 1$		
	Underestimation $\hat{\beta} < \beta$	Insignificant difference $\hat{\beta} = \beta$	Overestimation $\hat{\beta} > \beta$
Future bias ($\beta > 1$)	40%	50%	10%
No bias ($\beta = 1$)	8%	59%	32%
Present bias ($\beta < 1$)	0%	50%	50%
Total	14%	57%	29%

short-term discount rate. Together with those who are unbiased and overestimate their short-term discount rate (between 14% and 32% of the unbiased participants), these participants anticipate to commit by delaying the monetary rewards when the immediate present is involved but fail facing the decisions.

Figure 9 represents the values of the anticipation accuracy ($\hat{\beta} - \beta$) regarding the values of the short-term discount rate (β). The accuracy of the anticipation is decreasing when the short-term discount rate increases. The superior corner at the left of the graph and the inferior one at the right represent the naive participants. The first one represents the naive present-biased subjects whereas the last one represents the naive future-biased participants. Most of the observations are located in the naive zone.

To sum up, even though a majority of the participants are time-consistent and accurately anticipate their time preferences, when they are time-inconsistent, both present or future-biased participants tend to be naive about their bias, i.e., they underestimate their bias.

Figure 4: Accuracy of the anticipation ($\hat{\beta} - \beta$) by values of the short-term discount rate (β) (Self-reported average daily consumption)



4 Conclusion and discussions

Up to now, the experimental literature is mostly focused on eliciting the present bias and too little has been done to elicit the naivety bias. For these reasons, this paper aims to elicit, through a lab experiment, the accuracy of the anticipation of the participants' potential biases. The experiment proceeds in two rounds with the same participants. The second round elicit the participants' time preferences whereas the first round elicit the anticipation of these preferences. To measure participants' time-preferences, I use Andreoni and Sprenger (2012a)'s Convex Time Budget method and then I adapt this method to measure their anticipation.

First, I investigated whether there is overall behavior for time inconsistency and anticipation accuracy at the aggregate level. I find no general pattern for time inconsistency and on average the participants accurately anticipate their time preferences. This findings appear to raise questions about the relevance of the aggregate analysis to determine if participants accurately anticipate their bias. Indeed, there can be some heterogeneity among participants. Some participants can be present-biased and others future-biased. Additionally, if both of them underestimate their bias, i.e., future-biased participants underestimate their short-term discount rate and present-biased ones overestimate it, on average the difference between $\hat{\beta}$ and β might not be significantly different from 0.

Second, I investigated potential sources of heterogeneity: the delay lengths between the payment dates and the heterogeneity across participants assuming that the parameters of their utility function are driven by their cognitive ability. In both cases, I find heterogenous behaviors but what is interesting is that the anticipated short-term discount rate is for some delay lengths or cognitive classes significantly different from the real one. Moreover, it is often the case when the participants are considered time-inconsistent. Thus this intermediate step is convincing to go further to elicit the parameters of the utility function of each participants.

Finally one main result emerges from the estimation of the individual time preferences, when the participants are biased they also tend to be naive about their bias. However, a majority of them exhibit no bias and accurately anticipate their time preferences.

Thereby, this paper gives some directions to better understand both the individuals' time-inconsistency bias and their ability to anticipate it. First, for monetary allocations, behaviors are subsequently heterogeneous across individuals. The sample for this experiment is quite homogeneous: the majority of the subjects are students in their twenties and yet I observe heterogeneity. Next, it seems that even the characteristics of the decision may influence whether participants are more likely to exhibit bias or to accurately anticipate it.[26]

Furthermore, two more results in marge of the purpose of this paper appears during the analysis and need to be discussed. First, the decreasing of the parameter α when the delay length increases. The explanation of this result depends on how one interprets the parameter α. While it represents the curvature degree of the utility function, the economics meaning of α on this settings is a matter of debate. One can consider that this parameter define either risk aversion, elasticity of the intertemporal substitution or reduction of the wealth marginal utility. The intuition to explain lower α for longer delay goes as follows: the longer the delay is and the riskier the future is perceived. However, the relation between time and risk preferences is a core issue in the design of experimental studies which want to elicit time preferences. A main question is whether the utility under risk is interchangeable with the utility over time. Andersen et al. (2008a) seems to agree this proposition since they estimate the degree of curvature of the utility function using risk elicitation tasks. However, Andreoni and Sprenger (2012b) are in favor that "risks preferences are not time preferences". Indeed, by adapting their CTB design to include uncertainty about payment they elicit a more concave utility function compared to the one with certain payment. Although their

[26]Given the small number of allocation decisions and participants in this experiment, it would not have been reasonable to estimate at the individual level, different parameters for different characteristics of the decision.

method were criticized (Cheung (2015a); Epper and Fehr-Duda (2015); Miao, Zhong et al. (2015)), other studies confirm their result with different methods (Abdellaoui, Diecidue and Öncüler (2011); Cheung (2015b)). In relation to this question, the finding presented above suggest an approach where α will be dependent on delay lengths. Nevertheless, this experiment is not designed to answer to this question and the low number of observations don't enable us to make more precise tests to verify this hypothesis.

Second, the relevance of monetary rewards to elicit time-inconsistencies bias is questioned during this article. Particularly, a substantial proportion of participants overestimate their future bias or anticipate they will be future-biased while they are not. This behavior is puzzling given theories on time-inconsistency biases. It cannot be considered that those people are naive about their bias. On the contrary, these participants anticipate to commit themselves by delaying the monetary rewards when it involves the immediate present but end up failing to commit. For future research, if monetary rewards are used to elicit time-inconsistencies bias, it will be necessarily to find a way to disentangle the different participant's understanding of the money role, whether it is tempting or a way to commit or something between. I believe the study of the anticipation was a first step. Also, the use of unambiguous tempting goods such as ice-cream (Olea and Strzalecki (2014)) or immediate costly activities (Augenblick, Niederle and Sprenger (2015); Augenblick and Rabin (n.d)) may be more relevant. To go further, behavior seems to be very volatile on the different characteristics of the decision, my guess is that the subjects' time-inconsistency bias depends on the object of their decision. It will be interesting to test whether one person may exhibit a time-inconsistency bias for one good and not another one and if this bias change with the temporal characteristics of the decisions.

References

Abdellaoui, Mohammed, Enrico Diecidue, and Ayse Öncüler. 2011. "Risk preferences at different time periods: An experimental investigation." *Management Science*, 57(5): 975–987.

Acland, Dan, and Matthew R Levy. 2015. "Naiveté, projection bias, and habit formation in gym attendance." *Management Science*, 61(1): 146–160.

Akerlof, George A. 1991. "Procrastination and obedience." *The American Economic Review*, 1–19.

Andersen, Steffen, Glenn W Harrison, Morten I Lau, and E Elisabet Rutström. 2008a. "Eliciting risk and time preferences." *Econometrica*, 76(3): 583–618.

Andersen, Steffen, Glenn W Harrison, Morten I Lau, and E Elisabet Rutström. 2008b. "Lost in state space: are preferences stable ?" *International Economic Review*, 49(3): 1091–1112.

Andreoni, James, and Charles Sprenger. 2012a. "Estimating Time Preferences from Convex Budgets." *The American Economic Review*, 102(7): 3333–56.

Andreoni, James, and Charles Sprenger. 2012b. "Risk preferences are not time preferences." *The American Economic Review*, 102(7): 3357–3376.

Andreoni, James, Michael A Kuhn, and Charles Sprenger. 2015. "Measuring Time Preferences: A Comparison of Experimental Methods." *Journal of Economic Behavior and Organization*, 116: 451–464.

Ariely, Dan, and Klaus Wertenbroch. 2002. "Procrastination, deadlines, and performance: Self-control by precommitment." *Psychological Science*, 13(3): 219–224.

Ashton, Lydia. 2014. "Hunger Games: Does Hunger and Cognitive Fatigue Affect Time Preferences?" *Available at SSRN 2538740*.

Augenblick, Ned, and Matthew Rabin. n.d. "An Experiment on Time Preference and Misprediction in Unpleasant Tasks."

Augenblick, Ned, Muriel Niederle, and Charles Sprenger. 2015. "Working over Time: Dynamic Inconsistency in Real Effort Tasks." *The Quaterly Journal of Economics*, 130(3): 1067–1115.

Balakrishnan, Uttara, Johannes Haushofer, and Pamela Jakiela. 2015. "How Soon Is Now? Evidence of Present Bias from Convex Time Budget Experiments."

Baucells, Manel, and Antonio Villasís. 2010. "Stability of risk preferences and the reflection effect of prospect theory." *Theory and Decision*, 68(1-2): 193–211.

Benhabib, Jess, Alberto Bisin, and Andrew Schotter. 2010. "Present-bias, quasi-hyperbolic discounting, and fixed costs." *Games and Economic Behavior*, 69(2): 205–223.

Bentham, Jeremy. 1879. *An introduction to the principles of morals and legislation.* Clarendon Press.

Bostic, Raphael, Richard J Herrnstein, and R Duncan Luce. 1990. "The effect on the preference-reversal phenomenon of using choice indifferences." *Journal of Economic Behavior & Organization*, 13(2): 193–212.

Cheung, Stephen L. 2015a. "Risk Preferences Are Not Time Preferences: On the Elicitation of Time Preference under Conditions of Risk: Comment." *American Economic Review*, 105(7): 2242–60.

Cheung, Stephen L. 2015b. "Eliciting utility curvature and time preference."

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

DellaVigna, Stefano, and Ulrike Malmendier. 2004. "Contract Design and Self-Control Theory and Evidence." *The Quaterly Journal of Economics*, 119(2): 352–402.

DellaVigna, Stefano, and Ulrike Malmendier. 2006. "Paying Not To Go to the Gym." *The American Economic Review*, 96(3): 694–719.

Epper, Thomas, and Helga Fehr-Duda. 2015. "Balancing on a Budget Line: Comment on Andreoni and SprengerâĂŹsRisk Preferences Are Not Time Preferences." *The American Economic Review*, 105(7): 2260–2271.

Frederick, Shane. 2005. "Cognitive reflection and decision making." *Journal of Economic perspectives*, 25–42.

Frederick, Shane, George Loewenstein, and Ted O'donoghue. 2002. "Time discounting and time preference: A critical review." *Journal of economic literature*, 351–401.

Giné, Xavier, Jessica Goldberg, Dan Silverman, and Dean Yang. 2012. "Revising commitments: field evidence on the adjustment of prior choices." National Bureau of Economic Research.

Harrison, Glenn W, and Morten Igel Lau. 2005. "Is the evidence for hyperbolic discounting in humans just an experimental artifact?" *Behavioral and brain sciences.*, 28(5): 657–657.

Harrison, Glenn W, Eric Johnson, Melayne M McInnes, and E Elisabet Rutström. 2005*a*. "Temporal stability of estimates of risk aversion." *Applied Financial Economics Letters*, 1(1): 31–35.

Harrison, Glenn W, Morten Igel Lau, Elisabet E Rutström, and Melonie B Sullivan. 2005*b*. "Eliciting risk and time preferences using field experiments: Some methodological issues." *Research in Experimental Economics*, 10: 125–218.

Holt, Charles A, and Susan K Laury. 2002. "Risk aversion and incentive effects." *American economic review*, 92(5): 1644–1655.

Jevons, Herbert Stanley. 1905. *Essays on economics.* Macmilan.

Kahneman, Daniel. 2011. *Thinking, fast and slow.* Macmillan.

Kuhn, Michael, Peter Kuhn, and Marie Claire Villeval. 2014. "Self control and intertemporal choice: Evidence from glucose and depletion interventions."

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

Laibson, David, Andrea Repetto, and Jeremy Tobacman. 2007. "Estimating discount functions with consumption choices over the lifecycle." National Bureau of Economic Research.

Loewenstein, George. 1987. "Anticipation and the valuation of delayed consumption." *The Economic Journal*, 666–684.

Meier, Stephan, and Charles D Sprenger. 2015. "Temporal stability of time preferences." *Review of Economics and Statistics*, 97(2): 273–286.

Miao, Bin, Songfa Zhong, et al. 2015. "Risk Preferences Are Not Time Preferences: Separating Risk and Time Preference: Comment." *American Economic Review*, 105(7): 2272–86.

O'Donoghue, Ted, and Matthew Rabin. 1999. "Doing it now or later." *American Economic Review*, 103–124.

O'Donoghue, Ted, and Matthew Rabin. 2001. "Choice and Procrastination." *The Quaterly Journal of Economics*, 116(1): 121–160.

Olea, José Luis Montiel, and Tomasz Strzalecki. 2014. "Axiomatization and measurement of quasi-hyperbolic discounting." *The Quarterly Journal of Economics*, 129(3): 1449–1499.

Page, Ellis Batten. 1963. "Ordered hypotheses for multiple treatments: a significance test for linear ranks." *Journal of the American Statistical Association*, 58(301): 216–230.

Phelps, Edmund, and Robert Pollak. 1968. "On Second-Best National Saving Game-Equilibrium Growth." *Review of Economic Studies*, 35(2): 185–199.

Rabin, Matthew, and Georg Weizsacker. 2009. "Narrow Bracketing and Dominated Choices." *American Economic Review*, 99(4): 1508–43.

Samuelson, Paul A. 1937. "A note on measurement of utility." *The Review of Economic Studies*, 4(2): 155–161.

Sayman, Serdar, and Ayse Öncüler. 2009. "An investigation of time inconsistency." *Management Science*, 55(3): 470–482.

Skiba, Paige Marta, and Jeremy Tobacman. 2008. "Payday loans, uncertainty and discounting: explaining patterns of borrowing, repayment, and default." *Vanderbilt Law and Economics Research Paper*, , (08-33).

Takeuchi, Kan. 2011. "Non-parametric test of time consistency: Present bias and future bias." *Games and Economic Behavior*, 71(2): 456–478.

Thaler, Richard. 1981. "Some empirical evidence on dynamic inconsistency." *Economics Letters*, 8(3): 201–207.

Tversky, Amos. 1969. "Intransitivity of preferences." *Psychological review*, 76(1): 31.

Appendix

Table 5: Average values of early tokens and AER by sooner dates and delays

	Today		In Five Weeks		Total	
Delays	a_t	**AER**	a_t	**AER**	a_t	**AER**
21	1.0050	-6.3794	0.9775	64.7186	0.9912	29.1696
35	0.9350	136.2406	0.9225	198.1238	0.9288	167.1822
49	0.9125	151.0291	0.9275	92.1818	0.9200	121.6054
70	0.8625	181.7410	0.9000	105.3885	0.8813	143.5647
105	0.8250	146.2869	0.9075	68.1175	0.8663	107.2022
Total	0.9080	121.7836	0.9270	105.7060	0.9175	113.7448

a_t: Values of sooner tokens *AER:* Annual Effective Rate

Figure 5: Average response time by page decision order

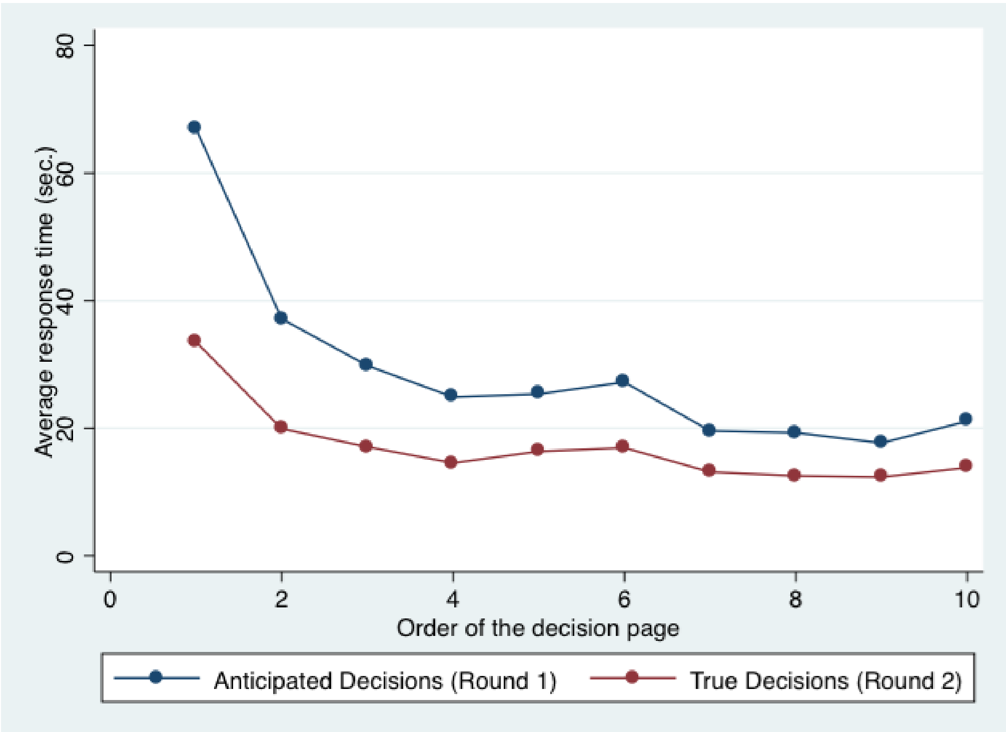


Table 6: Set of Allocation Decisions

N Alloc	d	t	N	a(d+t)	a(d)	P ou (1+r)	Annual Rate	AER
1	0	21	20	1	1,02	0,98	-34,08	-28,89
2	0	21	20	1	1,01	0,99	-17,21	-15,81
3	0	21	20	1	1,00	1,00	0,00	0,00
4	0	21	20	1	0,99	1,01	17,56	19,19
5	0	35	20	1	0,99	1,01	10,53	11,11
6	0	35	20	1	0,95	1,05	54,89	73,06
7	0	35	20	1	0,92	1,09	90,68	147,37
8	0	35	20	1	0,88	1,14	142,21	313,43
9	0	49	20	1	0,98	1,02	15,20	16,41
10	0	49	20	1	0,95	1,05	39,21	47,97
11	0	49	20	1	0,90	1,11	82,77	128,58
12	0	49	20	1	0,82	1,22	163,51	411,15
13	0	70	20	1	0,95	1,05	27,44	31,57
14	0	70	20	1	0,90	1,11	57,94	78,41
15	0	70	20	1	0,85	1,18	92,02	150,68
16	0	70	20	1	0,75	1,33	173,81	466,31
17	0	105	20	1	0,95	1,05	18,30	20,07
18	0	105	20	1	0,85	1,18	61,34	84,58
19	0	105	20	1	0,80	1,25	86,90	138,22
20	0	105	20	1	0,70	1,43	148,98	342,28
21	35	21	20	1	1,01	0,99	-17,21	-15,81
22	35	21	20	1	0,99	1,01	17,56	19,19
23	35	21	20	1	0,96	1,04	72,42	106,16
24	35	21	20	1	0,95	1,05	91,48	149,34
25	35	35	20	1	0,98	1,02	21,28	23,71
26	35	35	20	1	0,94	1,06	66,57	94,46
27	35	35	20	1	0,92	1,09	90,68	147,37
28	35	35	20	1	0,85	1,18	184,03	526,96
29	35	49	20	1	0,98	1,02	15,20	16,41
30	35	49	20	1	0,95	1,05	39,21	47,97
31	35	49	20	1	0,90	1,11	82,77	128,58
32	35	49	20	1	0,88	1,14	101,58	175,76
33	35	70	20	1	0,98	1,02	10,64	11,23
34	35	70	20	1	0,94	1,06	33,28	39,47
35	35	70	20	1	0,88	1,14	71,10	103,47
36	35	70	20	1	0,80	1,25	130,36	267,39
37	35	105	20	1	1,00	1,00	0,00	0,00
38	35	105	20	1	0,98	1,02	7,09	7,35
39	35	105	20	1	0,90	1,11	38,62	47,11
40	35	105	20	1	0,70	1,43	148,98	342,28

Table 7: Estimation results : logit Interior allocations

Interior allocations	b	se	z	p-values
delay1T0	.1034256	.1117026	.9259008	.3544975
delay2T0	.0848621	.1089784	.7787064	.4361527
delay3T0	.1453592	.1084625	1.34018	.1801868
delay4T0	.104683	.1098782	.9527181	.3407329
delay2T35	-.0070258	.1121132	-.0626674	.9500313
delay3T35	-.0561443	.1109537	-.506016	.6128454
delay4T35	-.176055	.1130019	-1.557983	.1192372
delay5T35	-.1214718	.1123907	-1.0808	.2797861
AER	.0000755	.0002315	.3261926	.7442786
_cons	-.8952832	.0680744	-13.15153	0

Figure 6: Comparison Early Payments (Round 2)

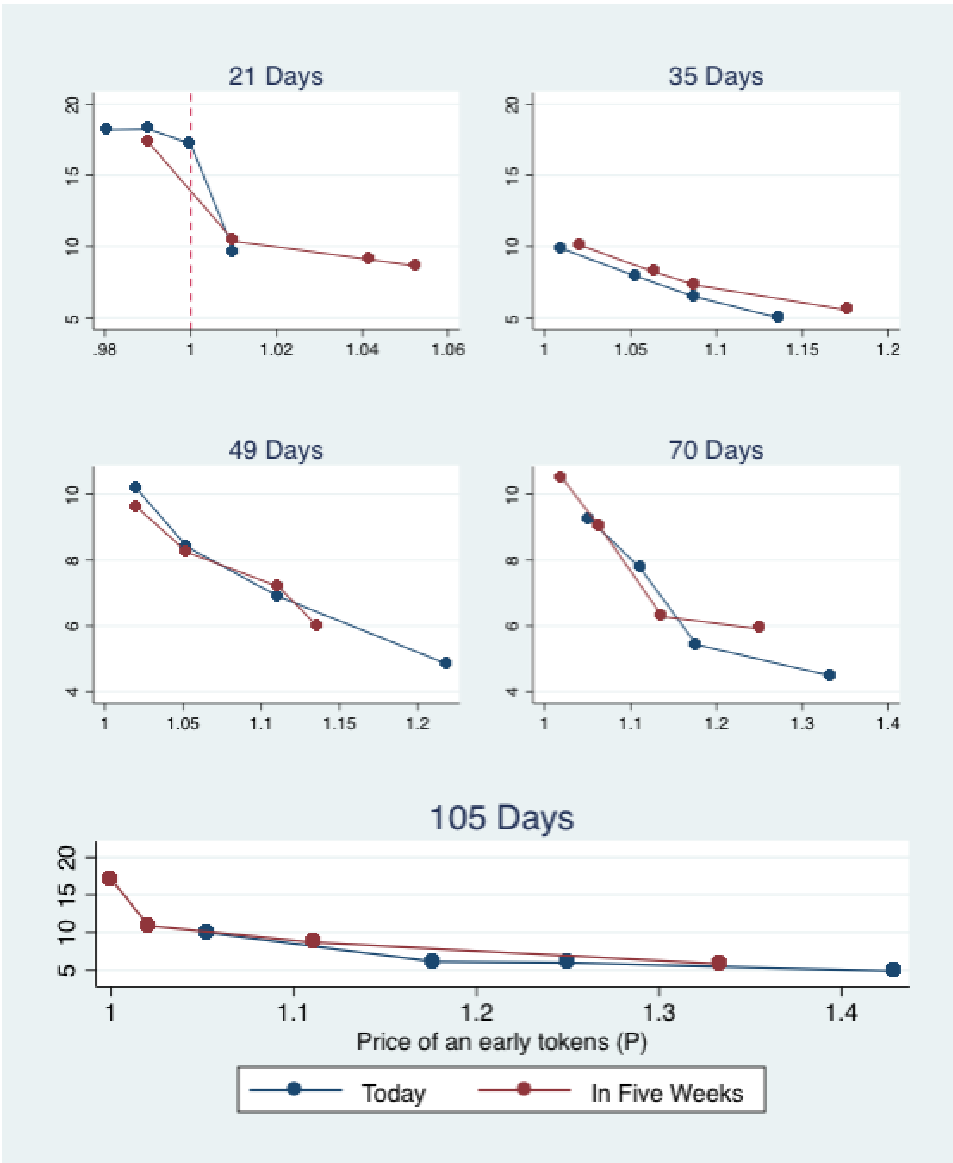


Table 8: Estimation of the aggregate parameters

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	NLS	NLS	NLS	NLS	NLS	NLS	NLS	NLS	NLS	NLS
α	0.9109***	0.8303***	0.6216***	0.9757***	0.9750***	0.8627***	0.7530***	0.4570***	0.9379***	0.9375***
	(0.0100)	(0.0149)	(0.0631)	(0.0035)	(0.0024)	(0.0178)	(0.0291)	(0.0960)	(0.0105)	(0.0094)
δ	0.9993***	0.9993***	0.9991***	0.9999***	0.9994***	0.9994*	0.9994	0.9993	0.9991***	0.9994**
	(0.0002)	(0.0002)	(0.0003)	(0.0000)	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0001)	(0.0002)
AR	0.2910***	0.3119***	0.3855***	0.0357***	0.2273***	0.2347	0.2236	0.3016	0.4001***	0.2354**
	(0.0953)	(0.1116)	(0.1485)	(0.0123)	(0.0699)	(0.1485)	(0.1739)	(0.2260)	(0.0714)	(0.1116)
β	0.9825**	0.9827**	0.9808**	1.0002	0.9874***	1.0268**	1.0333**	1.0340**	1.0141	1.0162*
	(0.0062)	(0.0071)	(0.0089)	(0.0022)	(0.0046)	(0.0128)	(0.0147)	(0.0166)	(0.0097)	(0.0097)
$\hat{\beta}$	0.9918	0.9928	0.9939	1.0070**	0.9942	1.0304	1.0365	1.0402	1.0177	1.0202
	(0.0064)	(0.0075)	(0.0099)	(0.0034)	(0.0047)	(0.0125)	(0.0138)	(0.0173)	(0.0122)	(0.0105)
$\omega_t = \omega_{t+k}$	0	5	ω_i		-4.5400	0	5	ω_i		-3.4984
					(0.6196)					(0.5064)
ω_t				-5.1318					-3.3556	
				(0.6026)					(0.5480)	
ω_{t+k}				2.8249					-5.4493	
				(0.9625)					(1.5754)	
$H_0 : \beta = 1$	0.0480	0.0154	0.0315	0.9373	0.0065	0.036	0.0236	0.0398	0.1473	0.0931
$H_0 : \beta = \hat{\beta}$	0.2768	0.3110	0.3241	0.0351	0.2464	0.8312	0.8636	0.7820	0.8104	0.7757
$H_0 : \omega_t = \omega_{t+k}$				0.0000					0.2324	
N	4960	4960	4960	4960	4960	4340	4340	4340	4340	4340

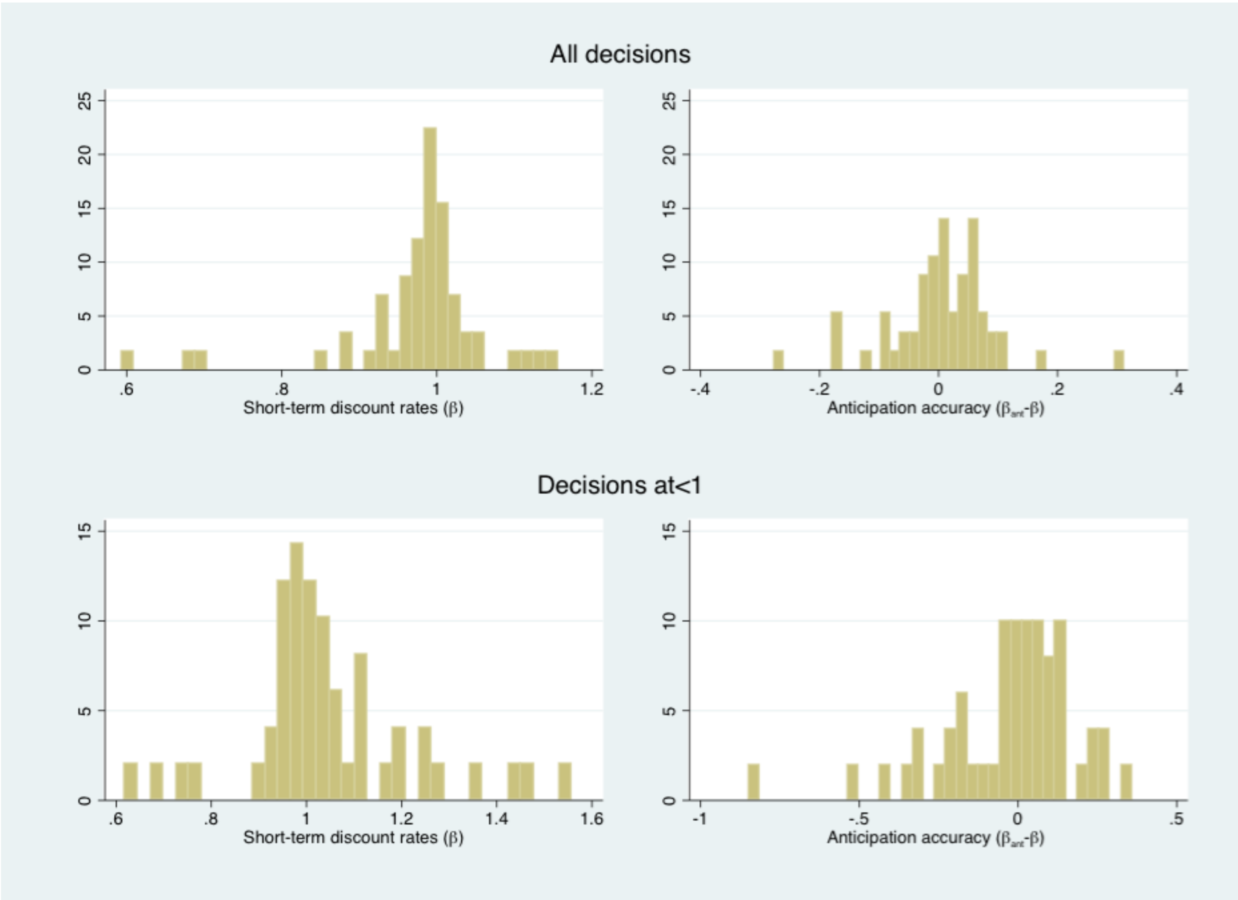
Robust standard errors clustered at the subject level.
ω_i indicates self-reported average daily expenditure, which varies across subjects.
AR: Annual Rate
H_0: $b = 1$, H_0: $AR = 0$ or H_0: $\hat{\beta} = \beta$: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 9: Parameters estimation across delay-length class

	(1) NLS	(2) NLS	(3) NLS	(4) NLS	(5) NLS	(6) NLS	(7) NLS	(8) NLS	(9) NLS	(10) NLS
δ	0.9990***	0.9989***	0.9987***	0.9997***	0.9994***	0.9993*	0.9993	0.9991*	0.9991***	0.9993**
	(0.0002)	(0.0002)	(0.0003)	(0.0001)	(0.0001)	(0.0004)	(0.0004)	(0.0005)	(0.0002)	(0.0003)
AR	0.4585***	0.4919***	0.5982***	0.1314***	0.2519***	0.2797*	0.2752	0.3898	0.3944***	0.2754**
	(0.1315)	(0.1347)	(0.1848)	(0.0381)	(0.0617)	(0.1680)	(0.1894)	(0.2630)	(0.0851)	(0.1371)
α										
- *SD*	0.9736***	0.9583***	0.9136***	0.9833***	0.9963***	0.9188***	0.8763***	0.7471***	0.9418***	0.9446***
	(0.0029)	(0.0043)	(0.0177)	(0.0037)	(0.0006)	(0.0202)	(0.0294)	(0.0751)	(0.0166)	(0.0150)
- *MD*	0.9054***	0.8407***	0.6379***	0.9605***	0.9593***	0.9017***	0.8338***	0.6239***	0.9478***	0.9459***
	(0.0131)	(0.0196)	(0.0773)	(0.0064)	(0.0068)	(0.0140)	(0.0212)	(0.0793)	(0.0105)	(0.0098)
- *LD*	0.8693***	0.7707***	0.5049***	0.9463***	0.9508***	0.8448***	0.7270***	0.4165***	0.9223***	0.9184***
	(0.0152)	(0.0227)	(0.0824)	(0.0081)	(0.0057)	(0.0205)	(0.0342)	(0.1001)	(0.0154)	(0.0144)
β										
- *SD*	0.9924**	0.9937*	0.9961	0.9967	1.0028	1.0008	1.0005	0.9995	0.9940	1.0009
	(0.0035)	(0.0033)	(0.0041)	(0.0024)	(0.0021)	(0.0109)	(0.0107)	(0.0118)	(0.0129)	(0.0114)
- *MD*	1.0243*	1.0290*	1.0309	1.0182**	1.0060	1.0134	1.0161	1.0194	1.0057	1.0086
	(0.0141)	(0.0157)	(0.0187)	(0.0087)	(0.0112)	(0.0137)	(0.0147)	(0.0187)	(0.0122)	(0.0116)
- *LD*	1.0432***	1.0507***	1.0553***	1.0220**	1.0093	1.0371*	1.0440*	1.0507*	1.0265	1.0270
	(0.0156)	(0.0176)	(0.0202)	(0.0096)	(0.0118)	(0.0200)	(0.0223)	(0.0265)	(0.0178)	(0.0170)
$\hat{\beta}$										
- *SD*	1.0045***	1.0051***	1.0077***	1.0047***	1.0054**	1.0324*	1.0325*	1.0293	1.0276*	1.0320*
	(0.0045)	(0.0044)	(0.0062)	(0.0031)	(0.0026)	(0.0156)	(0.0156)	(0.0181)	(0.0189)	(0.0158)
- *MD*	1.0630***	1.0704***	1.0787**	1.0418**	1.0350**	1.0529***	1.0585***	1.0683**	1.0399**	1.0415**
	(0.0142)	(0.0149)	(0.0219)	(0.0111)	(0.0120)	(0.0145)	(0.0149)	(0.0237)	(0.0138)	(0.0132)
- *LD*	1.0347	1.0422	1.0487	1.0163	1.0016	1.0206	1.0266	1.0359	1.0108	1.0118
	(0.0134)	(0.0149)	(0.0185)	(0.0091)	(0.0102)	(0.0153)	(0.0166)	(0.0221)	(0.0145)	(0.0133)
$\omega_t = \omega_{t+k}$	0	5	ω_i		-4.0886	0	5	ω_i		-3.0341
					(0.4655)					(0.5686)
ω_t				-4.1076					-3.0340	
				(0.5186)					(0.5828)	
ω_{t+k}				0.6370					-4.4882	
				(1.3331)					(1.8270)	
N	4960	4960	4960	4960	4960	4340	4340	4340	4340	4340

Robust standard errors clustered at the subject level.
ω_i indicates self-reported average daily expenditure, which varies across subjects.
AR: Annual Rate
H_0: $b = 1$, H_0: $AR = 0$ or H_0: $\hat{\beta} = \beta$: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Figure 7: Estimated short-term discount rates (β) and anticipation accuracy ($\hat{\beta} - \beta$) (Self-reported average daily consumption)



For a matter of clarity some estimated values are not represented. When we consider all the allocations, 2 pairs (β,$\hat{\beta}$) are not represented: (5.88,2.45) and (0.59,2.18). When we consider only the sooner-smaller allocations, 2 pairs are not represented: (3.01,0.52) and (3.69,2.84).

Figure 8: Accuracy of the anticipation over temporal bias (Self-reported average daily consumption)

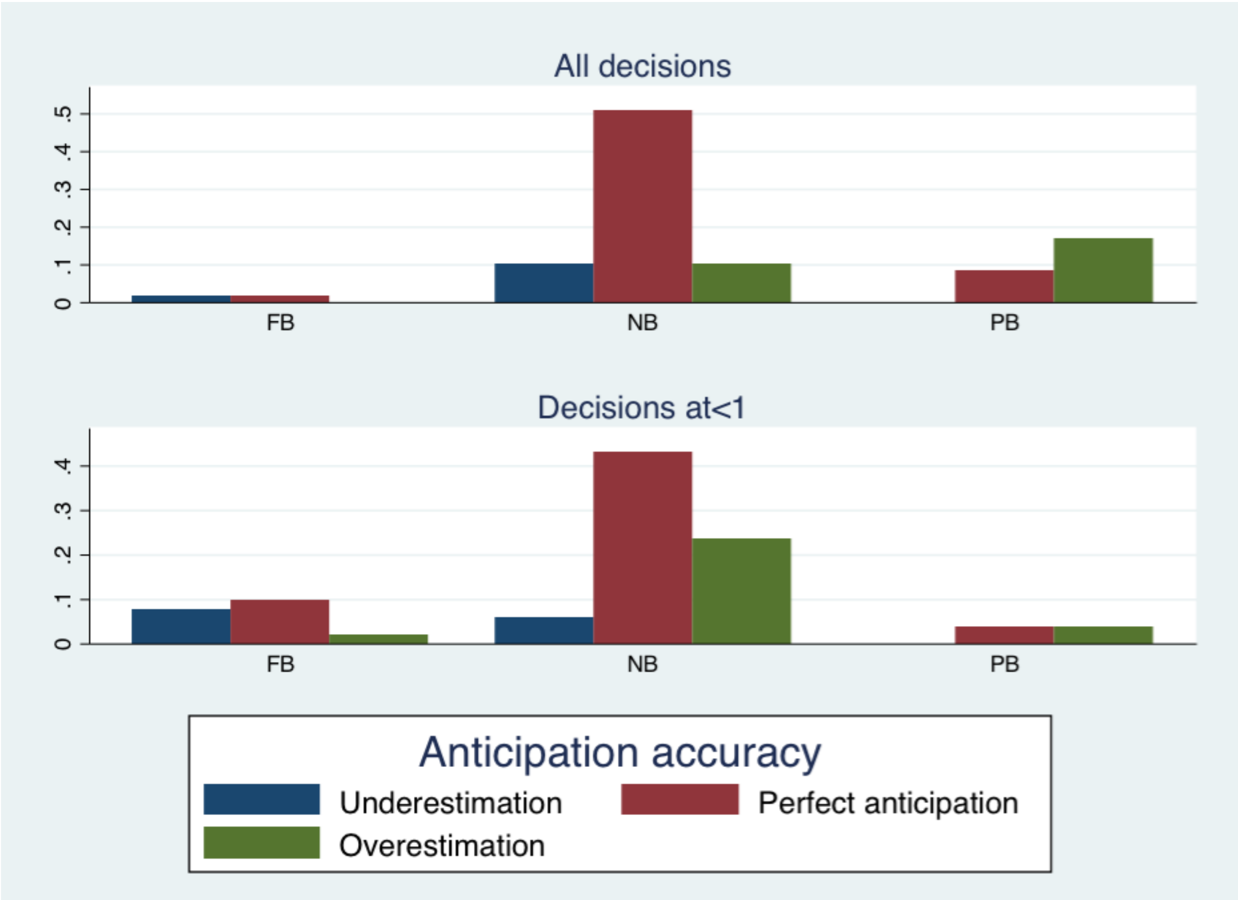


Figure 9: Accuracy of the anticipation ($\hat{\beta} - \beta$) by values of the short-term discount rate (β) (Self-reported average daily consumption)

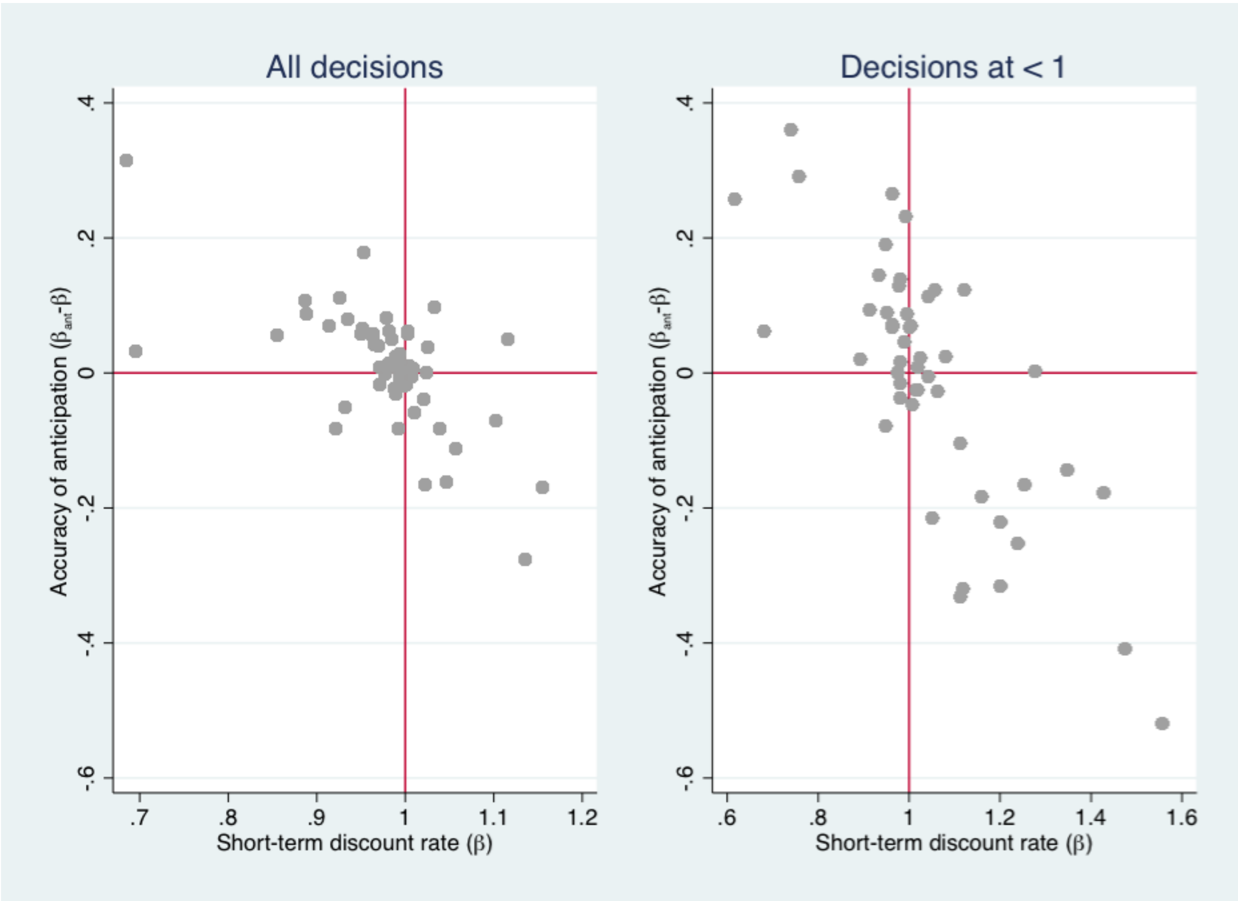


Table 10: P-value associated to the test $H_0 : \alpha_i = \alpha_j$

All decisions

	(1) $\omega = 0$		(2) $\omega = 5$		(3) ω_i		(4) $\hat{\omega_t} \neq \hat{\omega_{t+k}}$		(5) $\hat{\omega_t} = \hat{\omega_{t+k}}$	
	α_{SD}	α_{MD}	α_{SD}	α_{MD}	α_{SD}	α_{MD}	α_{SD}	α_{MD}	α_{SD}	α_{MD}
α_{MD}	0^{***}		0^{***}		0.0001^{***}		0^{***}		0^{***}	
α_{LD}	0^{***}	0.0001^{***}	0^{***}	0^{***}	0^{***}	0^{***}	0^{***}	0.0195^{*}	0^{***}	0.1553
$\alpha_{SD} = \alpha_{MD} = \alpha_{LD}$	0		0		0		0		0	

Decisions $a_t < 1$

	(6) $\omega = 0$		(7) $\omega = 5$		(8) ω_i		(9) $\hat{\omega_t} \neq \hat{\omega_{t+k}}$		(10) $\hat{\omega_t} = \hat{\omega_{t+k}}$	
	α_{SD}	α_{MD}	α_{SD}	α_{MD}	α_{SD}	α_{MD}	α_{SD}	α_{MD}	α_{SD}	α_{MD}
α_{MD}	0.3632		0.1552		0.0798		0.6207		0.9071	
α_{LD}	0.0031^{***}	0^{***}	0.0006^{***}	0^{***}	0.0002^{***}	0^{***}	0.1634	0.0058^{**}	0.0757	0.0038^{**}
$\alpha_{SD} = \alpha_{MD} = \alpha_{LD}$	0.0001		0		0		0.0215		0.0147	

Bonferroni adjustement: the probability threshold of H_0 rejection is divided by the number of multiple tests (3)
*** significance at 1% ($p < 0.0033$), ** significance at 5% ($p < 0.0167$), * significance at 10% ($p < 0.0333$)

Table 11: Classes of cognitive abilities

	CRT2 0	CRT2 1	CRT2 2	CRT2 3
CRT1 0	25	7	1	0
CRT1 1	1	7	6	0
CRT1 2	0	0	3	4
CRT1 3	0	0	0	8

CRT Class	Participants Nb
LowCRT	26
LowLearningCRT	8
MediumCRT	16
HighLearningCRT	4
PerfectCRT	8

5 Experiment Materials

5.1 Screenshots

Table 12: Parameters estimation by Cognitive abilities class

	(1) NLS	(2) NLS	(3) NLS	(4) NLS	(5) NLS	(6) NLS	(7) NLS	(8) NLS	(9) NLS	(10) NLS
δ										
LCRT	1.0000	1.0002	1.0003	0.9997	0.9998***	1.0012*	1.0018	1.0021	0.9987***	1.0023
	(0.0002)	(0.0004)	(0.0005)	(0.0002)	(0.0000)	(0.0007)	(0.0011)	(0.0015)	(0.0002)	(0.0015)
LLCRT	0.9991**	0.9990**	0.9985***	0.9993**	0.9990***	0.9990*	0.9990*	0.9984***	0.9988***	0.9990*
	(0.0004)	(0.0004)	(0.0005)	(0.0003)	(0.0003)	(0.0005)	(0.0006)	(0.0006)	(0.0004)	(0.0006)
MCRT	0.9985***	0.9985***	0.9983***	0.9993**	0.9985***	0.9984***	0.9984***	0.9982**	0.9989***	0.9983***
	(0.0005)	(0.0004)	(0.0005)	(0.0002)	(0.0005)	(0.0006)	(0.0006)	(0.0007)	(0.0002)	(0.0006)
HLCRT	0.9977**	0.9978**	0.9968**	0.9990***	0.9977**	0.9975**	0.9975**	0.9962*	0.9985***	0.9975**
	(0.0011)	(0.0010)	(0.0015)	(0.0003)	(0.0011)	(0.0013)	(0.0012)	(0.0019)	(0.0005)	(0.0011)
PCRT	0.9996	0.9996	0.9997	0.9993**	0.9997*	0.9998	0.9999	1.0003	0.9984***	1.0001
	(0.0003)	(0.0005)	(0.0004)	(0.0003)	(0.0002)	(0.0005)	(0.0010)	(0.0010)	(0.0004)	(0.0013)
AR										
LCRT	0.0060	-0.0680	-0.1126	0.1222	0.0618***	-0.3569**	-0.4809**	-0.5302**	0.5795***	-0.5672**
	(0.0864)	(0.1307)	(0.1669)	(0.0832)	(0.0085)	(0.1641)	(0.2080)	(0.2554)	(0.1331)	(0.2289)
LLCRT	0.4079*	0.4386*	0.7313**	0.2886**	0.4203**	0.4381	0.4553	0.8268**	0.5616**	0.4663
	(0.2097)	(0.2309)	(0.3033)	(0.1418)	(0.1796)	(0.2842)	(0.3193)	(0.4071)	(0.2200)	(0.3400)
MCRT	0.7308**	0.7476***	0.8335***	0.3042**	0.7284**	0.8092**	0.8227**	0.9227*	0.5141***	0.8375**
	(0.2983)	(0.2853)	(0.3665)	(0.0814)	(0.2845)	(0.3874)	(0.3812)	(0.5082)	(0.1355)	(0.3754)
HLCRT	1.2896	1.2563	2.1795	0.4262***	1.2937	1.5169	1.5217	2.9536	0.7261**	1.5086
	(0.8952)	(0.8151)	(1.7362)	(0.1317)	(0.9381)	(1.1611)	(1.1094)	(2.7863)	(0.3280)	(1.0248)
PCRT	0.1463	0.1672	0.1004	0.2853*	0.1072*	0.0766	0.0257	-0.1055	0.8173***	-0.0282
	(0.1165)	(0.1983)	(0.1704)	(0.1458)	(0.0607)	(0.2139)	(0.3564)	(0.3105)	(0.2744)	(0.4710)
α										
LCRT	0.9010***	0.7754***	0.5935***	170.2087***	0.9965***	0.7879***	0.5524***	0.2084***	1.0456***	-7924.0351***
	(0.0192)	(0.0288)	(0.0463)	(18.7242)	(0.0006)	(0.0382)	(0.0665)	(0.1311)	(0.0139)	(1344.2145)
LLCRT	0.9362***	0.8722***	0.4778**	140.4596***	0.9748***	0.9130***	0.8376***	0.3623**	41.9059***	-2.6461e+07
	(0.0180)	(0.0294)	(0.2299)	(29.1614)	(0.0066)	(0.0281)	(0.0464)	(0.2860)	(11.8110)	(35170335.0891)
MCRT	0.9111***	0.8460***	0.6697***	60.5048***	0.9717***	0.8840***	0.8073***	0.5901***	17.5526***	-7.8326e+07***
	(0.0168)	(0.0254)	(0.0989)	(9.2391)	(0.0047)	(0.0259)	(0.0397)	(0.1313)	(3.3588)	(25595367.6575)
HLCRT	0.9202***	0.8604***	0.6381*	72.4586***	0.9389***	0.8963***	0.8273***	0.5615*	45.8024***	-1.7515e+08***
	(0.0156)	(0.0357)	(0.2095)	(23.8210)	(0.0124)	(0.0254)	(0.0476)	(0.2633)	(13.3864)	(36680295.5024)
PCRT	0.9595***	0.8899***	0.8410***	389.5274***	0.9864***	0.9239***	0.8215***	0.7449***	26.3017***	394.5633***
	(0.0125)	(0.0163)	(0.0211)	(50.1022)	(0.0032)	(0.0241)	(0.0373)	(0.0632)	(7.7490)	(112.3060)
β										
LCRT	0.9978	1.0032	1.0085	0.9864	0.9991	1.0995***	1.1259***	1.1387***	1.0714**	1.1492***
	(0.0084)	(0.0115)	(0.0129)	(0.0130)	(0.0014)	(0.0287)	(0.0373)	(0.0434)	(0.0346)	(0.0467)
LLCRT	0.9734**	0.9698**	0.9798	0.9788	0.9812	0.9957	0.9980	1.0192	0.9965	0.9996
	(0.0130)	(0.0149)	(0.0213)	(0.0125)	(0.0122)	(0.0196)	(0.0224)	(0.0295)	(0.0177)	(0.0255)
MCRT	0.9830	0.9810	0.9692*	1.0060*	0.9919	1.0133	1.0141	0.9992	1.0254	1.0151
	(0.0152)	(0.0164)	(0.0180)	(0.0173)	(0.0132)	(0.0238)	(0.0252)	(0.0228)	(0.0241)	(0.0251)
HLCRT	0.9661*	0.9614	0.9281**	0.9958*	0.9692	0.9930	0.9934	0.9626	1.0139	0.9944
	(0.0188)	(0.0256)	(0.0449)	(0.0013)	(0.0171)	(0.0266)	(0.0313)	(0.0450)	(0.0093)	(0.0368)
PCRT	0.9775**	0.9740***	0.9730**	0.9657***	0.9838**	1.0013	1.0148	1.0146	0.9921	1.0262
	(0.0101)	(0.0094)	(0.0114)	(0.0107)	(0.0077)	(0.0157)	(0.0218)	(0.0279)	(0.0164)	(0.0285)
$\hat{\beta}$										
LCRT	0.9833	0.9807	0.9745	0.9598	0.9994	1.0150*	1.0258*	1.0194**	0.9688*	1.0360*
	(0.0113)	(0.0155)	(0.0160)	(0.0228)	(0.0018)	(0.0316)	(0.0389)	(0.0382)	(0.0410)	(0.0457)
LLCRT	1.0037*	1.0065**	1.0180**	1.0192	1.0071*	1.0369	1.0453	1.0596	1.0468	1.0503
	(0.0077)	(0.0093)	(0.0181)	(0.0174)	(0.0066)	(0.0158)	(0.0186)	(0.0256)	(0.0217)	(0.0235)
MCRT	1.0017	1.0003	1.0067	1.0259*	1.0061	1.0320	1.0331	1.0422	1.0443	1.0342
	(0.0140)	(0.0147)	(0.0210)	(0.0205)	(0.0127)	(0.0227)	(0.0235)	(0.0339)	(0.0260)	(0.0237)
HLCRT	1.0135***	1.0078***	0.9757***	1.0427***	1.0162***	1.0562***	1.0527***	1.0211***	1.0694***	1.0495**
	(0.0229)	(0.0283)	(0.0498)	(0.0177)	(0.0197)	(0.0353)	(0.0375)	(0.0540)	(0.0191)	(0.0465)
PCRT	0.9874	0.9867	0.9892	0.9796	0.9900	1.0212	1.0369	1.0431	1.0143	1.0485
	(0.0077)	(0.0104)	(0.0118)	(0.0183)	(0.0062)	(0.0241)	(0.0277)	(0.0339)	(0.0301)	(0.0321)
ω	0	5	ω_i	$\hat{\omega}_t \neq \hat{\omega}_{t+k}$	$\hat{\omega}_t = \hat{\omega}_{t+k}$	0	5	ω_i	$\hat{\omega}_t \neq \hat{\omega}_{t+k}$	$\hat{\omega}_t = \hat{\omega}_{t+k}$

Robust standard errors clustered at the subject level. H_0: $b = 1$, H_0: $AR = 0$ or H_0: $\hat{\beta} = \beta$: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
ω_i indicates self-reported average daily expenditure, which varies across subjects/AR: Annual Rate.

Table 13: Estimated background consumption by Cognitive abilities class

	(1) NLS	(2) NLS	(3) NLS	(4) NLS	(5) NLS	(6) NLS	(7) NLS	(8) NLS	(9) NLS	(10) NLS
ω_t										
LCRT				-9116.6906					-7.8299	
				(1.6965)					(1.2269)	
LLCRT				-13670.7492					-3228.0460	
				(3.5303)					(.)	
MCRT				-5182.2538					-1201.3396	
				(2.6762)					(.)	
HLCRT				-6600.4897					-3590.9841	
				(5.6005)					(.)	
PCRT				-37749.3868					-1556.6314	
				(3.1105)					(.)	
ω_{t+k}										
LCRT				-9119.7011					-15.4315	
				(.)					(1.0752)	
LLCRT				-13667.8488					-3229.1538	
				(.)					(4.7782)	
MCRT				-5176.1343					-1198.2871	
				(.)					(3.3950)	
HLCRT				-6590.8559					-3584.5167	
				(.)					(7.6351)	
PCRT				-37751.6214					-1565.3419	
				(.)					(3.9178)	
$\omega_t = \omega_{t+k}$										
LCRT					-5.0146					209220.6015
					(0.8583)					(.)
LLCRT					-3.6247					2.0866e+09
					(1.2090)					(2.4731e+09)
MCRT					-4.5430					5.5739e+09
					(0.8053)					(2.5233e+09)
HLCRT					-1.5486					1.3720e+10
					(0.8523)					(1.7890e+09)
PCRT					-3.1664					-24873.3203
					(1.7431)					(.)

Table 14: Individual estimated parameters (all decisions, self-reported average daily consumption)

N	AR	(s.e.)	α	(s.e.)	[p-val] ($\alpha = 1$)	β	(s.e.)	[p-val] ($\beta = 1$)	$\hat{\beta}$	(s.e.)	[p-val] ($\beta = \hat{\beta}$)	ω
1	.2622	(.002)	.9787	(0)	[0]	1.0052	(.0001)	[.5519]	1.0134	(.0001)	[.437]	2.9
4	.0422	(.0035)	.933	(.0001)	[0]	.9719	(.0002)	[.0442]	1.0111	(.0002)	[.0417]	5.7
5	1418.6964	(93926312)	-3.0952	(16.9264)	[.3227]	.5943	(.1008)	[.2052]	2.1843	(3.1962)	[.4476]	42.9
7	-.0321	(.0178)	.8431	(.0012)	[0]	1.0244	(.0011)	[.4706]	.8562	(.0013)	[.0008]	10.7
10	.0686	(.0066)	.9176	(.0002)	[0]	.9722	(.0004)	[.1463]	.954	(.0004)	[.4449]	7.1
12	-.2061	(.0202)	.8066	(.002)	[0]	1.0054	(.0011)	[.8705]	1.0054	(.0011)	[1]	12.9
13	.1798	(.0077)	.8712	(.0004)	[0]	1.0087	(.0004)	[.6756]	1.0022	(.0004)	[.8008]	11.4
14	1.302	(.0414)	.7981	(.0009)	[0]	.9543	(.0005)	[.0463]	1.1309	(.0011)	[0]	7.1
15	2.0539	(.0123)	.9825	(0)	[0]	1.0044	(.0001)	[.7094]	1.0599	(0)	[0]	2.1
16	2.5354	(.1177)	.9453	(.0001)	[0]	1.0102	(.0004)	[.6173]	1.0154	(.0004)	[.8289]	2.9
17	.3346	(.1631)	.4184	(.0943)	[.062]	1.1168	(.0153)	[.3476]	1.1643	(.0214)	[.7123]	14.3
18	.4978	(.0066)	.9378	(.0001)	[0]	.9835	(.0002)	[.267]	1.0432	(.0003)	[.0038]	7.1
21	-.5792	(.0299)	.6436	(.0106)	[.0009]	1.0121	(.0021)	[.7918]	.9522	(.0018)	[.2935]	14.3
23	.0386	(.0056)	.9353	(.0002)	[0]	1.023	(.0004)	[.2631]	.9828	(.0003)	[.1129]	2.1
25	3.9168	(.7555)	.8838	(.0005)	[0]	1.0345	(.0007)	[.1898]	1.1296	(.0011)	[.0072]	3.6
26	.0656	(.004)	.9413	(.0001)	[0]	.9907	(.0002)	[.5386]	1.0142	(.0003)	[.2581]	4.3
27	1.1726	(.0451)	.6302	(.0035)	[0]	.978	(.0007)	[.4001]	.9752	(.0007)	[.933]	21.4
29	-.22	(.0111)	.9035	(.0004)	[0]	.9871	(.0004)	[.5326]	.9975	(.0005)	[.6995]	7.1
30	1.0033	(.0134)	.9655	(0)	[0]	.9829	(.0002)	[.258]	.9958	(.0002)	[.4451]	2.9
31	1.087	(.1009)	.6101	(.0099)	[.0002]	1.059	(.0024)	[.2325]	.9455	(.0017)	[.0647]	28.6
32	-.2989	(.0217)	.8288	(.0018)	[.0001]	.9953	(.001)	[.8841]	1.0226	(.0012)	[.5194]	10
33	-.337	(.0238)	.7988	(.0025)	[.0001]	.9947	(.0012)	[.8774]	1.0086	(.0012)	[.753]	11.4
34	.2581	(.0078)	.8778	(.0003)	[0]	.9512	(.0004)	[.0142]	1.0074	(.0004)	[.0303]	.1
36	.0371	(.0002)	.9916	(0)	[0]	.9993	(0)	[.8143]	1.0027	(0)	[.4375]	5.7
37	.2726	(.0061)	.9065	(.0002)	[0]	.9906	(.0003)	[.5879]	.9579	(.0003)	[.1324]	11.4
38	1.5156	(.2786)	.4578	(.0268)	[.0014]	1.1043	(.0045)	[.1252]	1.0328	(.0029)	[.312]	14.3
39	23.739	(1141.3963)	.3774	(.0977)	[.05]	.8888	(.0072)	[.1923]	.9933	(.0053)	[.3039]	7.1
40	.4607	(.0532)	.543	(.0176)	[.0009]	1.156	(.006)	[.0476]	.9854	(.0022)	[.0441]	5.7
41	2.042	(.0481)	.9374	(.0001)	[0]	.9658	(.0004)	[.0789]	1.0223	(.0003)	[.0103]	5.7
42	-.685	(.2039)	-4.2634	(19.156)	[.2329]	.6866	(.051)	[.1691]	.9991	(.0193)	[.2412]	14.3
43	-.105	(.0494)	-.9331	(.3613)	[.0019]	1.0475	(.0033)	[.4141]	.8842	(.0029)	[.0442]	8.6
44	-1	(0)	-3.8558	(278.3734)	[.7718]	5.8811	(1306.6393)	[.8929]	2.4573	(60.6343)	[.9047]	11.4
45	-.4685	(.026)	.7451	(.0044)	[.0003]	.9275	(.0013)	[.0519]	1.0369	(.0018)	[.0455]	7.1
46	1.9416	(.0627)	.8992	(.0002)	[0]	.9866	(.0004)	[.5021]	1.0355	(.0004)	[.0436]	8.6
47	.0327	(.0001)	.9943	(0)	[0]	.9928	(0)	[.0008]	.9984	(0)	[.0515]	3.6
48	-.3735	(.0189)	.7703	(.0025)	[0]	1.0412	(.0013)	[.249]	.9579	(.0009)	[.0586]	7.1
49	.4745	(.0083)	.586	(.0021)	[0]	1.0023	(.0004)	[.9038]	.984	(.0003)	[.4298]	42.9
50	-.3791	(.0261)	.7548	(.0038)	[.0002]	.99	(.0014)	[.7872]	.9643	(.0013)	[.5757]	14.3
51	75.5525	(40062.304)	-.7672	(1.4127)	[.1412]	.6968	(.0322)	[.0953]	.7265	(.0284)	[.7618]	28.6
53	8.1793	(29.2921)	.5225	(.0257)	[.0039]	.8564	(.0039)	[.0241]	.9109	(.0029)	[.3729]	14.3
54	-.6863	(.0269)	.2776	(.0473)	[.0014]	.8891	(.0026)	[.0343]	.9744	(.0023)	[.1736]	21.4
55	1.7596	(.0384)	.9328	(.0001)	[0]	.9654	(.0004)	[.0774]	1.018	(.0003)	[.0191]	5
56	4.574	(2.8596)	.829	(.0021)	[.0004]	.9335	(.0016)	[.0972]	.8801	(.0024)	[.2799]	5.7
57	.576	(.0253)	.7799	(.0017)	[0]	.9151	(.001)	[.0074]	.9829	(.0009)	[.0785]	21.4
58	.0247	(.0033)	.9549	(.0001)	[0]	.9948	(.0002)	[.7155]	.9789	(.0002)	[.3837]	2.9
59	.2921	(.0049)	.929	(.0001)	[0]	.973	(.0002)	[.0769]	.9802	(.0002)	[.7034]	8.6
60	1.5815	(.0503)	-.072	(.0171)	[0]	1.0275	(.0005)	[.211]	1.0638	(.0006)	[.1823]	71.4
61	.0933	(.0138)	.5256	(.006)	[0]	1.0046	(.0007)	[.8656]	1.0648	(.001)	[.1]	7.1
62	.797	(.009)	.88	(.0002)	[0]	1.0003	(.0002)	[.9837]	.9796	(.0002)	[.2648]	14.3
63	.3951	(.0009)	.9888	(0)	[.0001]	1.025	(0)	[0]	1.023	(0)	[.7753]	1.4
66	-.6445	(.033)	.7292	(.0079)	[.0033]	.9667	(.0019)	[.4458]	1.0062	(.0021)	[.4889]	10
67	-.4857	(.0307)	.5847	(.0128)	[.0004]	.995	(.0019)	[.9075]	.991	(.0019)	[.942]	21.4
68	-.3352	(.0653)	.6599	(.0171)	[.0113]	1.1367	(.009)	[.154]	.8594	(.0044)	[.0377]	7.1
69	-.3234	(.0246)	.7373	(.0039)	[.0001]	.9932	(.0013)	[.852]	.9092	(.0013)	[.0772]	17.1
70	.4407	(.0046)	.9581	(0)	[0]	.9535	(.0002)	[.0012]	1.0172	(.0002)	[.0002]	5
71	5.6468	(1.3949)	.9238	(.0002)	[0]	.9799	(.0007)	[.4456]	1.0596	(.0004)	[.0066]	4.3
72	-.2332	(.0117)	.8977	(.0005)	[0]	.9987	(.0005)	[.9516]	.9987	(.0005)	[1]	7.1
74	-.9504	(.0118)	.2457	(.2155)	[.1083]	.9231	(.0092)	[.4253]	.8388	(.0134)	[.4513]	14.3
75	.1236	(.0149)	.7972	(.0013)	[0]	.9367	(.0007)	[.0226]	1.0151	(.0008)	[.0351]	17.9

Table 15: Individual estimated parameters (only Smaller-Sooner decisions, self-reported average daily consumption)

N	AR	(s.e.)	α	(s.e.)	[p-val] ($\alpha = 1$)	β	(s.e.)	[p-val] ($\beta = 1$)	$\hat{\beta}$	(s.e.)	[p-val] ($\beta = \hat{\beta}$)	ω
1	.3403	(.0036)	.9683	(.0001)	[0]	1.027	(.0002)	[.0758]	1.0468	(.0004)	[.3457]	2.9
4	-.2969	(.0162)	.8449	(.0011)	[0]	.9835	(.0006)	[.5162]	1.1208	(.0023)	[.0091]	5.7
7	-.3617	(.0529)	.7468	(.0075)	[.0047]	1.1147	(.0066)	[.1613]	.7805	(.005)	[.0092]	10.7
10	-.1537	(.026)	.8585	(.0014)	[.0003]	.9823	(.0013)	[.6214]	.9428	(.0012)	[.36]	7.1
12	-.9494	(.0186)	.141	(.4226)	[.1909]	1.279	(.0902)	[.3562]	1.279	(.0902)	[1]	12.9
13	.0441	(.0174)	.8092	(.0015)	[0]	1.0647	(.0014)	[.0879]	1.0358	(.0011)	[.4795]	11.4
14	1.6697	(.099)	.74	(.002)	[0]	.9964	(.0008)	[.9005]	1.2258	(.0033)	[.0002]	7.1
15	2.1613	(.0176)	.9808	(0)	[0]	1.008	(.0001)	[.5085]	1.0751	(.0001)	[0]	2.1
16	2.7194	(.2252)	.9365	(.0002)	[0]	1.0218	(.0007)	[.416]	1.0281	(.0007)	[.8333]	2.9
17	.7342	(.3208)	.3702	(.145)	[.1029]	1.3497	(.0887)	[.2445]	1.2048	(.0383)	[.4625]	14.3
18	.5687	(.0099)	.9286	(.0001)	[0]	.997	(.0003)	[.8703]	1.0829	(.0007)	[.0036]	7.1
21	-.9989	(.0001)	-.8389	(4.6965)	[.3992]	1.5581	(.8128)	[.538]	1.0363	(.0427)	[.539]	14.3
23	-.1796	(.025)	.87	(.0013)	[.0007]	1.2427	(.0148)	[.0503]	.9875	(.001)	[.0411]	2.1
25	6.8555	(6.774)	.8424	(.0014)	[.0001]	1.1251	(.0023)	[.0118]	1.2461	(.0053)	[.0258]	3.6
26	-.317	(.0321)	.8324	(.0025)	[.0013]	1.0613	(.0022)	[.1973]	1.1829	(.0077)	[.1328]	4.3
27	1.1663	(.0621)	.6031	(.0059)	[0]	.9846	(.0011)	[.639]	.9668	(.001)	[.6535]	21.4
30	1.0065	(.0172)	.9629	(.0001)	[0]	.9833	(.0003)	[.3418]	.9982	(.0003)	[.4566]	2.9
31	1.4495	(.3262)	.4999	(.032)	[.0068]	1.164	(.0102)	[.1094]	.9782	(.0036)	[.0875]	28.6
34	.0256	(.0054)	.7832	(.0006)	[0]	.9928	(.0003)	[.6679]	1.0377	(.0004)	[.0419]	.1
37	.2507	(.0113)	.886	(.0004)	[0]	1.0111	(.0006)	[.6627]	.9616	(.0005)	[.1039]	11.4
38	2.2276	(1.1697)	.2984	(.0783)	[.0146]	1.2575	(.0231)	[.0947]	1.0911	(.0077)	[.185]	14.3
39	332.6634	(3097609.9)	-.1714	(1.3647)	[.3197]	.9511	(.0231)	[.7488]	1.1394	(.0569)	[.5011]	7.1
40	.5068	(.0705)	.5204	(.0239)	[.0028]	1.2049	(.0108)	[.0533]	.9821	(.0028)	[.0424]	5.7
41	2.1215	(.0701)	.9335	(.0001)	[0]	.9651	(.0005)	[.1247]	1.0351	(.0004)	[.0084]	5.7
42	-.7652	(.1903)	-4.0039	(20.5723)	[.2739]	.6185	(.0755)	[.1696]	.8733	(.0264)	[.2513]	14.3
43	-.2464	(.0644)	-1.1642	(.5626)	[.0053]	1.0528	(.0046)	[.4383]	.8362	(.0045)	[.0329]	8.6
44	-1	(0)	-3.9454	(279.9229)	[.7685]	3.6914	(277.462)	[.8721]	2.8432	(106.8947)	[.8997]	11.4
45	-.7793	(.0382)	.5126	(.0429)	[.0216]	.9668	(.0039)	[.5963]	1.2301	(.0215)	[.0958]	7.1
46	2.1923	(.1096)	.8903	(.0003)	[0]	1.0027	(.0006)	[.9077]	1.0678	(.0006)	[.0268]	8.6
47	-.9979	(.0002)	.6081	(.1851)	[.3658]	.7613	(.0604)	[.3351]	1.0503	(.0232)	[.3592]	3.6
48	-.7426	(.0258)	.5933	(.0173)	[.0029]	1.205	(.0107)	[.0514]	.8884	(.0026)	[.0158]	7.1
49	.4289	(.0122)	.5202	(.0041)	[0]	1.0193	(.0006)	[.4276]	.9934	(.0005)	[.3608]	42.9
50	-.9999	(0)	-1.2057	(12.5156)	[.5351]	1.4774	(1.0825)	[.6478]	1.0674	(.0943)	[.6582]	14.3
51	1372.4276	(1.173e+08)	-1.8852	(11.4691)	[.3973]	.685	(.101)	[.3253]	.7447	(.0786)	[.7353]	28.6
53	8.8939	(43.5512)	.5248	(.0313)	[.0091]	.8968	(.0039)	[.1042]	.9148	(.0036)	[.79]	14.3
54	-.9669	(.0068)	-.5875	(.9833)	[.1142]	.7438	(.0225)	[.0925]	1.1026	(.0206)	[.1438]	21.4
55	1.8349	(.0569)	.926	(.0001)	[0]	.9671	(.0005)	[.1544]	1.0341	(.0004)	[.0147]	5
56	5.8702	(10.2841)	.7948	(.0052)	[.0058]	.9507	(.0025)	[.3273]	.871	(.0043)	[.2482]	5.7
57	.5884	(.0419)	.7529	(.0034)	[.0001]	.9148	(.0016)	[.0358]	1.0064	(.0017)	[.0764]	21.4
58	-.3845	(.0529)	.8418	(.0037)	[.0116]	1.1159	(.0069)	[.1691]	1.01	(.0023)	[.2166]	2.9
59	.2755	(.0079)	.9205	(.0002)	[0]	.9785	(.0004)	[.2785]	.9781	(.0004)	[.9852]	8.6
60	1.9486	(.1069)	-.241	(.0317)	[0]	1.0827	(.001)	[.0098]	1.1061	(.0011)	[.4793]	71.4
61	.0903	(.0208)	.4211	(.0123)	[0]	1.0439	(.0013)	[.2294]	1.1557	(.0028)	[.0275]	7.1
62	.8894	(.0123)	.8746	(.0002)	[0]	1.0221	(.0003)	[.2304]	.9955	(.0003)	[.2178]	14.3
63	.426	(.0013)	.9856	(0)	[.0002]	1.0447	(.0001)	[.0002]	1.0369	(.0001)	[.5438]	1.4
67	-.9978	(.0002)	-1.1961	(5.6548)	[.3591]	1.4292	(.409)	[.5045]	1.25	(.1596)	[.6493]	21.4
68	-.9646	(.0291)	-.2881	(2.5211)	[.4201]	3.0059	(17.7868)	[.6359]	.5233	(.1737)	[.5923]	7.1
69	-.9196	(.0234)	.2081	(.2349)	[.1071]	1.1216	(.0218)	[.4128]	.8012	(.016)	[.1601]	17.1
70	.4656	(.0061)	.9538	(.0001)	[0]	.9542	(.0002)	[.0046]	1.042	(.0003)	[.0001]	5
71	7.9078	(7.4759)	.9022	(.0005)	[0]	.9814	(.0013)	[.6127]	1.1083	(.0013)	[.0074]	4.3
75	-.0618	(.0357)	.7076	(.0059)	[.0003]	.9354	(.0017)	[.1207]	1.0778	(.003)	[.0319]	17.9

Table 16: Individuals estimated parameters statistics (Self-reported average daily consumption)

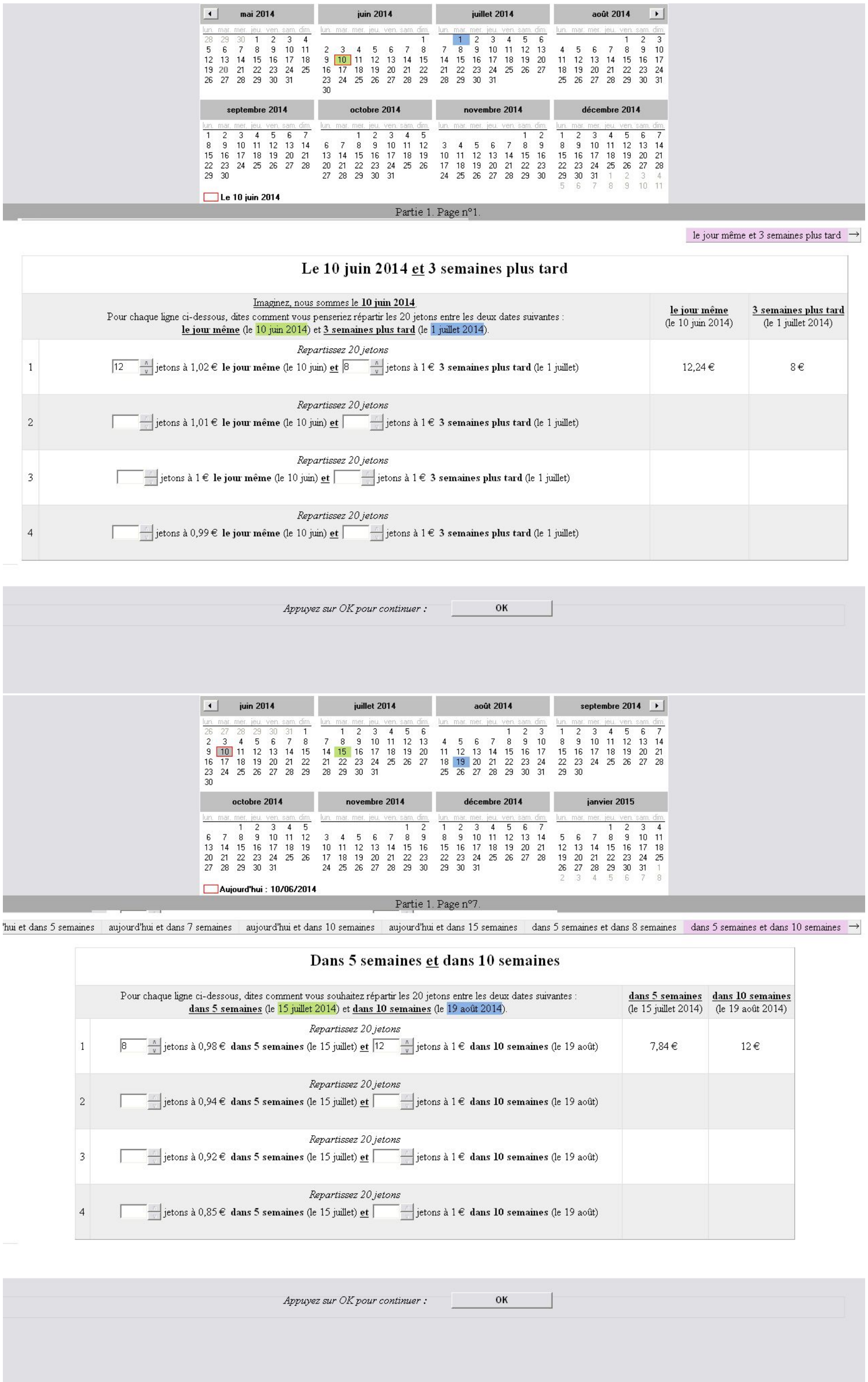
All decisions								
Param.	N	Mean	s.d.	Median	5th Percentile	95th Percentile	Min	Max
δ	59	.9998	.0082	.9994	.9912	1.0032	.9803	1.055
AR	59	26.3682	183.1246	.2581	-.6863	23.739	-1	1418.6964
α	59	.4844	1.048	.8066	-3.0952	.9888	-4.2634	.9943
β	59	1.0591	.6397	.9928	.6968	1.1367	.5943	5.8811
$\hat{\beta}$	59	1.035	.2518	.9991	.8562	1.1643	.7265	2.4573
ω	59	11.9879	11.6922	8.5714	2.1429	42.8571	.1429	71.4286

Decisions $a_t < 1$								
Param.	N	Mean	s.d.	Median	5th Percentile	95th Percentile	Min	Max
δ	51	1.0017	.0108	.9992	.9937	1.019	.9804	1.0575
AR	51	34.268	194.7927	.3403	-.9989	8.8939	-1	1372.4276
α	51	.27	1.0879	.74	-1.8852	.9683	-4.0039	.9856
β	51	1.1371	.4841	1.0193	.7438	1.5581	.6185	3.6914
$\hat{\beta}$	51	1.0603	.2871	1.0363	.7805	1.25	.5233	2.8432
ω	51	11.7395	11.724	7.1429	2.1429	28.5714	.1429	71.4286

Table 17: Proportion of individuals who exhibit bias when we consider all the decisions and only the smaller-sooner ones

		Decisions $a_t < 1$		
		FB	NB	PB
All decisions	FB	0.039	0	0
	NB	0.136	0.576	0
	PB	0	0.186	0.068

Figure 10: Example allocation decisions page during first round (Top) and during the second round (Bottom)



5.2 Instructions

Questions used for the Cognitive Reflection Test (Frederick (2005))

- A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?
- If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
- In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Questionnaire

Pour cette étude, les questions sont essentiellement descriptives et posées dans le but de nous aider à analyser les résultats. Il est important de rappeler que, même si les questions peuvent paraître personnelles, elles sont confidentielles.
Nous vous remercions d'apporter la plus grande attention aux questions et d'y répondre de manière la plus précise et la plus véridique possible.

1. **Quel est votre âge ?** _________ ans
2. **Quel est votre sexe ?** Homme Femme
3. **Quel type de logement occupez-vous ?**
   - Pas de logement personnel (vous vivez chez vos parents ou toute autre personne vous hébergeant gratuitement)
   - Foyer, résidence étudiante, chambre étudiante, chambre chez particulier
   - Appartement/maison/studio que vous partagez en colocation
   - Appartement/maison/studio en location
   - Appartement/maison/studio dont vous êtes le propriétaire
4. **Avec combien de personnes partagez-vous votre appartement ?** _________
5. **Vivez-vous en couple ?** Oui Non
6. **Combien avez-vous de personnes (enfants, parents) à charge ?** _________
7. **Combien de ces personnes vivent avec vous ?** _________
8. **Si vous êtes locataire, quel est le montant mensuel de votre loyer charges incluses?** (charges de résidence, EDF, GDF, internet, taxes etc. inclus)

   ____
9. **Si vous êtes propriétaire, quel est le coût mensuel de votre logement ?** (Mensualité de crédit, charges associées (EDF, GDF, charges de copropriété, internet, taxes, impôts etc.))

   ____
10. **Quel niveau d'étude avez-vous atteint pour l'instant?**
    - BEPC (Brevet des collèges)
    - BEP, CAP
    - Baccalauréat (général, professionel, technologique)
    - Bac +2
    - Bac +3
    - Bac +5 et plus
11. **Quelle est votre situation professionnelle ?**
    - Emploi (salarié ou à votre propre compte)

- Apprentissage sous contrat ou stage rémunéré
- Étudiant
- Chômage
- Retraité
- Homme ou femme au foyer
- Autre situation

12. **Votre domaine de compétence/formation concerne-t'il l'économie, la finance ou la gestion ?** Oui Non

13. **De combien de personnes est composé votre foyer? (Couple/personne seule plus personnes à charge)** ____________

14. **Quel est le montant total des revenus nets mensuels moyens de tous les membres du foyer ? (Enfants inclus) ?** (Prendre en compte toutes les formes de revenus, salaires principaux, revenus d'activité, bourse pour étudiant, aide des parents, pension alimentaire, revenus du capital, chômage, pension de retraite...)

    ____

15. **Quel est le total de vos revenus nets mensuels moyens ?** (De même, prendre en compte toutes les formes de revenus).

    ____

16. **Quel est la part en pourcentage de ces revenus que votre foyer épargne ?**

    ____

17. **Quel revenu net total mensuel minimum estimez-vous nécessaire pour votre foyer pour pouvoir épargner ?**

    ____

18. **Quel est la part en pourcentage de VOS revenus que vous épargnez ?**

    ____

19. **À partir de quel revenu net total mensuel, commencez-vous à épargner ?**

    ____

20. **À combien estimez-vous le montant moyen que votre foyer dépense hors dépenses de logement par semaine ?**

    ____

21. **À combien estimez-vous le montant moyen de vos dépenses hors dépenses de logement par semaine ?**

    ____

22. **Possédez-vous un compte épargne ?** Oui Non

23. **Si oui, quel est le taux d'intérêt auquel est rémunéré votre compte épargne ?**

    - ______ %
    - Je ne sais pas

24. **Avez-vous contractez un crédit à la consommation ?** Oui Non

25. **Si oui, quel est le taux d'intérêt auquel vous avez emprunté ?**
    - ______ %
    - Je ne sais pas
26. **Consommez-vous de l'alcool ?**
    - Non
    - Rarement
    - Occasionnellement
    - Souvent
27. **Fumez-vous ?** Oui Non
28. **Si oui, combien de cigarettes par jour ?** ________
29. **Avez-vous une carte d'abonnement pour aller au cinéma ?**
    Oui Non
30. **Si oui, combien de fois y allez vous par mois en moyenne?** ________
31. **Avez-vous une carte d'abonnement pour une salle de gym?**
    Oui Non
32. **Si oui, combien de fois y allez vous par mois en moyenne?** ________
33. **Pratiquez- vous des sports extrêmes ?**
    - Non
    - Rarement
    - Occasionnellement
    - Souvent
34. **Quelle part en pourcentage de l'argent que vous allez gagner suite à cette expérience comptez-vous épargner ?**
    ______ %
35. **Y a t'il un montant minimum de gain pour cette expérience en dessous duquel vous n'épargnerez pas ?**
    - Oui. Lequel ___________
    - Non

Nous vous remercions pour vos réponses.

Bienvenue

Nous vous remercions de participer à cette expérience.
Au cours de cette expérience, nous allons vous demander de prendre des décisions qui détermineront votre rémunération.
Avant de démarrer, nous allons vous expliquer son processus et les différentes instructions que vous devrez suivre.

Éligibilité à l'expérience

Nous vous rappelons que cette expérience va se dérouler sur deux sessions à deux dates différentes. La première aujourd'hui et la seconde le mardi 10 juin à la même heure. Nous vous rappelons que votre présence est obligatoire aux deux séances. Dans le cas contraire, vos gains en seront affectés.

Lors de cette expérience, nous vous demanderons votre nom et adresse mail. Ces informations resteront confidentielles et ne seront visibles que par les administrateurs de cette expérience. Elles seront utilisées uniquement pour procéder à votre paiement et effacées ensuite. Ainsi, toutes vos décisions seront anonymes.

Nous vous rappelons également que le paiement de vos gains se fera par compte Paypal.

Si vous ne remplissez pas un de ces critères (présence, possibilité de paiement), merci de nous l'indiquer dès maintenant.
Nous pouvons désormais commencer.

Déroulement de l'expérience

Cette expérience va se faire en deux sessions qui auront lieu à deux dates différentes.
Au cours de chaque session, nous vous demanderons de répondre à un certain nombre de questions et de prendre des décisions. Une de ces décision sera tirée au sort et déterminera votre rémunération.
La première session se déroule aujourd'hui alors que la seconde aura lieu le mardi 10 juin.

Procédure de paiement

Vos gains seront de deux types.

- Les gains de participation à l'expérience :
  - **5 euros en liquide** dès la fin de cette séance afin de vous remercier d'avoir participé aujourd'hui.
  - **10 euros de plus** si vous êtes effectivement présent lors de la seconde session dans deux semaines. Ce paiement se fera par Paypal à deux dates différentes, déterminées à la fin de la seconde session. Vous recevrez alors 5 euros à chacune de ces dates.

- LES GAINS ASSOCIÉS À VOS DÉCISIONS AU COURS DE L'EXPÉRIENCE.

  À la fin de la seconde session, nous tirerons au sort une décision parmi toutes celles que vous prendrez aujourd'hui et lors de la seconde session. La décision tirée au sort permettra de déterminer à la fois vos gains supplémentaires et vos dates de paiement. Les gains associés à vos décisions seront compris entre 14 euros et 20,4 euros.

Ainsi, vous recevrez 5 euros en liquide aujourd'hui et deux paiements par Paypal à deux dates différentes. La date de paiement la plus proche sera comprise entre le jour de la seconde session et 5 semaines plus tard. La date de paiement la plus éloignée sera comprise entre 3 semaines après le jour de la seconde session et 20 semaines après ce jour-là.

Le tableau suivant présente un récapitulatif du déroulement de l'expérience et de vos paiements :

	Première session	**Deuxième session**	**Première date paiement**	**Seconde date paiement**
Date	Aujourd'hui	Le 10 juin 2014	Entre le 10 juin et 5 semaines après le 10 juin	Entre 3 semaines et 20 semaines après le 10 juin
Déroulement	Décisions + questions	Décisions + questions		
Paiements	5 euros participation (liquide)	Dates de paiements déterminées à la fin	5 euros participation (Paypal) + Gains associés à la décision tirée au sort (Paypal)	5 euros participation (Paypal) + Gains associés à la décision tirée au sort (Paypal)

IMPORTANT : Veuillez noter qu'en cas d'absence à la seconde session, votre gain se limitera aux 5 euros de participation versés aujourd'hui.

Nous vous fournirons à la fin de la seconde session, une feuille récapitulative que vous remplirez pour que vous vous souveniez de la valeur des montants et des dates auxquelles vous devez recevoir ces montants. Une adresse mail vous sera également fournie pour nous contacter pour tout problème.

Au fur et à mesure du déroulement de l'expérience, nous reviendrons plus en détail sur le paiement associé à chaque décision.

Instructions
Première session

Nous allons maintenant décrire le déroulement de la première session.

Déroulement de la session

Au cours de cette session, nous allons vous demander quelles décisions vous pensez prendre lors de la deuxième session. Ces décisions concernent l'allocation de jetons ayant une valeur monétaire entre deux dates espacées dans le temps. Ces deux dates ainsi que la valeur des jetons vont varier d'une décision à l'autre. Aujourd'hui, vous devrez estimer les 40 allocations de jetons que vous pensez faire lors de la prochaine session.

Procédure de paiement

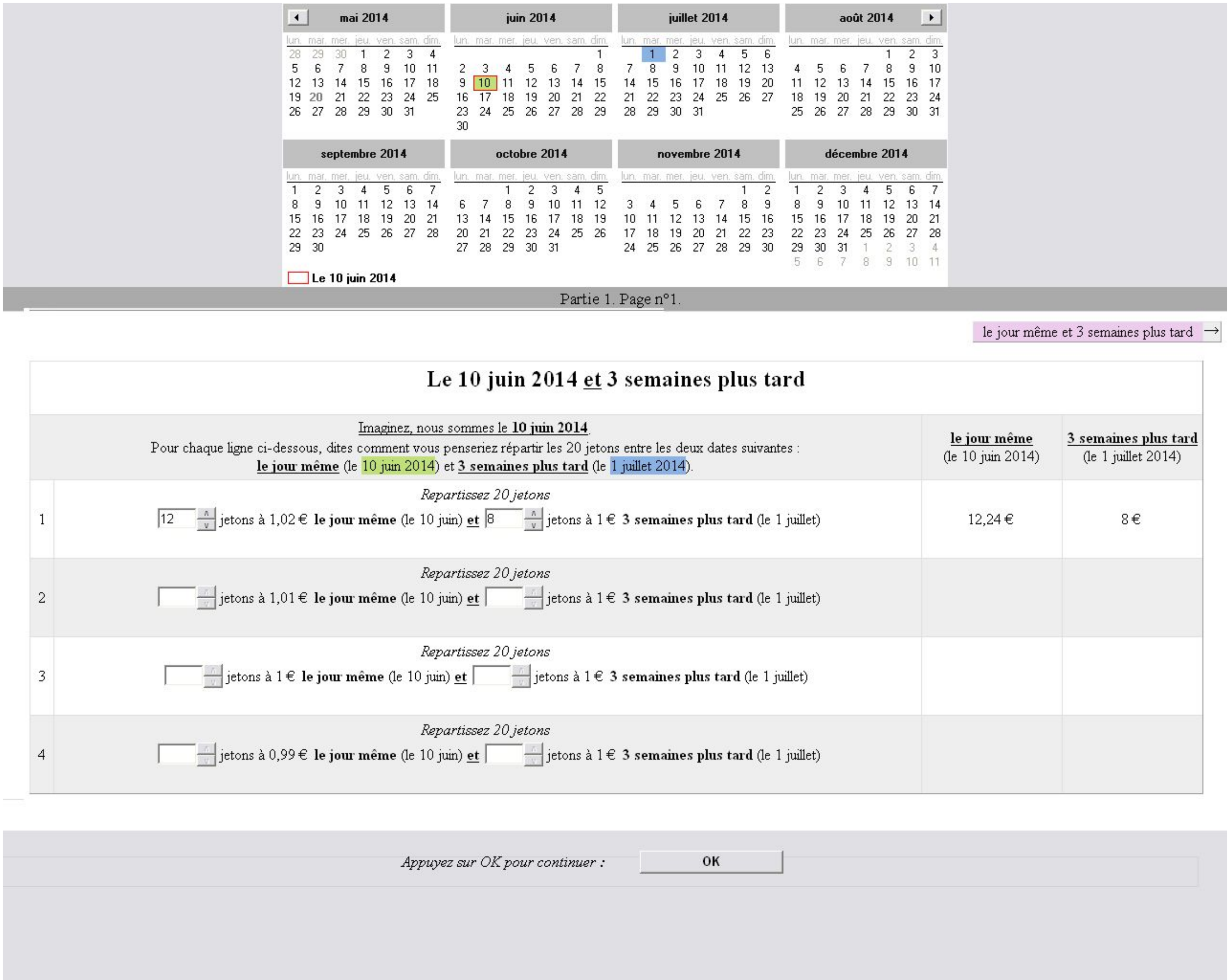
À la fin de la deuxième session, nous tirerons au sort une décision parmi les 80 allocations de jetons que vous allez faire (40 aujourd'hui et 40 à la prochaine session) pour déterminer vos gains ainsi que vos dates de paiement. Ainsi, il est important que vous apportiez dès aujourd'hui la plus grande attention à chaque décision que vous prendrez puisque celles-ci pourront affecter vos gains.
Les deux dates de votre paiement correspondront alors aux deux dates d'allocation de la question tirée au sort. Nous vous rappelons qu'à chacune de ces dates vous recevrez 5 euros de participation. Ainsi, à chaque date vous recevrez forcément un paiement.

La question tirée au sort sera la même pour tous les participants. Ce tirage aura lieu en votre présence à la fin de la seconde session et grâce à un processus aléatoire sur Excel.

Allocation de jetons

Nous allons vous demander quelle répartition de jetons vous pensez faire le 10 juin entre une date proche et une date plus éloignée. Vous disposerez de 20 jetons. Ces jetons auront une valeur différente à chaque date.
Aujourd'hui, nous vous proposerons 10 pages avec sur chacune 4 allocations de jetons à effectuer. À chaque allocation, les dates et les valeurs des jetons peuvent varier. Nous vous demandons de réaliser toutes les allocations présentes sur la page avant de changer de page.

Exemple d'une page de décision



Vous pourrez dans un premier temps répartir ces jetons entre les deux dates proposées à l'aide du clavier numérique. Vous observerez dans les colonnes de droite, le montant que vous percevrez à la date la plus proche et celui que vous percevrez à la date la plus éloignée selon l'allocation que vous avez choisie. Vous pourrez ajuster cette répartition grâce au clavier numérique ou à l'aide des boutons à côté des cases prévues pour la répartition. Une fois que vous êtes satisfait de votre allocation vous pouvez passer à la suivante. (Notez que vous pouvez selon vos préférences, allouer tous les jetons à la date la plus proche ou à la date la plus éloignée ou en allouer aux deux dates).
Pour chaque page, vous devrez prendre une décision par ligne. Sur chacune, vous devrez dire quelle répartition de jetons vous pensez faire le jour de la seconde session (le 10 juin) entre les deux dates proposées. Un calendrier vous permet de visualiser les deux dates proposées ainsi que la date à laquelle vous devez vous projeter pour faire la décision.

Sur la page d'exemple, nous voyons que la répartition des jetons se fait entre le 10 juin et le 1 juillet. Si nous prenons comme exemple la décision 1 de la page ci-dessus, vous devez dire de quelle manière vous pensez répartir, le jour de la seconde session (le 10 juin) les 20 jetons entre le 10 juin 2014 et le

1 juillet 2014. Un jeton le 10 juin vaut 1,02 euros et 1 euro le 1 juillet.
Dans notre exemple, nous avons déclaré penser, le jour de la seconde session, allouer 12 jetons le 10 juin (le jour même de la seconde session) et 8 jetons le 1 juillet, cela implique que nous pensons que ce jour-là nous préférerons recevoir 12,24 euros le jour même et 8 euros 3 semaines plus tard à toutes les autres options. De manière non exhaustive, nous aurions pu choisir,

- *Répartir 8 jetons le 10 juin et 12 jetons le 1 juillet, c'est à dire penser préférer le jour de la seconde session (le 10 juin), recevoir 8,16 euros le jour même et 12 euros le 3 semaines plus tard.*
- *Répartir 20 jetons le 10 juin et 0 jetons le 1 juillet, c'est à dire penser préférer le jour de la seconde session (le 10 juin), recevoir 20,40 euros le jour même et 0 euros 3 semaines plus tard.*
- *Répartir 3 jetons le 10 juin et 17 jetons le 1 juillet, c'est à dire penser préférer le jour de la seconde session (le 10 juin), recevoir 3,06 euros le jour même et 17 euros 3 semaines plus tard.*
- *Répartir 10 jetons le 10 juin et 10 jetons le 1 juillet, c'est à dire penser préférer le jour de la seconde session (le 10 juin), recevoir 10,20 euros le jour même et 10 euros 3 semaines plus tard.*
- *...*

Vous pouvez donc faire varier le nombre de jetons entre les deux dates jusqu'à choisir l'option qui vous convienne le mieux.

Exemple de paiement

Vous serez payé selon l'allocation que vous avez choisi à la question qui sera tirée au sort (parmi celles d'aujourd'hui et celles du 10 juin).

Si nous supposons que c'est la décision 1 de la page ci-dessus qui est tirée au sort.
Avec l'allocation que nous avons choisi (12 jetons le 10 juin et 8 jetons le 1 juillet), nous recevrons 12,24 euros le jour même et 8 euros 3 semaines plus tard.

Nous vous rappelons que la décision tirée au sort permet également de déterminer les deux dates de paiement.
Ici, pour chaque décision de la page ci-dessus tirée au sort, vos dates de paiements seront donc le 10 juin et le 1 juillet.
Nous vous rappelons qu'à chacune de ces dates vous recevrez de toute façon un paiement (les 5 euros de participation à chacune de ces dates).

Une fois que vous aurez pris toutes les décisions proposées, nous vous demanderons de répondre à 3 questions et cette session sera terminée.

Dans le but de vérifier que les instructions ont été suffisamment claires et comprises par tout le monde, nous vous proposons de répondre à quelques questions sur ces instructions. Une fois que tout le monde aura rempli le questionnaire, nous le corrigerons ensemble à l'oral.

<u>Merci de remplir ce questionnaire</u>

1. Si je ne viens pas à la seconde session, je n'aurais aucun gain ?
   ❏ Vrai ❏ Faux

2. Les gains seront déterminés à la fin de cette session ?
   ❏ Vrai ❏ Faux

3. Les deux dates auxquelles je serais rémunéré sont d'ores et déjà connues ?
   ❏ Vrai ❏ Faux

4. Chaque question pourra déterminer mon gain ?
   ❏ Vrai ❏ Faux

5. Je peux décider de mettre tous mes jetons sur une seule date plutôt que de les répartir entre deux dates ?
   ❏ Vrai ❏ Faux

6. Je suis obligé de répartir le même nombre de jetons entre les deux dates à toutes les questions ?
   ❏ Vrai ❏ Faux

Si vous êtes surpris par certaines des réponses, n'hésitez pas à nous poser des questions.

Merci ne ne pas parler ou essayer de communiquer avec un autre participant pendant l'expérience. Le non-respect de cette règle entrainera votre exclusion de la salle en abandonnant la rémunération que vous auriez pu percevoir jusqu'ici.
Il est très important que vous ayez compris les instructions. Si vous avez des questions, s'il vous plaît levez la main, une personne viendra vous apporter des réponses. Merci de suivre ces instructions.

Nous vous remercions de votre participation.

Instructions
Deuxième session

Nous vous remercions pour votre présence. Vous recevrez la somme de 10 euros au titre de votre participation à cette seconde session.

Lors de cette session, vous allez prendre des décisions sur la façon dont vous souhaitez répartir vos gains dans le temps. Ces décisions sont indépendantes de celles de la première session. Ensuite, vous remplirez un questionnaire et enfin, nous tirerons au sort la décision qui compte pour le paiement de vos gains parmi vos choix d'allocation de la première session et de celle-ci.

Nous allons maintenant décrire le déroulement de la seconde session.

Déroulement de la session

Au cours de cette session, nous allons vous demander de prendre des décisions concernant l'allocation de montants monétaires entre deux dates espacées dans le temps. Ces deux dates (à la fois la plus proche et la plus éloignée) ainsi que les montants à allouer vont varier d'une décision à l'autre. Aujourd'hui, pour cette partie, vous devrez estimer les 40 allocations de jetons.

Procédure de paiement

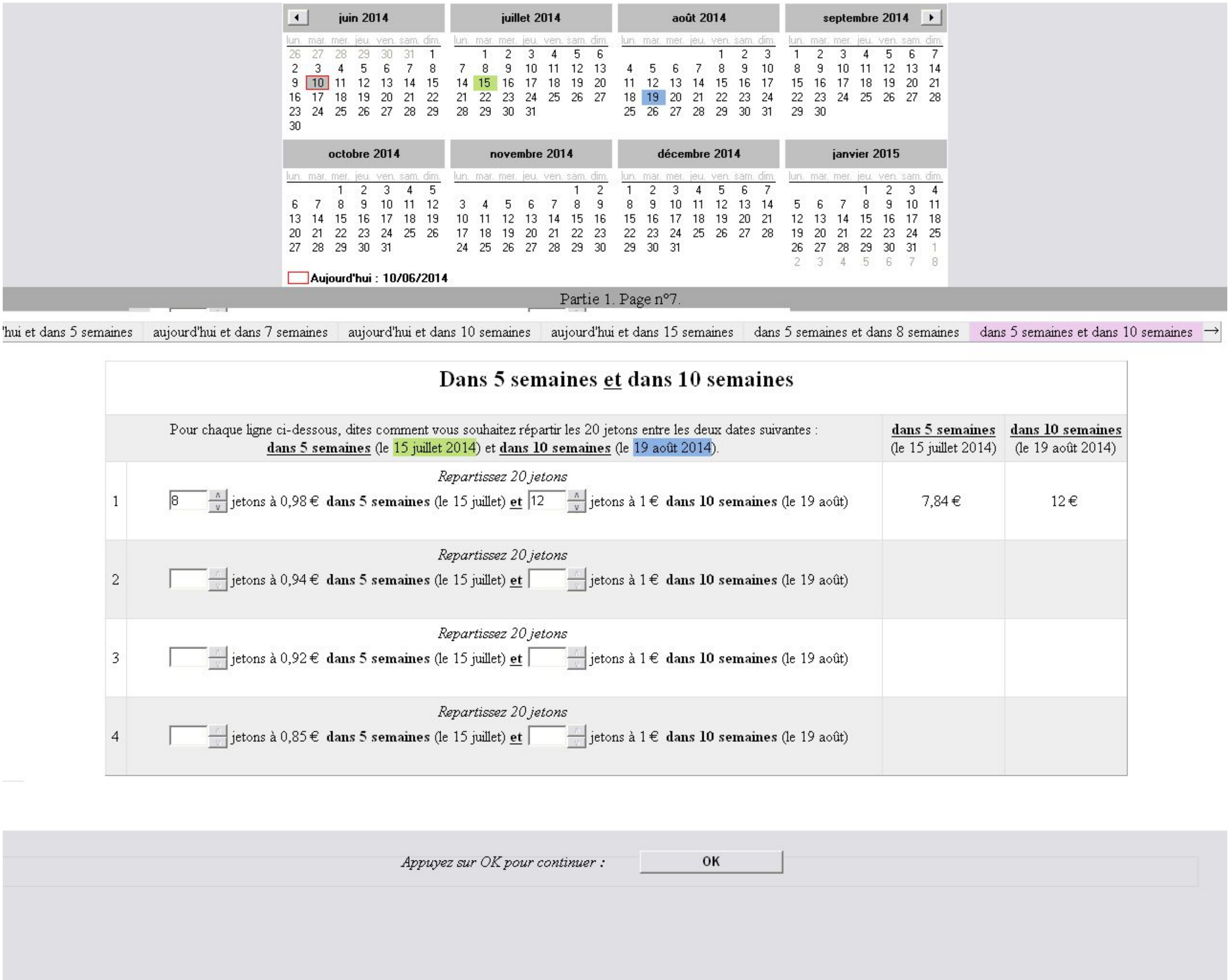
À la fin de cette session, nous tirerons au sort une décision parmi les 80 allocations que vous avez faites (les 40 de la première session et les 40 d'aujourd'hui) pour déterminer vos gains ainsi que vos dates de paiement. Ainsi, il est important que apportiez la plus grande attention à chaque décision que vous prendrez puisque celles-ci pourront affecter vos gains.
Les deux dates de votre paiement correspondront alors aux deux dates d'allocation de la question tirée au sort. Nous vous rappelons qu'à chacune de ces dates vous recevrez 5 euros de participation. Ainsi, à chaque date vous recevrez forcément un paiement.

La question tirée au sort sera la même pour tous les participants. Ce tirage aura lieu en votre présence à la fin de cette session et grâce à un processus aléatoire sur Excel.

Allocation de jetons

Nous allons vous demander d'allouer des jetons entre une date proche et une date plus éloignée. Vous disposerez de 20 jetons. Ces jetons auront une valeur différente à chaque date.
Aujourd'hui, nous vous proposerons 10 pages avec sur chacune 4 allocations de jetons à effectuer. À chaque allocation, les dates et les valeurs des jetons peuvent varier. Nous vous demandons de réaliser toutes les allocations présentes sur la page avant de changer de page.

Exemple d'une page de décision



Vous pourrez dans un premier temps répartir ces jetons entre les deux dates proposées à l'aide du clavier numérique. Vous observerez dans les colonnes de droite, le montant que vous percevrez à la date la plus proche et celui que vous percevrez à la date la plus éloignée selon l'allocation que vous avez choisie. Vous pourrez ajuster cette répartition grâce au clavier numérique ou à l'aide des boutons à côté des cases prévues pour la répartition. Une fois que vous êtes satisfait de votre allocation vous pouvez passer à la suivante. (Notez que vous pouvez selon vos préférences, allouer tous les jetons à la date la plus proche ou à la date la plus éloignée ou en allouer aux deux dates).
Pour chaque page, vous devrez prendre une décision par ligne. Sur chacune, vous devrez dire la répartition de jetons que vous préférez entre les deux dates proposées. Un calendrier vous permet de visualiser les deux dates proposées.

Sur la page d'exemple, nous voyons que la répartition des jetons se fait entre le 15 juillet (dans 5 semaines) et le 19 août (dans 10 semaines).
Si nous prenons comme exemple la décision 1 de la page ci-dessus, vous devez répartir les 20 jetons entre le 15 juillet 2014 et le 19 août. Un jeton le 15 juillet vaut 0,98 euros et 1 euro le 19 août.

Dans notre exemple, nous avons allouer 8 jetons le 15 juillet et 12 jetons le 19 août, cela implique que nous préférons recevoir 7,84 euros dans 5 semaines et 12 euros dans 10 semaines à toutes les autres allocations. De manière non exhaustive, nous aurions pu choisir,

- *Répartir 15 jetons le 15 juillet et 5 jetons le 19 août, c'est à dire préférer, recevoir 14,7 euros dans 5 semaines et 5 euros dans 10 semaines.*
- *Répartir 10 jetons le 15 juillet et 10 jetons le 19 août, c'est à dire préférer recevoir 9,8 euros dans 5 semaines et 10 euros dans 10 semaines*
- *Répartir 1 jetons le 15 juillet et 19 jetons le 19 août, c'est à dire préférer recevoir 0,98 euros dans 5 semaines et 19 euros dans 10 semaines.*
- *etc.*

Vous pouvez donc faire varier le nombre de jetons entre les deux dates jusqu'à choisir l'option qui vous convienne le mieux.

Exemple de paiement

Vous serez payé selon l'allocation que vous avez choisie à la question qui sera tirée au sort (parmi celles de la première session et celles d'aujourd'hui).

Si nous supposons que c'est la décision 1 de la page ci-dessus qui est tirée au sort.
Avec l'allocation que nous avons choisi (8 jetons le 15 juillet et 12 jetons le 19 août), nous recevrons 7,84 euros dans 5 semaines et 12 euros dans 10 semaines.

Nous vous rappelons que la décision tirée au sort permet également de déterminer les deux dates de paiement.
Ici, pour chaque décision de la page ci-dessus tirée au sort, vos dates de paiements seront donc le 15 juillet et le 19 août.
Nous vous rappelons également qu'à chacune de ces dates vous recevrez de toute façon un paiement (5 euros de participation à chacune de ces dates).

Une fois que vous aurez pris toutes les décisions, nous vous demanderons de répondre à un questionnaire. Nous vous rappelons que toutes vos réponses restent confidentielles et anonymes.
Une fois que tous les participants de l'expérience auront répondu au questionnaire, nous procéderons au tirage au sort des questions qui compteront pour la détermination de vos gains. Lorsque vos gains et dates auxquelles ceux-ci seront reversés seront déterminés, vous pourrez les écrire sur la reconnaissance de dette que nous vous distribuerons. Une adresse mail vous sera également fournie pour nous contacter en cas de problème.

Dans le but de vérifier que les instructions ont été suffisamment claires et comprises par tout le monde, nous vous proposons de répondre à quelques questions sur ces instructions. Une fois que tout le monde aura rempli le questionnaire, nous le corrigerons ensemble à l'oral.

Merci de remplir ce questionnaire

1. Mentir sur mes préférences me permettra d'augmenter mes gains ?
   ❏ Vrai ❏ Faux
2. Je dois prendre en compte les décisions que j'ai prises à la première session pour prendre mes décisions aujourd'hui ?
   ❏ Vrai ❏ Faux
3. Si je décide d'allouer tous mes jetons sur une seule date, je ne recevrais qu'un paiement ?
   ❏ Vrai ❏ Faux
4. Les gains seront décidés à la fin de cette session ?
   ❏ Vrai ❏ Faux

Si vous êtes surpris par certaines des réponses, n'hésitez pas à nous poser des questions.

Merci ne ne pas parler ou essayer de communiquer avec un autre participant pendant l'expérience. Le non-respect de cette règle entrainera votre exclusion de la salle en abandonnant la rémunération que vous auriez pu percevoir jusqu'ici.
Il est très important que vous ayez compris les instructions. Si vous avez des questions, s'il vous plaît levez la main, une personne viendra vous apporter des réponses. Merci de suivre ces instructions.

Nous vous remercions de votre participation.