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JEL Classification: C91, D01, D91, J22

Keywords: consistency across domains, negative discounting, laboratory experiment, Non-monetary rewards

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Estimating time preferences for leisure

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Abstract

We study time preferences by means of a longitudinal lab experiment involving both monetary and non-monetary rewards (leisure). Our novel design allows to measure whether participants prefer to anticipate or delay gratification, without imposing any structural assumption on the instantaneous utility, intertemporal utility or the discounting functions. We find that most people prefer to anticipate monetary rewards (positive time preferences for money), but they delay non-monetary rewards (negative time preferences for leisure). These results cannot be explained by personal timetables and heterogeneous preferences only. They invite to reconsider the psychological interpretation of the discount factor, and suggest that the assumption that discounting is consistent across domains can lead to non-negligible prediction errors in models involving non-monetary decisions, such as labor supply models.

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1 Introduction

Arguably every decision involves a time dimension.[1] Intertemporal choice has been discussed as an economic topic for over one century (Rae, 1834; Jevons, 1879; Böhm-Bawerk, 1889;

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Jevons, 1905; Pigou, 1920; Fisher, 1930) before a widely accepted model was settled. The merit of this standardization goes to Paul Samuelson, who in his 1937 article "A Note on Measurement of Utility" establishes the paradigm of positive discounting, based on a simple and intuitive idea: people tend to prefer benefits sooner rather than later. Over the decades, many alternative models of time preferences have been proposed, the large majority of them belonging to the positive discounting paradigm (for reviews, see Doyle et al., 2013; Cohen et al., 2020).

Although no model has been able to parsimoniously account for the many empirical anomalies observed in the laboratory and in the field (Frederick et al., 2002), the principle of positive discounting appears to be a fairly accurate predictor of financial decisions: people prefer money sooner rather than later. Since many economic decisions are not about money, and intertemporal models are typically defined over time-dated utils, not over financial streams, it remains an open question whether discounting is invariant across domains, that is, whether the same discount function can be applied to all forms of consumption.

One of the fundamental and peculiar functions of money is that of a "store of value": money can be saved, stored and retrieved. In this sense, we say that money is temporally fungible. This characteristic does not always hold for other forms of consumption. Leisure, for example, is a good that cannot be easily transferred over time. These considerations can be particularly important in a labor perspective, where intertemporal choices involving, e.g., intertemporal allocation of effort and time, investments in human capital, and trade-offs between consumption and savings (see, e.g. Heckman, 1976), are pervasive. However, to date the labor economics literature has been only marginally affected by insights from behavioral economics on anomalies in discounting (see Dohmen, 2014, for a review).

A vibrant strand of empirical research has measured discount rates for a variety of consumption items, including consumption of non-durable leisure items such as dinner and movies. These experiments have shown that, when asked to allocate temporally non-fungible goods over two future periods, many people contradict noticeably the prediction that "sooner is better than later". Loewenstein and Prelec (1991) provide seminal evidence of people violating the positive discounting paradigm. In a series of hypothetical trade-offs between non-monetary rewards, most respondents preferred the smaller reward sooner (in one month) and the larger reward later (in two months). This pattern replicates in a controlled laboratory setting with real rewards (Read et al., 1999). However, consumption items may carry several confounds (e.g. the levels of saliency, perishability, nonsatiation, market fungibility), hence it is not clear to what extent discount rates for a certain item can lead to more general conclusions about preferences for time-infungible items (see, e.g. Casari and Dragone, 2011).

Only few studies have brought a labor inter-temporal allocation problem to the laboratory. Casari and Dragone (2015) ask subjects to decide when to complete an unpleasant task and find that about two third of them prefer to complete the task immediately rather than in a few weeks. Augenblick et al. (2015) introduce a design which allows to compare time preferences for money and effort. They offer students the possibility to allocate money and real-effort tasks over future periods and observe that most of them prefer to smooth effort over time (rather than delaying it), and to get all the money sooner. Using a similar setup, Augenblick and Rabin (2019) find that the experimental subjects prefer to allocate labor earlier rather than later. Augenblick (2018) documents the importance of present bias in labor decisions over very short periods of time, but no detectable impatience for horizons beyond one week. Finally, Abdellaoui et al. (2018) observe that a significant portion of the subjects display negative time preferences for leisure when asked whether they would prefer to gain some time now or in the coming months.

Even though these results call into question the descriptive and predictive ability of positive discount models for labor choices, these experiments were not specifically designed to study the sign of time preferences. The main aim of Casari and Dragone (2015) and Augenblick et al. (2015) was to measure dynamic inconsistency, and the preference for smoothing non-monetary consumption was only a tangential observation. Augenblick and Rabin (2019) and Augenblick (2018) focused on present bias and sophistication, not on long-term time preferences, and they paid subjects a piece rate for the effort tasks, thus entangling the monetary domain and the labor domain. Yet, the anomalies observed in these papers raise a paramount question: in an intertemporal problem of allocation of work and leisure, does positive discounting emerge as the predominant pattern?

In this paper, we address this question through a novel experimental design that allows to measure whether participants prefer to anticipate or delay gratification, without imposing any structural assumption on the instantaneous utility, intertemporal utility or the discounting functions. The design is characterized by some important features, which deliver clear and replicable evidence of negative time preferences for leisure, and that can be relevant in the domain of labor supply.[2] First, we consider a longitudinal experiment where we ask the

[2] To denote the preference for postponing benefits, we indifferently use "negative time preference" (Loewenstein and Prelec, 1991) and "negative discounting", and we call a "negative discounter" a person exhibiting negative time preferences.

experimental subjects to allocate both leisure time from a work task, and money. We control for personal timetables, and the allocation choices concern two future periods, so that the elicitation of time preferences is not confounded by present bias. Second, we design an environment which ensures that, for any feasible allocation (x_{t+1}, y_{t+2}) between two future dates, the symmetric allocation (y_{t+1}, x_{t+2}) is also available. This enables to elicit the sign of time preferences without relying on any structural assumption. The symmetric setup, based on a non-linear generalization of the Convex Time Budget design (Andreoni and Sprenger, 2012; Augenblick et al., 2015), also allows us to vary how costly it is to smooth consumption over time, to test whether leisure and money follow the law of demand and whether individuals behave consistently with positive discounting when consumption smoothing is costly.

We document three main findings. First, we replicate Augenblick et al. (2015)'s results: in the monetary domain, people tend to prefer benefits sooner rather than later, while in the leisure domain, they tend to smooth outcomes over time. Second, decisions about leisure are incompatible with predictions from the positive discounting paradigm, as the majority of subjects tend to allocate leisure to the later period. This result emerges even when we offset the desire for intertemporal smoothing by making it costly. Third, we compare within-subject preferences across domains. The modal pattern we observe is positive discounting for money and negative discounting for leisure. Among non-modal types, we find some inter-domain consistency: people who are negative discounters for money tend to be negative discounters for leisure too, and people who positively discount leisure tend do so also with money.

This study belongs to the nascent literature which uses personal time as an experimental reward. Berger et al. (2012) and Doll et al. (2017) set up ultimatum games where the payoff function is expressed in time units. Noussair and Stoop (2015) ask their participants to play a dictator game, an ultimatum and a trust game, with waiting time (treatment I) and with time and money (treatment II). Abdellaoui and Kemel (2014) and Festjens et al. (2015) look at the degree of risk aversion when the outcome is expressed as waiting time. Our strategy to generate leisure incentives is similar to Abdellaoui et al. (2018), that use the amount of working hours required by a job contract to set a reference point and subsequently offer the possibility to shorten the duration of the job task.

Our design closely mirrors the ideal experiment on time preferences described by Cohen et al. (2020) in their recent review: "[...] to empirically identify the shape of the discount function, a researcher would like to ask experimental participants to choose between (separable) increments of utility available at different dates in time. [...] However, experimenters cannot directly deliver utils — rather, they deliver rewards that experimental participants value: direct consumption experiences— e.g., food, goods, effort — or money (which can be used to purchase consumption experiences)" (ibid, pp. 310-311). It also solves the two main methodological challenges outlined in that same review: on the one hand, the need of a design which experimentally controls for the level of convexity of the utility function; on the other hand, the introduction of generalizable rewards which offer subjects a direct utility stream (see Cohen et al., 2020, p. 311). Our results suggest that positive discounting models can lead to non-negligible predictive errors in the domain of labor decisions.

The remainder of the paper is organized as follows. The next section explains in detail the experimental design, and it spells out the underlying theoretical assumptions and testable hypotheses; Section 3 presents the results; Section 4 concludes.

2 Design

2.1 The intertemporal allocation problem

To study time preferences, our experiment follows a within-subject design in which each subject makes intertemporal allocation choices in the domains of money and leisure. We adopt a longitudinal structure, in which subjects come to the laboratory three times at a 3-week distance. All relevant decisions are taken in the first session ($t = 0$), for a total of 17 monetary allocations and 17 leisure allocations per subject (Table 1). To rule out concerns about the possible confounding effect of a present bias, the decisions taken at time $t = 0$ have effects at $t = 1$ and $t = 2$. Specifically, subjects are asked to allocate their endowment of $M = 30$ experimental units (expressed in minutes or money) over two future dates, $t = 1$ and $t = 2$. We consider three alternative scenarios: *Delay*, *Anticipate* and *Symmetric*, each one corresponding to different choice sets (see Figure 1).

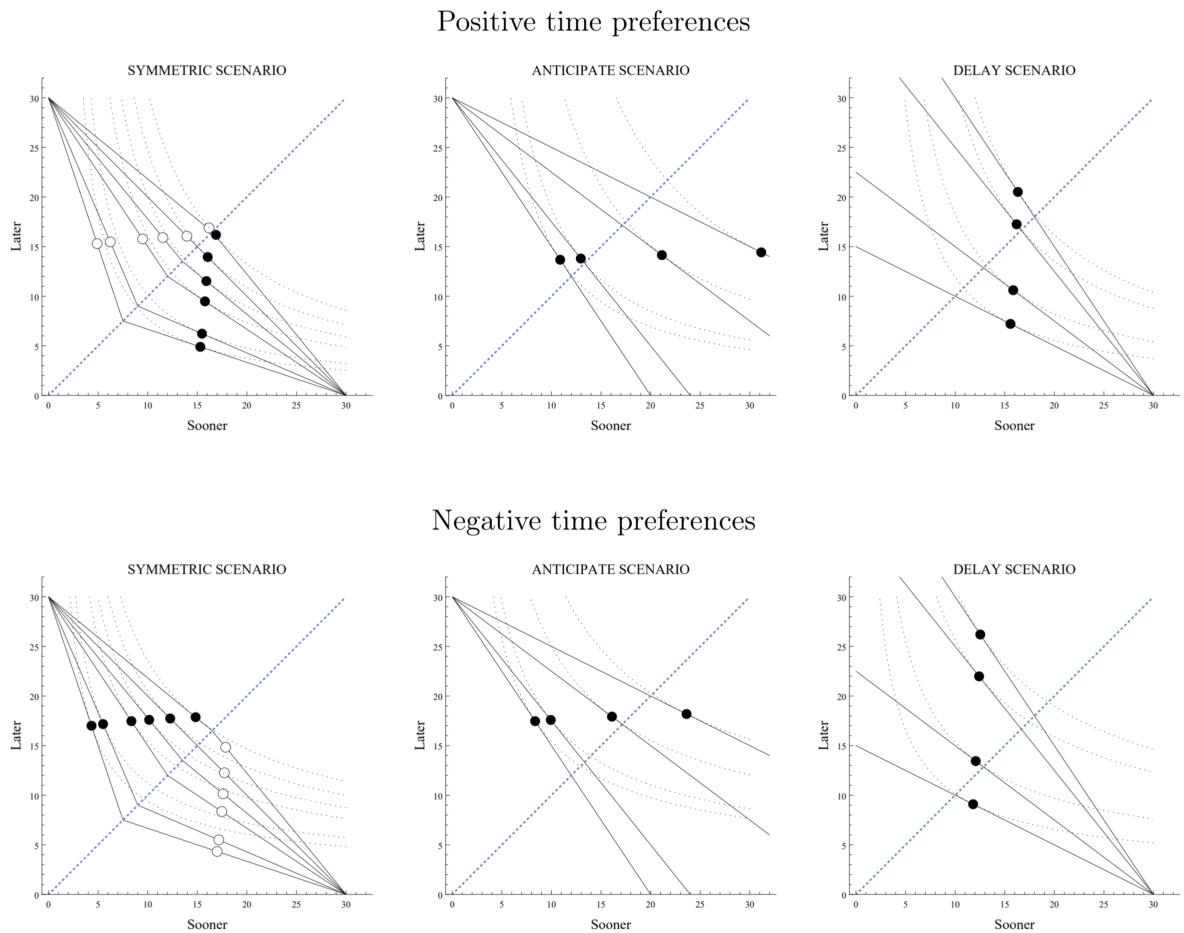
In the *Anticipate* scenario, the choice set is defined by

$$\mathcal{L} \leq M - R\mathcal{S} \qquad \text{(Anticipate scenario)} \tag{1}$$

where $\mathcal{S}$ denotes the sooner alternative (at $t = 1$), $\mathcal{L}$ the later alternative (at $t = 2$) and $R > 0$ is the relative price. The values of R used in the experiment are described in Table 1.

By inverting $\mathcal{S}$ and $\mathcal{L}$, we obtain the symmetric version with respect to the 45-degree line,

Figure 1: Possible optimal choices in the Symmetric, Anticipate and Delay scenarios for an agent with positive time preferences (top row) and negative time preferences (bottom row).



Notes: The Symmetric scenario corresponds to eq. 3, the Anticipate scenario corresponds to eq. 1, the Delay scenario to eq. 2. Dotted curves describe indifference curves, solid dots denote optimal allocations for a given value of R. In the Anticipate and Delay scenarios, optimal choices can be on either side with respect to the 45-degree line, both with positive and negative time preferences. In the Symmetric scenario, the optimal allocation is below the 45-degree line if time preferences are positive, and above it if time preferences are negative; the circles denote the symmetric alternatives that are available but not optimal.

which we denote as the *Delay* scenario

$$\mathcal{S} \leq M - R\mathcal{L} \qquad \text{(Delay scenario)} \tag{2}$$

The Anticipate and Delay scenario describe two alternative versions of the Convex Time Budget proposed in Andreoni and Sprenger (2012). As illustrated in Figure 1, in the Anticipate scenario the budget line passes through allocation $(0, M)$, and in the Delay scenario it passes through $(M, 0)$. In either case the budget line rotates inward toward the origin as R increases.

Our innovation in the experimental design consists in considering a *Symmetric* scenario in which the budget constraint 1 holds above the 45-degree line, and the budget constraint 2 holds otherwise:

$$\begin{cases} \mathcal{L} \leq M - R\mathcal{S} & \text{if } \mathcal{L} \geq \mathcal{S} \\ \mathcal{S} \leq M - R\mathcal{L} & \text{if } \mathcal{S} \geq \mathcal{L} \end{cases} \qquad \text{(Symmetric scenario)} \tag{3}$$

Figure 1 shows that the Symmetric scenario describes a budget set with a kink at $\mathcal{S} = \mathcal{L}$ if $R \neq 1$. The distinctive feature of this scenario is that, for any R and for any available allocation (x, y), there exists a symmetric allocation (y, x) available to the experimental subject. On the contrary, the linear budget sets described in the Anticipate and Delay scenarios 1 and 2 cannot guarantee that symmetric consumption pairs are available (unless $R = 1$). Accordingly, in the proceeding we will refer to these two scenarios as Asymmetric scenarios. Differently from the Symmetric scenario, the Asymmetric scenarios admit optimal choices both above or below the 45-degree line, irrespective of whether time preferences are positive or negative.

An additional feature of the Symmetric scenario is that the choice set shrinks symmetrically when R increases, as the kink shifts toward the origin. This creates an efficiency-equality trade-off. By measuring efficiency in terms of total consumption $\mathcal{S} + \mathcal{L}$, and equality by the distance $|\mathcal{L} - \mathcal{S}|$, it is clear that total consumption $\mathcal{S} + \mathcal{L}$ is smallest in the kink and largest in the corners (for $R > 1$), while equality follows the opposite pattern.

2.2 Theoretical considerations

Consider a set up where there are a sooner and a later consumption alternative available at some future time τ and $\tau + k$. Most laboratory experiments on time preferences rely on an intertemporal utility function $\mathcal{V}(\mathcal{S}, \mathcal{L})$ based on the discounted utility model:

$$\mathcal{V}(\mathcal{S}, \mathcal{L}) = D(\tau)U(\mathcal{S}) + D(\tau + k)U(\mathcal{L})$$

where $D(\cdot)$ is a discount function. This specification generates two problems for the experimental elicitation of time preferences (see Cohen et al., 2020, for a discussion). First, to uniquely determine the discount function one needs to choose some external criterion for selecting the (cardinal) instantaneous utility function $U(\cdot)$ (Ok and Benoît, 2007). In other words, by imposing a particular form for the instantaneous utility function, the experimenter is implicitly determining the elicited discount function. Second, the additively separable specification can-

Table 1: Asymmetric and Symmetric scenarios adopted in the experiment.

#	Scenario	R	$\max(\mathcal{S}+\mathcal{L})$	$(\mathcal{S}+\mathcal{L})_{\mathcal{S}=\mathcal{L}}$
1	Anticipate	1/2	60	40
2	Anticipate	3/4	40	34.2
3	Anticipate	5/4	30	26.7
4	Anticipate	3/2	30	24
5	Delay	1/2	60	40
6	Delay	3/4	40	34.2
7	Delay	5/4	30	26.7
8	Delay	3/2	30	24
9	Symm.	9/11	33	33
10	Symm.	1	30	30
11	Symm.	11/9	30	27
12	Symm.	3/2	30	24
13	Symm.	7/3	30	18
14	Symm.	3	30	15

Notes: The Anticipate scenario corresponds to eq. 1, the Delay scenario to eq. 2. The Symmetric scenario corresponds to eq. 3: when the relative price $R = 1$ the budget line is a straight line, otherwise it is kinked. Column 4 shows the maximum value of the sum of sooner and later allocations (leisure or money) that can be obtained in each case. Except for decisions #9 and #10, it is obtained in a corner solution where either $\mathcal{S} = 0$ or $\mathcal{L} = 0$. The last column indicates maximum total consumption when the subject allocates an equal amount to $t = 1$ and $t = 2$. To check for consistency in their choices, in the experiment subjects face decisions #10 and #14 three and two times, respectively (see Sections 2.4 and 3.1 for details).

not account for between-period preferences, such as preferences for smoothing consumption or, more in general, for consumption patterns (Loewenstein and Sicherman, 1991; Frederick et al., 2002). This can be a reasonable assumption in specific circumstances, but it is a restriction that rules out plausible explanations for observed behavior (see Harrison et al., 2013).

Here, we do not apply these restrictions. These assumptions are typically needed when experiments aim at providing point estimates of one or more parameters that describe the discount function. Our goal is simpler and, in some sense, more primordial. We want to assess whether time preferences have a positive or negative *sign*. The definition of positive time preferences adopted in this paper parallels Koopmans (1960) and Koopmans et al. (1964)'s definition of impatience. It implies that, if at time $t = 0$ consumption of x is preferred over y, then sooner consumption of x and later consumption of y is preferred to sooner consumption of y and later consumption of x (Koopmans et al., 1964, p.82). Following this intuition, we define negative time preference as the opposite pattern, in which an individual exhibits a preference for delaying consumption of the most preferred option and for advancing consumption of the least preferred one. Formally, assuming there exists a weak preference ordering $\succeq$, we define the sign of time preferences as follows:[3]

Definition 1 *Consider two options, x and y, and consider two alternative pairs, (x, y) and (y, x), where the first element in each parenthesis denotes the sooner consumption option (available at $t = 1$) and the second element denotes the later one (available at $t = 2$). Suppose at time $t = 0$, option $x \geq y$, then an individual exhibits*

- *Positive time preferences if $(x, y) \succeq (y, x)$,*
- *Negative time preferences if $(y, x) \succeq (x, y)$.*

Our definition implies that a setup in which symmetric consumption pairs are simultaneously available allows to infer whether individual time preferences are positive or negative. Accordingly, if the experimental subject chooses an allocation in which the sooner option is strictly larger than the later option (i.e. the allocation stays below the 45-degree line), by

[3]For a more general case, consider consumption bundles $\mathbf{z}_{t+k}$ available at date $t + k$, and denote a consumption stream to be chosen at time t as ${}_tz \equiv (\mathbf{z}_t, \mathbf{z}_{t+1}, ...)$. Assume there exists a weak ordering $\succeq$ over consumption streams ${}_tz$ which satisfies completeness, transitivity, continuity, and sensitivity (Koopmans, 1960). Moreover, assume that, for some time periods τ and $\tau + k$, with $\tau > t, k \geq 1$, the trade-offs between $\mathbf{z}_\tau$ and $\mathbf{z}_{\tau+k}$ are unaffected by the previous or the subsequent consumption streams, a requirement that relaxes the assumptions made by Koopmans (1960) whereby separability and stationarity holds for any period. Let $\mathbf{x} \succeq \mathbf{y}$ at $t = 0$; hence an individual exhibits positive time preferences if $(\mathbf{x}_\tau, \mathbf{y}_{\tau+k}) \succeq (\mathbf{y}_\tau, \mathbf{x}_{\tau+k})$, and she exhibits negative time preferences if $(\mathbf{y}_\tau, \mathbf{x}_{\tau+k}) \succeq (\mathbf{x}_\tau, \mathbf{y}_{\tau+k})$.

revealed preferences we can infer that the subject displays positive time preferences. On the contrary, when the sooner option is strictly smaller than the later one, the subject displays negative time preferences.[4]

As observed in the previous subsection, when the relative price R increases, sooner consumption becomes relatively more costly in the Anticipate scenario, and in the Symmetric one when the optimal choice is on the upper arm of the constraint, and relatively cheaper in the Delay scenario and in the Symmetric one when the optimal choice is on the lower arm (and the converse holds for later consumption). Accordingly, we can test whether sooner and later consumption follow the law of demand (as one would expect, at least for money). Clearly, the specific individual choice along the upper or lower arm of the budget set depends on time preferences, as well as additional factors, such as the degree of concavity of the instantaneous utility function, the degree of substitutability between sooner and later consumption, or efficiency considerations. Measuring their specific weight requires structural assumptions and is not the focus of our paper. For our purposes it suffices to observe that, in the Symmetric scenario as the kink of the choice set moves inward towards the origin, equal allocations of sooner and later consumption are associated to less overall consumption when compared to the allocations on the corners (see the last three columns of Table 1).

2.3 Behavioral hypotheses and analytical strategy

Our design is built over two assumptions. First, it is based on the premise that subjects respond to the variations of the relative price R in the expected way, according to well-behaved demand schedules (**Assumption 1**). Second, based on the exploratory findings by Augenblick et al. (2015), it is motivated by the idea that most people prefer to smooth consumption over dates (**Assumption 2**). Both preliminary assumptions are testable, and will be tested.

To make progress in the identification of positive and negative time preferences, we will conduct a statistical analysis and test three main hypotheses in each domain, which follow from the essential leitmotiv of positive discounting: "sooner benefits are better than later".

Hypothesis 1A (Time Preferences for Money)*: People typically allocate a larger amount of money to the sooner period rather than to the later period.*

Hypothesis 1B (Time Preferences for Leisure)*: People typically allocate a larger amount of leisure to the sooner period rather than to the later period.*

[4] The case in which the allocation stays on the 45-degree line, $\mathcal{L} = \mathcal{S}$, is compatible with time preferences of either sign.

Hypotheses 1A and 1B address the core question of this paper: the sign of time preferences. They formulate the null hypothesis that people display positive rather than negative time preferences, as intended in Definition 1. There are two ways of testing each hypothesis, depending on how "typical behavior" is intended: either as the most common allocation or as the average allocation. For sake of completeness, we conduct both tests. First, we test whether most decisions allocate a larger amount of benefit to the sooner period rather than to the later period. Second, we test whether the average amount allocated to the sooner period is higher than the average amount allocated to the later period. Hypotheses 1A and 1B will be tested using the subjects' decisions in the Symmetric scenarios, which is specifically designed for the purpose. Depending on the choices made in the Symmetric scenarios, we label individuals as positive or negative discounters, and then check whether they make different choices in the Asymmetric scenarios.

Hypothesis 2 (Out of Sample Prediction)*: In the Asymmetric scenarios, positive discounters allocate larger amounts to the sooner date than negative discounters.*

Hypothesis 2 tests whether the time preferences elicited in the Symmetric environment are useful for predicting behavior in other scenarios, for a given domain. The following Hypothesis concerns across-domain consistency of time preferences.

Hypothesis 3 (Conditional Correlation Across Domains)*: People display the same type of time preferences when choosing between leisure and monetary allocations.*

This last hypothesis allows to assess whether the sign of "time preference for money" is predictive of the sign of "time preference for leisure", or whether they are domain-specific. It is instructive for understanding whether time preferences can be treated as a domain-independent concept.

2.4 Experimental procedures

Using leisure time to measure time preferences faces the major challenge of obtaining experimental control over subjects' personal calendar engagements. We achieve this by initially assigning some expected work duration within the personal schedule of the subjects and subsequently allowing them to shrink this duration according to their preferences.

Our experiment is based on a longitudinal, within-subject design with 3 sessions in the laboratory, and two treatments: Leisure and Money. When students sign up for the experiment, they agree to show up at three sessions, three weeks apart from each other, which are announced to last up to 90 minutes each. This time slot should be considered as a sunk cost by the subjects, so that the opportunity cost of activities outside the lab is, on average, equal across subjects. In the first session, subjects first face the Leisure treatment, and decide how to allocate their leisure over sessions 2 and 3 in the Asymmetric and Symmetric scenarios. Leisure time z is given by the difference between the expected duration of a session ($90'$) and its actual duration ($90' - z$).[5] During the initial part of sessions 2 and 3, people complete some questionnaires and then wait in their cubicles without the possibility to interact or to use electronic devices.[6] During their leisure time, subjects are free to leave the laboratory. We set M=30 minutes. The maximum amount of leisure time subjects can allocate to the same session is $2M$=60 minutes, so that each subject must come back to the laboratory regardless of their decisions in session 1. At the end of session 1, one leisure allocation is randomly selected and subsequently implemented in sessions 2 and 3.

Once the Leisure treatment is completed, subjects begin the Money treatment, where they choose inter-temporal monetary allocations over sessions 2 and 3 in the Symmetric and Asymmetric scenarios. For every monetary decision, we set M=6€. The maximum amount of money subjects can allocate to the same date is $2M$=12€. Only one of the decisions is implemented, according to a random selection. The corresponding amount is paid in cash at the end of sessions 2 and 3.

In the experiment subjects make decisions in terms of minutes and euros. The minimum incremental change subjects can add or subtract is 1 minute for leisure and 0.20€ for money. However, for expositional reasons, in the proceeding we convert the monetary and leisure amounts into experimental units (EU) at the rate 1 EU=1 minute and 1 EU=0.20€. Hence, M=30 EU in both treatments, as shown in Figure 1 and in Table 1.[7]

When making their choices, subjects do not need to compute the sooner and later allocation

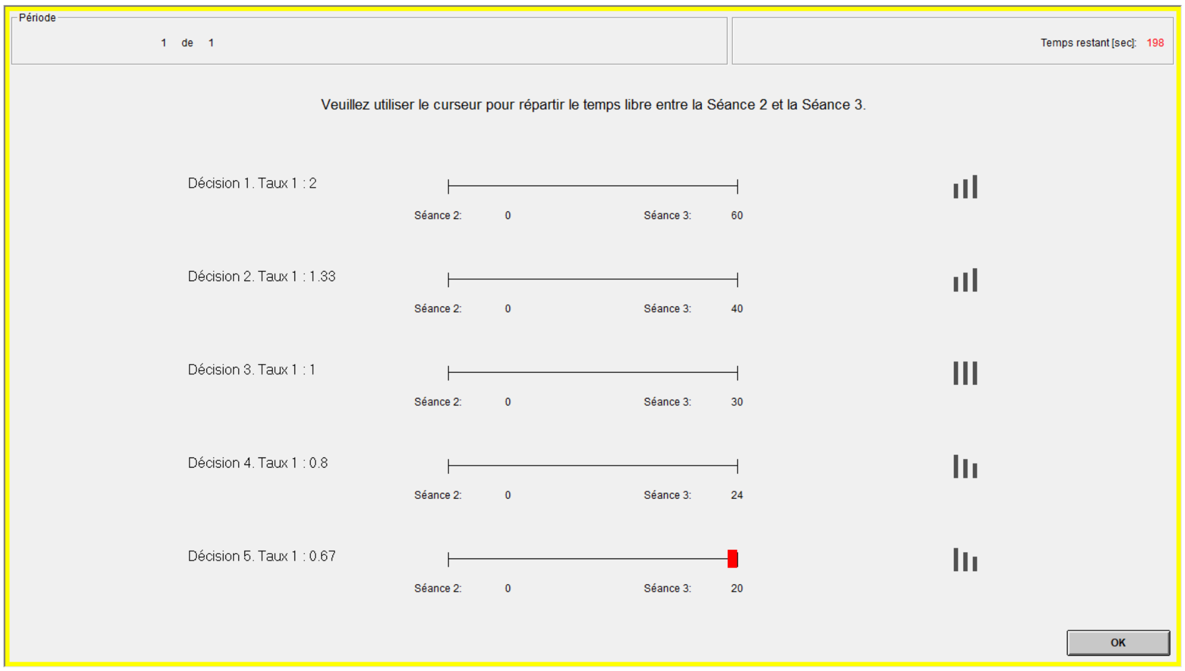
[5] We refer to the term "leisure" according to its textbook economic meaning, i.e. the difference between the maximum amount of time a consumer can work and the amount of time he actually works (Varian, 1992, p.145). This meaning can differ from the laymen use of "leisure" as time for enjoyment / pleasant activities.

[6] Waiting is intended to account for "time lost" and to minimize differences in the ex-ante perception among subjects (to rule out idiosyncratic preferences) and over time (to rule out learning or fatigue). It is the same experimental strategy already used by Noussair and Stoop (2015).

[7] Our experiment does not use experimental tokens. This allows for a direct comparability with Augenblick et al. (2015) and it avoids potential confusion that may arise with multiple conversions in the Convex Time Budget, as pointed out by Harrison et al. (2013). Our procedures respect the induced value theory for both the leisure and money treatments (Smith, 1976).

by themselves. They only need to understand the incentive structure and the type of trade-off at stake. To take their decisions, they move a slider along a bar and the computer displays the corresponding allocations $\mathcal{S}$ and $\mathcal{L}$, which are jointly determined. They can freely move the slider before making their decision, to assess the available trade-offs. Figure 2 shows a screenshot of the Asymmetric scenario as seen by the experimental subjects.

Figure 2: Screenshot of the decision environment



Subjects complete nine trials before taking the payoff-relevant decisions. They also complete a pen-and-paper quiz. To help them understanding variations in the incentive structure, a symbol on the right of the slider indicates whether it is relatively more costly to allocate to the later rather than the sooner session or if it is relatively more costly to spread rather than concentrate the allocation (see Figure 2). To reduce visual anchoring for equal splits, we also exogenously manipulate the visual focal point in the two decisions where R=3: the control bar appears at opposite edges of the slider, so that smoothing requires a small attention cost.

At the end of session 1, subjects are asked to self-report how confident they are about some of their decisions, using a Likert scale (see Appendix, Figure B.4), and to fill up a questionnaire about socio-demographic characteristics.[8]

[8] To measure the relative importance of efficiency motives with respect to time preferences, we also introduce two control decisions at the end of each treatment (see Appendix, Figure B.5).

The experiment was coded using z-Tree (Fischbacher, 2007) and conducted at the Laboratory of Experimental Economics in Montpellier, France, between October and December 2018. It took place over 7 weeks, at the same hour of the same day of the week. Participants were split in 6 groups and came to the lab for three sessions. Sessions were evenly distributed over time, with a 20-day interval between consecutive sessions. Participation to all three sessions was mandatory to obtain a fixed 25€ completion bonus. The completion bonus was intended to discourage attrition, and it was paid at the end of the last session. In all sessions, subjects received a show-up fee (2€ to 6€ depending on their main campus) on top of any eventual gain determined by their decisions (and luck).[9]

Table 2: Experimental sessions

Group	Session 1		Session 2		Session 3	
	date	# subjects	date	# subjects	date	# subjects
A	10/22/18	19	11/12/18	17	12/03/18	17
B	10/22/18	16	11/12/18	13	12/03/18	12
C	10/22/18	17	11/12/18	16	12/03/18	16
D	10/23/18	17	11/13/18	13	12/04/18	13
E	10/23/18	17	11/13/18	12	12/04/18	11
F	10/23/18	19	11/13/18	18	12/04/18	16

Note: Participants from group A came to the laboratory on October 22, November 12 and December 3. Among the initial 19 participants, 2 abandoned at the second session while 17 completed the whole experiment.

A total of 105 subjects took part to the first session; 16 abandoned the experiment at the second session, 4 abandoned it at the third session. Subjects who dropped out of the experiment are excluded from our analysis. They are not significantly different from the compliers in the decisions they took in session 1, nor in their socio-demographic characteristics (see Appendix, Table A.1). The attrition rate (19%) and the sample size (85 individuals) are similar to previous experiments (Augenblick et al., 2015; Augenblick, 2018; Augenblick and Rabin, 2019). Table 2 illustrates the number of participants across groups and sessions.

In the analysis, a critical aspect is the possibility of heuristic response strategies which seem to disregard differences across environments, for instance because of confusion. We drop from the analysis observations where average response time per treatment per subject was less than 1.5 seconds. Five batches of observations correspond to this case: two from the

[9] The University of Montpellier is spread over multiple campuses. The policy of the laboratory is to refund participants according to their main site of activity: 2€ for those who study in the same campus where the laboratory is, 6€ for the others.

same subject (i.e. both treatments) and three from other subjects in the leisure treatment only (therefore, we analyze only the monetary decisions of these three subjects).[10] Overall, we have a sample of 1,428 decisions from 84 subjects in the MONEY treatment and 1,377 decisions from 81 subjects in the LEISURE treatment.

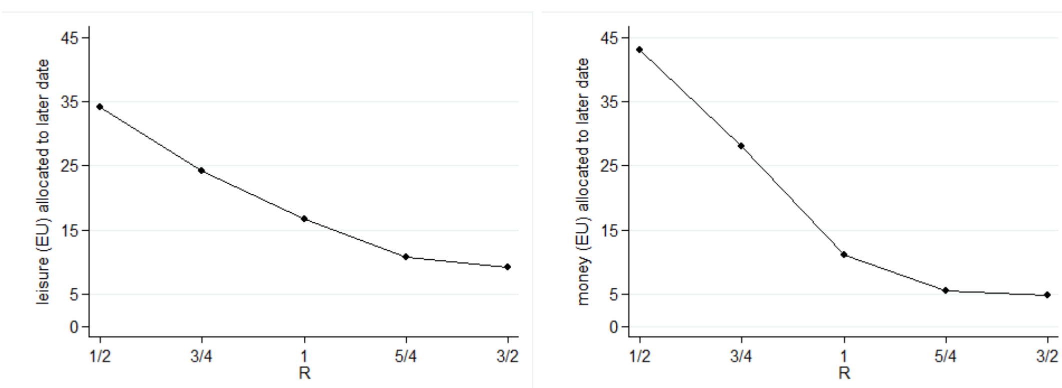
3 Results

We first check whether subjects properly understand the experimental setup and respond to the incentives as expected. Figure 3 shows the average amount of leisure and money allocated in the Delay scenario to the later date, as a function of the relative price R. The allocations monotonically decrease with the relative price. The same result holds when considering the Anticipate scenario, as shown in the Appendix (Figure B.1). These patterns suggest that subjects' behavior is responsive to price incentives and, specifically, that Assumption 1 holds.

Check I*: Sooner and later allocations of leisure and money are consistent with the law of demand.*

Figure 3: Demand schedule, Delay scenario

(a) Leisure (b) Money



Notes: Average allocation to the later period in the Delay Scenario as a function of the relative price R. The vertical axis is expressed in EU.

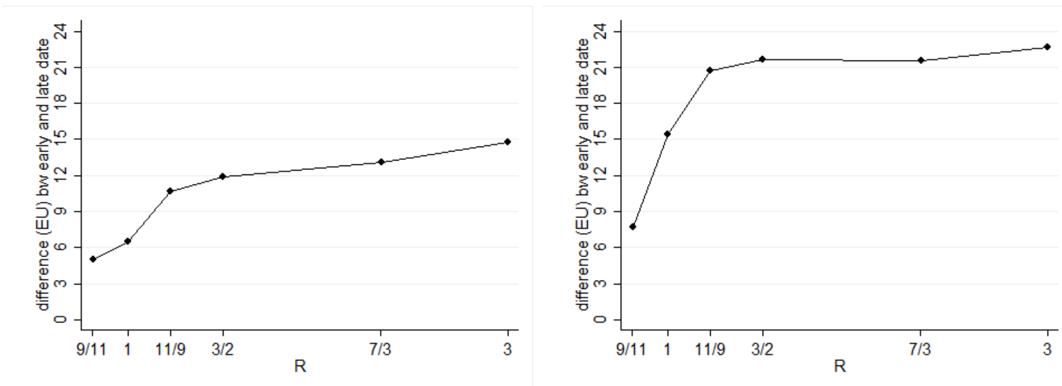
As a further check, recall that in the Symmetric scenario higher values of R make equal allocations between the sooner and later date more costly in terms of total efficiency ($\mathcal{S} + \mathcal{L}$). Accordingly, we would expect equal allocations to be less common as R increases (or, equivalently, that the absolute difference between sooner and later allocations increases with

[10]Including these outliers in the sample does not substantially affect the results.

R). This is indeed the case: as shown in Figure 4, subjects tend to pile up leisure and money in one session when spreading the allocation over two dates becomes more costly.

Figure 4: Difference between sooner and later allocation, Symmetric scenario

(a) Leisure (b) Money



Notes: In the Symmetric scenario, choosing equal allocations for the sooner and later date becomes more costly as R increases. In the experiment, higher values of R induce a larger difference (in absolute value) between sooner and later allocations of leisure and money. The vertical axis is expressed in EU.

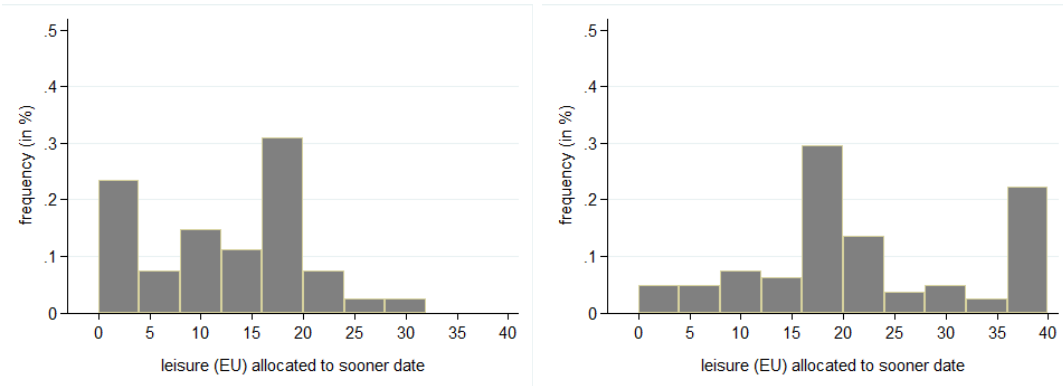
Beyond efficiency motives, subjects may also have a preference for smoothing leisure and money over the two dates (Assumption 2). For example, when the relative price is $R = 1$, almost two thirds of the subjects split the leisure budget equally between the two dates. This result persists as R changes. Figure 5 shows how many minutes are allocated to the sooner date when anticipating leisure is relatively expensive (Anticipate scenario, $R = 3/4$) or relatively cheap (Delay scenario, $R = 3/4$). Recall that, in both cases, an equal allocation of leisure is obtained when $(\mathcal{S}, \mathcal{L}) = (17.1, 17.1)$, but overall leisure is maximum in the corner solutions $(0, 40)$ and $(40, 0)$, respectively. In the experiment we find a tendency to shift the allocation of leisure toward the corner solution that maximizes overall leisure, but also a tendency toward choosing equal allocations (and implicitly forgo some efficiency).

Check II: *Subjects tend to equally distribute leisure between the two sessions (even when it means forgoing overall efficiency).*

Corner allocations are likely driven by efficiency motives and can be poorly informative about time preferences. Choices featuring equal allocations are consistent with preferences over the distribution of outcomes over time. This finding is not isolated. For example, using the data of Augenblick et al. (2015), in which subjects allocate effort in an Asymmetric scenario under the same structure of relative prices used in this paper, similar patterns hold

Figure 5: Allocations of leisure to the sooner date, Asymmetric scenario

(a) Anticipate scenario, $R = 3/4$ (b) Delay scenario, $R = 3/4$



Notes: In the Anticipate scenario, efficiency is maximized when no leisure is allocated to the sooner date ($\mathcal{S} = 0$). In the Delay scenario, the opposite holds ($\mathcal{S} = 40$). Equal allocation implies $(\mathcal{S}, \mathcal{L}) = (17.1, 17.1)$.

(see Appendix, Figure B.2) A tendency to distribute allocations equally between two dates can be easily reconciled with positive time preferences if one allows for some convexity in intertemporal preferences. This can result, for example, if the instantaneous utility of leisure is strictly concave, or if there is some degree of intertemporal complementarity. Importantly for our purposes, the degree of domain-specific convexity does not contaminate the sign of time preferences nor affects the results of our investigation. Simply, it makes it less detectable in the Asymmetric scenarios. The Symmetric scenario allows to directly address this confounder by making equal allocations costly, as shown in the next section.

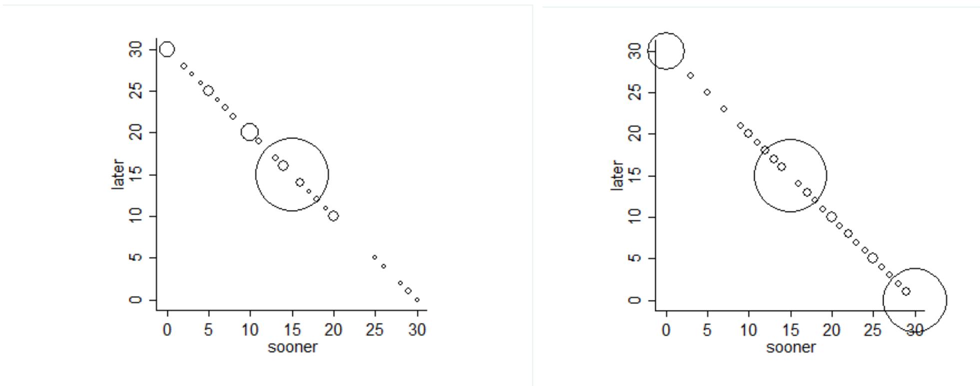
3.1 Positive vs negative time preferences

In this section we present the experimental results corresponding to the Symmetric scenario. This scenario allows to offset the confounding role of convexity in time preferences, and to assess whether time preferences are positive or negative by directly applying Definition 1. Empirically, this simply requires comparing whether sooner consumption $\mathcal{S}$ is larger than later consumption $\mathcal{L}$. Graphically, this is equivalent to check whether choices are above or below the 45-degree line, as shown in the left panels of Figure 1. Importantly, this criterion needs no structural assumption on the intertemporal utility function of the decision-maker.

The simplest case arises when $R = 1$, which corresponds to the Symmetric scenario in which $\mathcal{S} + \mathcal{L} \leq M$. This choice set is proposed to each subject three times, at different points in the experiment. Figure 6 illustrates the results. The scatter plots show a tendency to equally

Figure 6: Allocations in the Symmetric scenario for $R = 1$

(a) Leisure (b) Money



Notes: The scatterplots report 243 leisure allocations and 255 monetary allocations chosen in the Symmetric scenario when $R = 1$; the size of the circles corresponds to the observed frequency of each allocation. For leisure, $\mathcal{L} > \mathcal{S}$ in 32% of decisions, while $\mathcal{S} = \mathcal{L}$ and $\mathcal{S} > \mathcal{L}$ is observed in 54% and 14% of decisions, respectively. For money, $\mathcal{S} > \mathcal{L}$ in 43% of decisions, while $\mathcal{S} = \mathcal{L}$ and $\mathcal{L} > \mathcal{S}$ is observed in 35% and 22% of decisions, respectively.

allocate leisure and money over the two dates, or to choose corner solutions. When excluding equal allocations, two contrasting patterns emerge: leisure allocations are mostly located on the upper arm of the constraint ($\mathcal{S} < \mathcal{L}$), while monetary allocations tend to concentrate on the lower arm ($\mathcal{S} > \mathcal{L}$).

This pattern is more evident when the constraint becomes kinked ($R > 1$), as shown in Figure 7. Recall that, if $R > 1$ choosing a symmetric allocation $\mathcal{S} = \mathcal{L}$ is costly in the Symmetric scenario, because it entails a loss of efficiency. About half of the decisions (49%) allocate more leisure to the later than the sooner period (and only 24% do the opposite). Conversely, about half of the decisions (55%) allocate more money to the sooner than the later period. A one-sided t-test supports the alternative hypothesis that the majority of allocations feature $\mathcal{S} > \mathcal{L}$ for money (N=420, p-value = 1.000), but it strongly rejects this hypothesis for leisure (N=405, p-value = 0.000). These results are in line with Hypothesis 1A (positive discounting in the monetary domain), but contradict Hypothesis 1B (positive discounting in the leisure domain).

We summarize these results below:

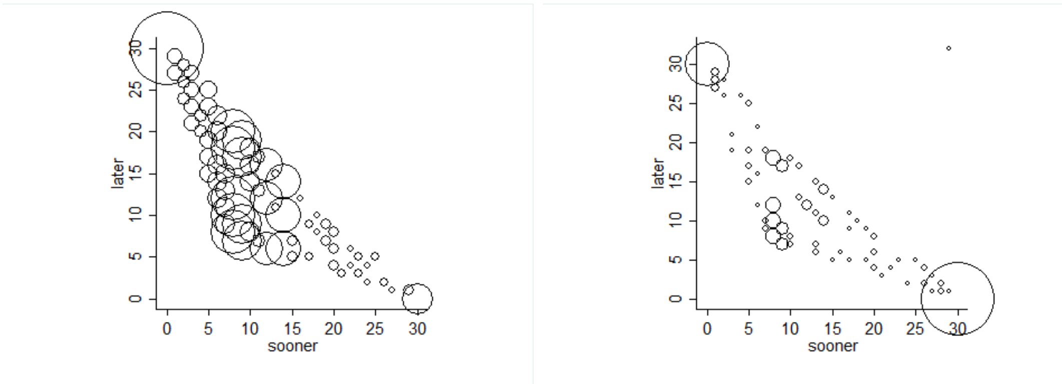
Result 1A': *The modal allocation is* ***consistent*** *with positive time preferences for* ***money.***

Result 1B': *The modal allocation is* ***not consistent*** *with positive time preferences for* ***leisure****.*

Figure 7: Allocations in the Symmetric scenario for $R > 1$

Panel A

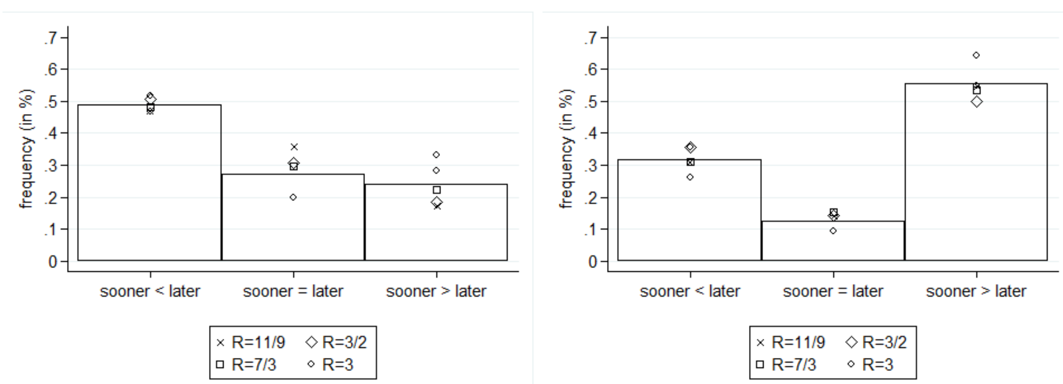
(a) Leisure (b) Money



Notes: The scatterplots report 405 leisure allocations and 420 monetary allocations chosen in the Symmetric scenario when $R > 1$; the size of the circles corresponds to the observed frequency of each allocation. For leisure, $\mathcal{L} > \mathcal{S}$ in 49% of decisions, while $\mathcal{S} = \mathcal{L}$ and $\mathcal{S} > \mathcal{L}$ is observed in 27% and 24% of decisions, respectively. For money, $\mathcal{S} > \mathcal{L}$ in 55% of decisions, while $\mathcal{S} = \mathcal{L}$ and $\mathcal{L} > \mathcal{S}$ is observed in 32% and 13% of decisions, respectively. See also Panel B, below.

Panel B

(c) Leisure (d) Money



Notes: The symbols refer to the proportion of choices in the Symmetric scenario where the sooner allocation is smaller, equal or larger than the later allocation for $R \in \{11/9, 3/2, 7/3, 3\}$; the bins correspond to the proportions aggregating over $R > 1$. Only 24% of the choices allocate more leisure to the sooner period, while 56% of the monetary choices allocate more money to the sooner period. See also Panel A, above.

Similar results hold when considering average allocations instead of modal choices, as shown in Tables 3 and 4. The Tables report the results of separate t-tests of the null hypothesis $\bar{\mathcal{S}} = \bar{\mathcal{L}}$, for leisure and for money separately. Each line corresponds to a decision. In Table 3, the large negative t-statistics displayed in the last column support the hypothesis that $\bar{\mathcal{S}} - \bar{\mathcal{L}}$ is significantly negative for leisure, while the positive t-statistics in Table 4 show that the difference is significantly positive for money. In line with the predictions of the positive discounting model, on average people allocate more money to the sooner period if $R \geq 1$. On the contrary, positive discounting makes poor predictions for leisure choices, as later allocations are on average higher than sooner allocations. These results hold not only when the experimental design makes equal allocations costly ($R > 1$), but also when sooner and later consumption have the same relative price ($R = 1$).[11] Consistent with the previous findings, they support Hypothesis 1 for money, but they reject it for leisure.

Result 1A": *The average allocation is consistent with* ***positive*** *time preferences for* ***money***.
Result 1B": *The average allocation is consistent with* ***negative*** *time preferences for* ***leisure***.

Table 3: Leisure allocations in the Symmetric scenario: Sooner vs later

R	$\bar{\mathcal{S}}$	sd($\mathcal{S}$)	$\bar{\mathcal{L}}$	sd($\mathcal{L}$)	$\bar{\mathcal{S}} - \bar{\mathcal{L}}$	t-stat
9/11	15.52	5.29	17.54	4.95	-2.02*	(-2.52)
1	13.32	5.03	16.68	5.03	-3.36***	(-4.25)
11/9	11.48	7.45	17.16	7.86	-5.68***	(-4.72)
3/2	9.70	7.40	16.81	8.75	-7.11***	(-5.59)
7/3	9.54	8.98	13.96	10.21	-4.42**	(-2.93)
3	9.15	8.52	14.06	9.92	-4.91***	(-3.38)

Note: Average allocations to the sooner and later period, $\bar{\mathcal{S}}$ and $\bar{\mathcal{L}}$ respectively, for different values of the relative price R. For all values of R, subjects prefer to allocate more leisure to the later than the sooner period. For instance, when the budget constraint is slightly kinked ($R = 11/9$) people on average allocate less leisure (about 5.7 EU) to the sooner date. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Results 1A' and 1A" suggest that positive time preferences are a good assumption to predict intertemporal choices about money. Conversely, Results 1B' and 1B" imply that the same assumption can produce poor predictions for choices involving leisure. Negative time

[11] When $R < 1$, choosing symmetric allocations where $\mathcal{S} = \mathcal{L}$ is efficient, hence no equality-efficiency trade-off arises. In such a case we still detect some difference between sooner and later allocation of leisure (p-value<0.10), and no statistical difference for monetary choices.

Table 4: Money allocations in the Symmetric scenario: Sooner vs later

R	$\bar{\mathcal{S}}$	sd($\mathcal{S}$)	$\bar{\mathcal{L}}$	sd($\mathcal{L}$)	$\bar{\mathcal{S}} - \bar{\mathcal{L}}$	t-stat
9/11	16.42	6.83	15.18	6.81	1.24	(1.18)
1	17.85	9.24	12.15	9.24	5.69***	(3.99)
11/9	17.70	11.87	11.65	11.77	6.05**	(3.32)
3/2	16.81	12.56	11.60	12.16	5.21**	(2.73)
7/3	16.68	12.69	10.08	11.95	6.60***	(3.47)
3	3.47	2.42	1.92	2.23	1.55***	(4.31)

Note: Average monetary allocations to the sooner and later period, $\bar{\mathcal{S}}$ and $\bar{\mathcal{L}}$ respectively, for different values of the relative price R. For $R \geq 1$, subjects prefer to allocate more money to the sooner than the later period. For instance, when the budget constraint is slightly kinked ($R = 11/9$) people on average allocate more money (about 6 EU) to the sooner date. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

preferences appear as a more appropriate assumption. When applied to intertemporal models of labor supply, our results suggest that there exist situations in which, everything else equal, workers prefer to postpone leisure rather than anticipating it, or equivalently, that they may prefer to exert more effort sooner than delaying it to a later date.

3.2 Negative and positive discounters

Based on the decisions in the Symmetric scenarios, we categorize the experimental subjects according to "types". The general criterion is that a subject displays (strict) positive time preferences if in the Symmetric scenarios she consistently chooses $\mathcal{S} > \mathcal{L}$. If instead $\mathcal{S} < \mathcal{L}$, the subject displays (strict) negative time preferences. We label the former subject a *positive discounter*, and the latter one a *negative discounter*.[12]

The labeling process is based on a lexicographic procedure. We first divide the symmetric scenarios in three categories: no smoothing cost ($R = 1$, three decisions), low smoothing cost ($1 < R < 3$, three decisions) and high smoothing cost ($R = 3$, two decisions). Subjects are labeled as positive or negative discounters if they consistently choose $\mathcal{S} < \mathcal{L}$ or $\mathcal{S} > \mathcal{L}$ when $R = 1$. If this is not the case, we consider allocations when the smoothing cost is low. If this step does not yield consistent results, we consider allocations when the smoothing cost is high. For instance, if a person consistently chooses equal allocations $\mathcal{S} = \mathcal{L}$ when $R = 1$, and she stacks allocations in the sooner period ($\mathcal{S} > \mathcal{L}$) when $R > 1$, she is labeled as a positive discounter. Among people who do not qualify as positive or negative discounters, we

[12]We treat $\mathcal{S} = \mathcal{L}$ as a separate case because it is compatible with both weak positive and weak negative time preferences.

Table 5: Types and time preferences

		Money				
		Neg. disc.	**Smoother**	**Pos. disc.**	**Others**	Total
Leisure	**Neg. disc.**	17.3%	0%	24.7%	1.2%	43.2%
	Smoother	2.5%	2.5%	7.4%	2.5%	14.8%
	Pos. disc.	1.2%	1.2%	18.5%	3.7%	24.7%
	Others	3.7%	0%	8.6%	4.9%	17.3%
	Total	24.7%	3.7%	59.3%	12.3%	100%

Notes: Consistency of individual time preferences across domains. For instance, 17.3% of subjects display negative time preferences both for money and for leisure.

distinguish those who persistently choose equal later and sooner allocations (*smoothers*) and a residual category (*others*). Money-types and leisure-types are labeled separately.[13]

Table 5 shows the proportion of subjects labeled as positive discounters, negative discounters, smoothers and other types. While most people (59%) behave consistently with positive discounting for monetary benefits, only a minority do so for leisure (25%). Negative discounting is the modal type (43%) for leisure choices.

Once types are assigned, we can study their allocations in the Asymmetric scenarios. Figure 8 shows the demand schedules for later leisure and money, separately for positive and negative discounters. Demand schedules are non-increasing in R. Consistent with the intuition that positive discounters prefer sooner outcomes and that negative discounters prefer later outcomes, negative discounters allocate more to the later period than positive discounters. Notably, this result holds for both leisure and money.

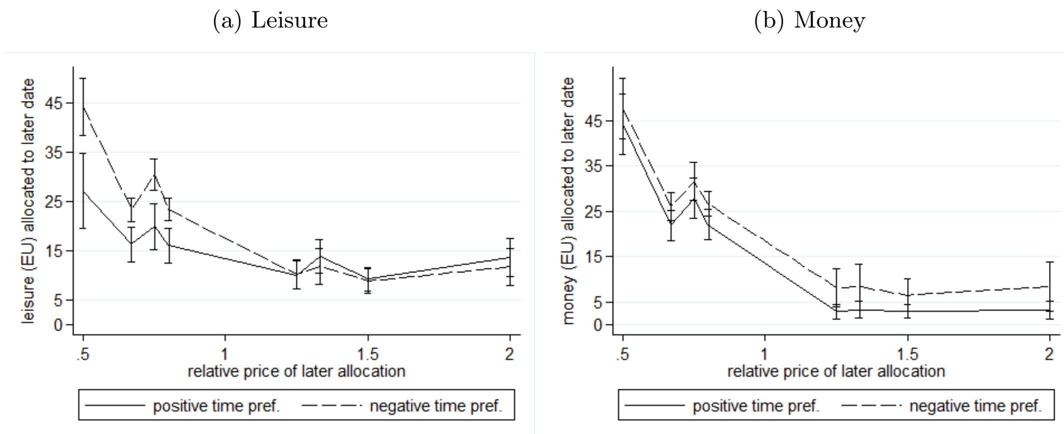
Regression analysis confirms these patterns. Tables 6 and 7 show the estimates of the amount of leisure and money allocated to the later period in the 8 decisions in the Asymmetric scenario. Positive discounting is the baseline type. The control variables include response time, session fixed effects, sex and age (1 if > 30). Errors are clustered at the individual level to control for individual-specific correlation across decisions.[14]

Tables 6 and 7 show that negative discounters allocate substantial and significantly higher amounts to the later period in the Asymmetric scenario. This holds true also when controlling

[13]The labeling procedure is described in detail in Section C in the Appendix. As a robustness check, we also use an alternative classification strategy, based on the average Euclidean distance from the point of equal split. When we replicate the regression analysis on the Asymmetric scenario using this alternative classification strategy, results hold qualitatively the same and are very close in terms of magnitude (see tables A.5, A.6 and A.7).

[14]Tables A.2 and A.3 in the Appendix report the full set of results.

Figure 8: Demand schedule in the Asymmetric scenario



Notes: Average allocation to the later period in the Delay and Anticipate scenarios, as a function of its relative price. The classification of types is based on the choices made in the Symmetric scenario. For both leisure and money the demand schedules are non-increasing in the relative price. For a given price, negative discounters tend to allocate more to the later period. The y-axis is expressed in EU. The price of the later allocation corresponds to R in the Delay scenario and to $1/R$ in the Anticipate scenario.

for demographic and experimental variates. Graphically, the estimated positive coefficient corresponds to the distance between the intercept of the conditional demand schedule of positive and negative discounters (Figure 8). The coefficient associated to the interaction between R and the dummy for negative discounting is consistent with the visual impression that the demand schedule for leisure features a different slope for positive and negative discounters.

***Result** 2: Negative discounters for leisure tend to allocate significantly more leisure to the later period than positive discounters; similarly, negative discounters for money tend to allocate significantly more money to the later period than positive discounters.*

Finally, we compare individual time preferences *across* domains, and test Hypothesis 3. As shown in Table 5 there is a certain consistency in time preferences across domains. In particular, people who are negative discounters for money tend to be negative discounters for leisure, and the same holds for positive discounters for leisure and money. A Fisher test rejects the null hypothesis that time preferences are independent across domains (N=81, p-value < 0.01).

We can formally test the conditional correlation of time preferences across domains with regression analysis. A word of caution is needed, however, because the sample size is equal to 84 observations. Yet, this exercise can provide suggestive evidence about the direction of the conditional correlation across domains. The results from four linear probability models

Table 6: Leisure allocations in the Asymmetric scenario: Positive vs negative discounters

	Dep. variable: Later allocation of leisure			
	(1)	(2)	(3)	(4)
Negative disc.		4.74***	5.38***	20.66***
		(1.25)	(1.29)	(4.30)
Smoothers and Others		0.51	0.78	0.78
		(1.18)	(1.20)	(1.20)
R	-12.03***	-12.03***	-12.04***	-6.03***
	(1.84)	(1.84)	(1.85)	(1.98)
R × Neg. disc.				-13.89***
				(3.51)
Controls	no	no	yes	yes
Constant	31.20***	28.99***	29.63***	22.47***
	(2.27)	(2.43)	(3.33)	(3.37)
	(2.27)	(2.43)	(3.27)	(3.37)
N	648	648	648	648
R^2 0.202	0.233	0.241	0.308	

Note: Linear regression results. Dependent variable: Later allocation of leisure. The classification of types is based on the choices made in the Symmetric scenario. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in parentheses; errors are clustered at the individual level. Positive time preferences is the baseline category. Leisure is expressed in EU. Controls: response time, session fixed effects, sex, age (1 if > 30).

are displayed in Table 8. They suggest some degree of consistency across domains: people who are negative discounters for money are more likely to be negative discounters for leisure than people who are positive discounters for money (columns 1 and 2). Conversely, they are less likely to be positive discounters for leisure than people who are positive discounters for money (columns 3 and 4). When re-running the analysis using Probit models the results are essentially the same (see Table A.4 in the Appendix). This leads to the formulation of our third and last result:

Result 3*: Time preferences are correlated across domains.*

Table 7: Money allocations in the Asymmetric scenario: Positive vs negative discounters

	Dep. variable: Later allocation of money			
	(1)	(2)	(3)	(4)
Negative disc.		4.40***	3.74***	6.47
		(1.23)	(1.10)	(4.71)
Smoothers and Others		2.14	1.49	1.50
		(1.31)	(1.21)	(1.21)
R	-23.48***	-23.48***	-23.48***	-22.89***
	(1.78)	(1.78)	(1.80)	(2.09)
R × Neg. disc.				-2.48
				(4.01)
Controls	no	no	yes	yes
Constant	43.31***	41.86***	39.67***	38.94***
	(2.30)	(2.57)	(3.61)	(3.83)
N	672	672	672	672
R^2	0.413	0.424	0.434	0.435

Note: Linear regression results. Dependent variable: Later allocation of money. The classification of types is based on the choices made in the Symmetric scenario. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in parentheses; errors are clustered at the individual level. Positive time preferences is the baseline category. Leisure is expressed in EU. Controls: response time, session fixed effects, sex, age (1 if > 30).

Table 8: Consistency of time preferences for leisure and money

	Dependent variable:			
	Negative disc. for leisure		Positive disc. for leisure	
	(1)	(2)	(3)	(4)
Negative disc. for money	0.37***	0.38***	-0.25***	-0.22**
	(0.12)	(0.10)	(0.08)	(0.08)
Controls	no	yes	no	yes
Constant	0.33***	1.04**	0.30***	1.10**
	(0.06)	(0.50)	(0.06)	(0.46)
N	84	84	84	84
R^2	0.103	0.313	0.061	0.124

Note: Linear probability model. The classification of types is based on the choices made in the Symmetric scenario. Standard errors in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Errors clustered at the individual level. Positive time preferences for money is the baseline category. Controls: response time, session fixed effects, sex, age (1 if > 30).

4 Conclusion

A growing empirical literature has documented violations of positive time preferences for consumption streams. However, such non-monetary studies contain debated confounds about the validity of their experimental rewards and their restrictive assumptions on the utility function (Cohen et al., 2020). In this study, we presented two methodological innovations to get around these problems. First, we adopted leisure time as a non-monetary incentive, which closely mirrors time-dated utils. Second, we introduced a novel allocation environment, which allows to experimentally disentangle discounting and convexity properties of preferences. We applied this new methodology in a longitudinal laboratory experiment where we identified the sign of time preferences for leisure (treatment) and money (control). We confirmed positive time preferences for money, but we documented negative time preferences for leisure. Our results suggest that the standard paradigm of time preferences, which assumes perfect consistency of discounting across domains, can lead to non-negligible predictive errors. Finally, the modal pattern we uncovered (positive discounting for money and negative for leisure) invites to reconsider the interpretation of the discount factor in monetary decisions. Insofar as money is a storable good, people have precautionary motives for preferring an earlier financial flow, regardless of their degree of impatience. Further evidence is needed to disentangle the importance of the storing technology and its implications for eliciting time preferences.

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A Supplementary Tables

Table A.1: Summary statistics

	Mean	sd	Min	Max	N
Sample used for the analysis					
Age	25.0	9.5	17	74	85
Gender	0.47	0.50	0	1	85
Non-student	0.17	0.37	0	1	85
$\bar{\mathcal{S}}$ (minutes)	13.66	10.62	0	60	1,377
$\bar{\mathcal{L}}$ (minutes)	16.90	10.63	0	60	1,377
$\bar{\mathcal{S}}$ (euros)	3.63	2.95	0	12	1,428
$\bar{\mathcal{L}}$ (euros)	2.87	2.94	0	12	1,428
Attrition sample					
Age	24.5	5.9	16	41	20
Gender	0.50	0.50	0	1	20
Non-student	0.15	0.36	0	1	20
$\bar{\mathcal{S}}$ (minutes)	14.39	9.41	0	60	340
$\bar{\mathcal{L}}$ (minutes)	15.85	9.42	0	60	340
$\bar{\mathcal{S}}$ (euros)	3.39	2.55	0	12	340
$\bar{\mathcal{L}}$ (euros)	2.94	2.59	0	12	340

Table A.2: Leisure allocations in the Asymmetric scenario: Positive vs negative discounters

	Dep. variable: Later allocation			
	(1)	(2)	(3)	(4)
Negative disc.		4.74***	5.38***	20.66***
		(1.25)	(1.29)	(4.30)
Smoothers and others		0.51	0.78	0.78
		(1.18)	(1.20)	(1.20)
R	-12.03***	-12.03***	-12.04***	-6.03***
	(1.84)	(1.84)	(1.85)	(1.98)
Response Time			0.00	0.00
			(0.00)	(0.00)
Session B			-1.76	-1.71
			(1.48)	(1.48)
Session C			-1.56	-1.44
			(1.34)	(1.34)
Session D			-0.93	-0.96
			(1.55)	(1.55)
Session E			-1.53	-1.61
			(1.74)	(1.74)
Session F			-1.75	-1.69
			(1.52)	(1.52)
Age>30			2.57*	2.57*
			(1.41)	(1.41)
Female			-1.05	-1.06
			(0.89)	(0.89)
R × Neg. disc.				-13.89***
				(3.51)
Constant	31.20***	28.99***	29.63***	22.47***
	(2.27)	(2.43)	(3.33)	(3.37)
N	648	648	648	648
R^2	0.202	0.233	0.241	0.308

Note: Linear regression: full set of results. Dependent variable: Later allocation of leisure. The classification of types is based on the choices made in the Symmetric scenario. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in parentheses; errors are clustered at the individual level. Positive time preferences is the baseline category. Leisure is expressed in EU. Controls: response time, session fixed effects, sex, age (1 if > 30).

Table A.3: Money allocations in the Asymmetric scenario: Positive vs negative discounters

	Dep. variable: Later allocation			
	(1)	(2)	(3)	(4)
Negative disc.		4.40***	3.74***	6.47
		(1.23)	(1.10)	(4.71)
Smoothers and others		2.14	1.49	1.50
		(1.31)	(1.21)	(1.21)
R	-23.48***	-23.48***	-23.48***	-22.89***
	(1.78)	(1.78)	(1.80)	(2.09)
Response Time			0.00	0.00
			(0.00)	(0.00)
Session B			0.37	0.39
			(2.12)	(2.12)
Session C			-1.09	-1.07
			(1.86)	(1.86)
Session D			-0.09	-0.08
			(2.23)	(2.23)
Session E			2.50	2.49
			(2.06)	(2.06)
Session F			2.41	2.43
			(1.60)	(1.59)
Age>30			-0.66	-0.65
			(1.57)	(1.57)
Female			2.83**	2.82**
			(1.10)	(1.10)
R × Neg. disc.				-2.48
				(4.01)
Constant	43.31***	41.86***	39.67***	38.94***
	(2.30)	(2.57)	(3.61)	(3.83)
N	672	672	672	672
R^2	0.413	0.424	0.434	0.435

Note: Linear regression: full set of results. Dependent variable: Later allocation of money. The classification of types is based on the choices made in the Symmetric scenario. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in parentheses; errors are clustered at the individual level. Positive time preferences is the baseline category. Leisure is expressed in EU. Controls: response time, session fixed effects, sex, age (1 if > 30).

Table A.4: Consistency of time preferences for leisure and money (Probit analysis)

	Dep. variable:			
	Negative disc. for leisure		Positive disc. for leisure	
	(1)	(2)	(3)	(4)
Neg. disc. for money	0.97***	1.43***	-1.11**	-1.10**
	(0.34)	(0.39)	(0.50)	(0.49)
Controls	no	yes	no	yes
Constant	-0.45***	17.87**	-0.53***	2.15
	(0.16)	(8.81)	(0.17)	(1.54)
N	84	84	84	84
Pseudo R^2	0.076	0.266	0.070	0.130

Note: Probit results. The classification of types is based on the choices made in the Symmetric scenario. Standard errors in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Errors clustered at the individual level. Positive time preferences for money is the baseline category. Controls: response time, session fixed effects, sex, age (1 if > 30).

Table A.5: Leisure. Robustness check with Euclidean classification: Positive vs negative discounters

	Dep. variable: Later allocation of leisure			
	(1)	(2)	(3)	(4)
Negative disc.		3.97***	4.59***	16.76***
		(1.28)	(1.35)	(4.48)
Smoothers and Others		0.44	0.80	0.80
		(1.22)	(1.35)	(1.35)
R	-12.03***	-12.03***	-12.04***	-6.71***
	(1.84)	(1.84)	(1.85)	(2.12)
R × Neg.disc.				-11.07***
				(3.52)
Controls	no	yes	yes	yes
Constant	31.20***	29.17***	29.12***	23.09***
	(2.27)	(2.49)	(3.63)	(3.71)
N	648	648	648	648
R^2	0.202	0.224	0.233	0.276

Note: Linear regression results. Dependent variable: Later allocation of leisure. The classification of types is based on the choices made in the Symmetric scenario. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in parentheses; errors are clustered at the individual level. Positive time preferences is the baseline category. Leisure is expressed in EU. Controls: response time, session fixed effects, sex, age (1 if > 30). This table shows the results of a replication exercise where the average Euclidean distance from the point of equal split is used as the classification criterion for positive and negative discounters. Results can be compared to tab. 6 in the main text.

Table A.6: Money. Robustness check with Euclidean classification: positive vs negative discounters

	Dep. variable: Later allocation of money			
	(1)	(2)	(3)	(4)
Negative disc.		5.16***	4.59***	14.09***
		(1.45)	(1.32)	(4.46)
Smoothers and Others		1.29	1.25	1.26
		(1.26)	(1.24)	(1.24)
R	-23.48***	-23.48***	-23.48***	-21.73***
	(1.78)	(1.78)	(1.80)	(2.04)
R × Neg.disc.				-8.64**
				(3.84)
Controls	no	yes	yes	yes
Constant	43.31***	41.79***	40.29***	38.27***
	(2.30)	(2.76)	(3.70)	(3.88)
N	672	672	672	672
R^2	0.413	0.425	0.436	0.445

Note: Linear regression results. Dependent variable: Later allocation of money. The classification of types is based on the choices made in the Symmetric scenario. $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors in parentheses; errors are clustered at the individual level. Positive time preferences is the baseline category. Leisure is expressed in EU. Controls: response time, session fixed effects, sex, age (1 if > 30). This table shows the results of a replication exercise where the average Euclidean distance from the point of equal split is used as the classification criterion for positive and negative discounters. Results can be compared to tab. 7 in the main text.

Table A.7: Robustness check with Euclidean classification: Consistency of time preferences for leisure and money

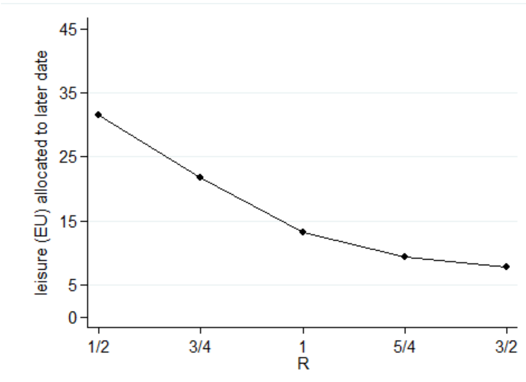
	Dependent variable:			
	Negative disc. for leisure		Positive disc. for leisure	
	(1)	(2)	(3)	(4)
Negative disc. for money	0.45***	0.37***	-0.22***	-0.17*
	(0.11)	(0.11)	(0.08)	(0.09)
Controls	no	yes	no	yes
Constant	0.37***	1.38***	0.28***	1.16**
	(0.06)	(0.48)	(0.06)	(0.45)
N	84	84	84	84
R^2	0.132	0.258	0.045	0.117

Note: Linear probability model. The classification of types is based on the choices made in the Symmetric scenario. Standard errors in parentheses. $^*p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$. Errors clustered at the individual level. Positive time preferences for money is the baseline category. Controls: response time, session fixed effects, sex, age (1 if > 30). This table shows the results of a replication exercise where the average Euclidean distance from the point of equal split is used as the classification criterion for positive and negative discounters. Results can be compared to table 8 in the main text.

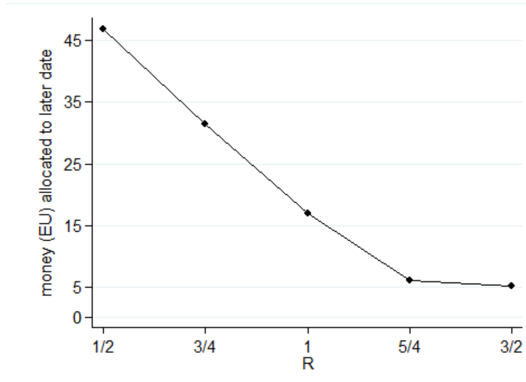
B Supplementary Figures

Figure B.1: Demand schedule, Anticipate scenario.

(a) Leisure



(b) Money

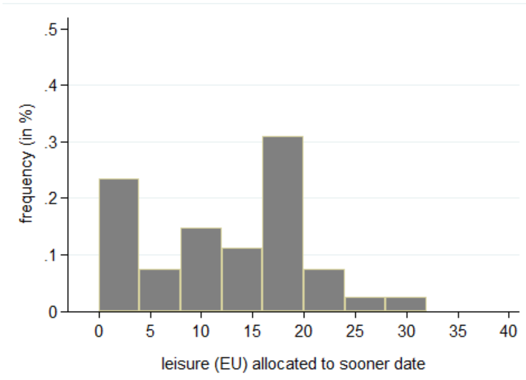


Notes: Average allocation to the later period in the Anticipate scenario as a function of the relative price R of the later allocation. The vertical axis is expressed in EU.

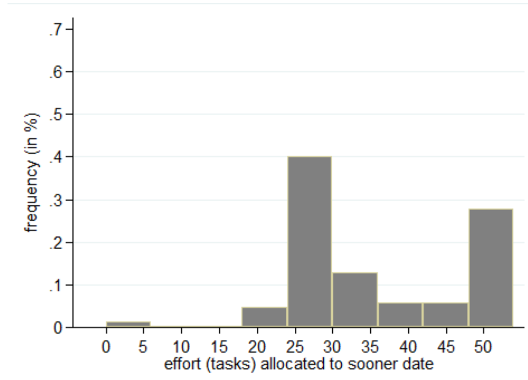
Figure B.2: Comparison with Augenblick et al. (2015). Allocation of leisure (a good) and effort (a bad), Asymmetric scenario

R = 3/4

(a) Bigoni et al.(2021)

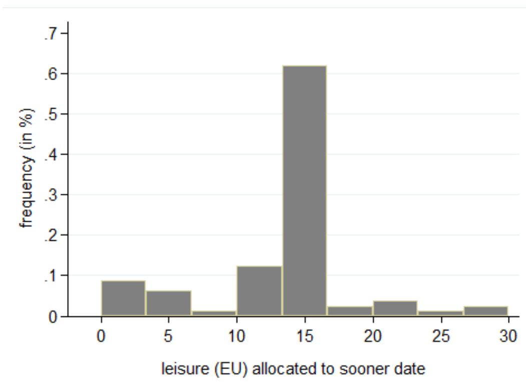


(b) Augenblick et al.(2015)

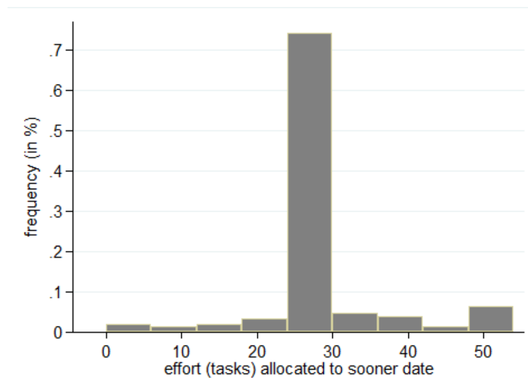


R = 1

(c) Bigoni et al.(2021)

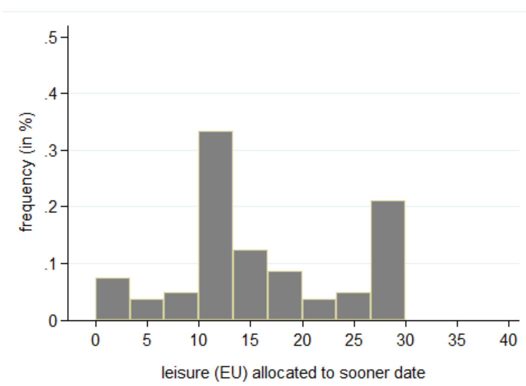


(d) Augenblick et al.(2015)

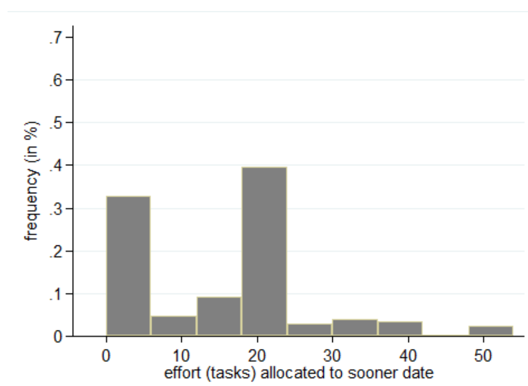


R = 3/2

(e) Bigoni et al.(2021)



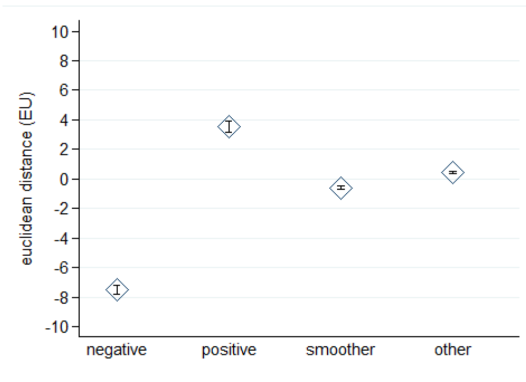
(f) Augenblick et al.(2015)



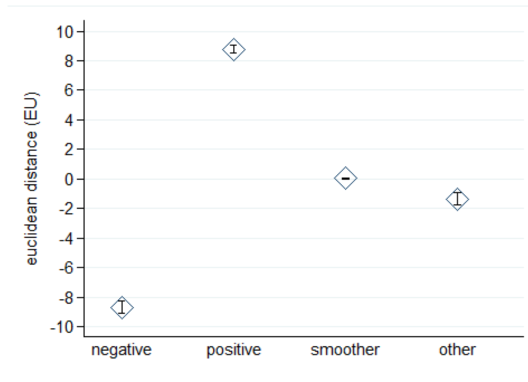
Notes: Leisure and effort observed in our experiment and in the experiment by Augenblick et al. (2015). The results are directly comparable because the two experiments use the same parametrization. They are symmetric because they leisure is a good and effort is a bad.

Figure B.3: Types and Euclidean distance

(a) Leisure



(b) Money

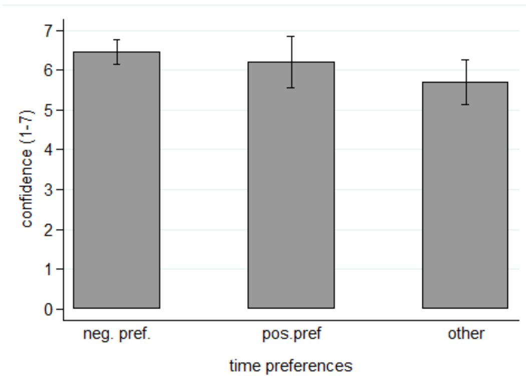


Notes: The figures show the average distance from the point of equal split (50-50) of all decisions, decomposed by time preferences. The vertical axis is expressed in EU. Distance is calculated as the Euclidean norm (d) for choices below the 45-degree line and as $-d$ for choices above the 45-degree. For instance, if someone consistently splits allocations 50-50, then her average distance from the point of equal split is zero EU. If someone randomizes allocations, then her expected average distance is again zero EU. Panel A shows that, on average, leisure allocations by negative discounters are about 8 EU above the 45-degree line, by positive discounters are about 4 EU below the 45-degree line, and by smoothers and other types are close to the point of equal split (50-50). The same holds for monetary allocations (Panel b). Overall, the Figure suggests that the time preferences types (that we labeled using frequencies) behave in the expected way when we test their performance using an alternative metric (the Euclidean norm). Vertical bars are 95% confidence intervals.

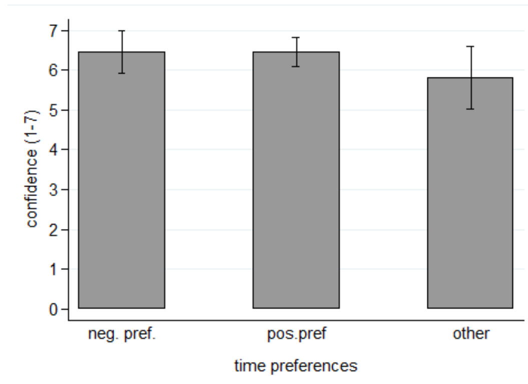
Figure B.4: Self-reported confidence in own decisions

Symmetric scenario, R = 1

(a) Leisure

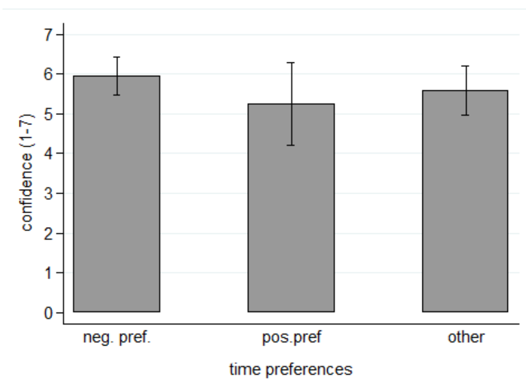


(b) Money

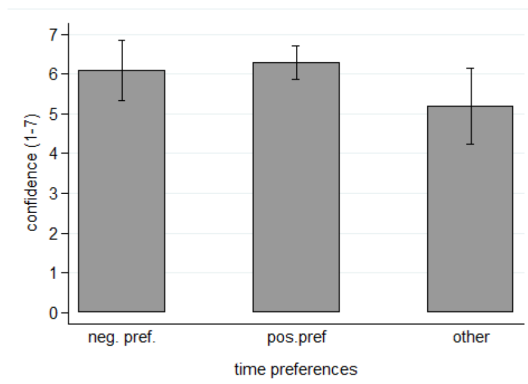


Symmetric scenario, R = 3

(c) Leisure



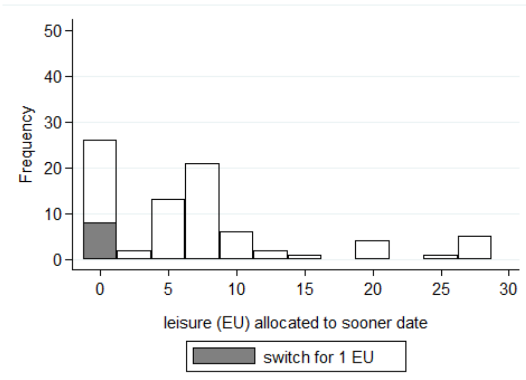
(d) Money



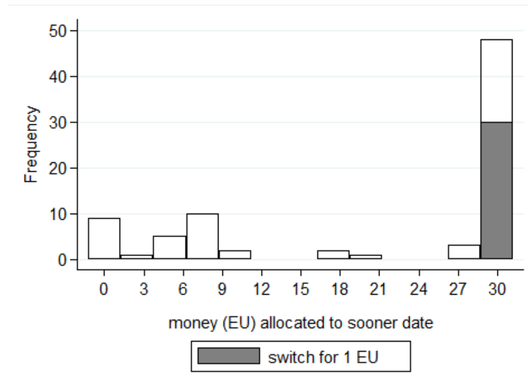
Notes: The histograms display the average confidence level regarding two decisions for leisure and two decisions for money (decomposed by time preference type). At the end of session 1, subjects were reminded their allocations in four instances and then asked the following question “Can you tell us how confident you are of your decision on a scale from 1 to 7? (where 1 represents "not at all sure" and 7 "completely sure")”. Subjects reported to be relatively confident with their decisions - between 5 and 6.5 on a 0-to-7 scale. Confidence levels are comparable across treatments (Panel a vs Panel b, Panel c vs Panel d) and irrespective of the linear or non-linear nature of the budget constraint (Panel a vs b, Panel b vs d). Confidence levels are also not statistically different across preference types - if anything, people not labeled as pos./neg. discounters tend to be the least confident. Vertical bars are 95% confidence intervals.

Figure B.5: Weak preferences

(a) Leisure



(b) Money



Notes: The histograms are based on two control decisions for leisure (panel a) and two for money (panel b) where we induce a small cost (1 EU) for one of the two corner solutions. In the first control decision, subjects allocate the resource in the Symmetric scenario ($R = 3$), except that the maximum amount they can allocate to the sooner session is constrained to be 29 EU, while they can allocate up to 30 EU to the later session (i.e. max($\mathcal{S}$)=29 ; max($\mathcal{L}$)=30). In the second control decision, the reverse holds: subjects can allocate up to 30 EU to the sooner session but only 29 to the later session (i.e. max($\mathcal{S}$)=30 ; max($\mathcal{L}$)=29). These decisions introduce an additional efficiency vs preferred period trade-off and they can offer an insight on the intensity of time preferences. In particular, they are useful to disentangle subjects who allocate all budget to the preferred period even if it implies a small cost (1 EU), from the ones who rather prefer to maximize the outcome and switch side when the cost is introduced. In the graph, the transparent bars show the distribution of allocations when max($\mathcal{L}$)=30 (leisure) and max($\mathcal{S}$)= 30 (money). The gray bars highlight subjects who then switch corner solution when the 1-EU cost is introduced. The graph shows that subjects are more prone to prioritize efficiency when it comes to money, rather than leisure. This is consistent with the idea that time preferences for leisure are more convex, although we cannot precisely identify the mechanism (e.g. the idiosyncratic conversion rate leisure-money can be an important confounder).

C Assigning types based on allocations in the Symmetric scenario

Strategy 1

We proceed step-by-step and we label money-types and leisure-types separately, according to their decisions in the Symmetric scenario. We distinguish between no cost of smoothing (R = 1), low cost of smoothing (1 < R < 3) and high cost of smoothing (R = 3).

The first step aims at labeling types according to their choices in the simplest decision environment, where the symmetric constraint is linear and there is no smoothing cost ($R = 1$). Remember that subjects take three decisions in this same environment. We qualify a subject as being a *positive discounter*, whether her three decisions lie below the 45-degree line. In other words, given a budget M and a unitary price ($R = 1$), we label as a positive discounter someone who consistently allocates more than half of the budget to the sooner period. Similarly, we label as a *negative discounter* someone who consistently chooses her optimal allocation above the 45-degree line, i.e. she allocates more than half of the budget to the later period when $R = 1$. In this first step, 21 decision-makers are qualified as particular leisure-types and 38 as particular money-types. If a subject does not make all three decisions consistently above/below the 45-degree line, we move on to the second step.

The second group of decisions consist of environments where smoothing is relatively costly (three decisions, $1 < R < 3$). As in the previous step, an individual is labeled for a particular type if all her decisions qualify consistently her preferences. 23 decision-makers consistently chose the optimal leisure allocations above/below the 45-degree line and so do 20 decision-makers with money. Subjects who have not been labeled so far, have their preferences scrutinized in the third and last step.

The third group of decisions consistent of the two environments where smoothing is very costly and 50-50 is not the default option (two decisions). In this step, we label 11 (resp. 10) individuals as positive or negative discounters for leisure (resp. money). Among the remaining subjects, we distinguish between those who chose a 50-50 allocation in both decisions (despite not being the default option in this environment) and people who do not. We qualify the former group as *smoother* and the latter as *others*.

STEP 1 Check allocations in the Symmetric scenario when there is no smoothing cost (3 decisions). If $\mathcal{S} > \mathcal{L}$ or $\mathcal{L} > \mathcal{S}$ in all decisions, label as positive/negative discounters, if not, proceed to step 2.

STEP 2 Check allocations in the Symmetric scenario when there is low smoothing cost (3 decisions). If $\mathcal{S} > \mathcal{L}$ or $\mathcal{L} > \mathcal{S}$ in all decisions, label as positive/negative discounters, if not, proceed to step 3.

STEP 3 Check allocations in the Symmetric scenario when there is high smoothing cost (2 decisions). If $\mathcal{S} > \mathcal{L}$ or $\mathcal{L} > \mathcal{S}$ in all decisions, label as positive/negative discounters, if not, distinguish between smoothers (if $\mathcal{S} = \mathcal{L}$) and other types (no detectable pattern).

Strategy 2 (robustness check)

As a robustness check, we use the average distance from the equal split option as the criterion to classify time preference types. We identify money-types and leisure-types separately, according to their decisions in the Symmetric scenario. For each decision n by subject i, we calculate the distance $d_{in}(\mathcal{S}, \mathcal{L})$ from the point of equal split within the feasible set of the budget constraint (i.e. where $\mathcal{S} = \mathcal{L}$). Distance is calculated as the Euclidean norm (d) for choices below the 45-degree line and as $-d$ for choices above the 45-degree.

We create a vector of distances and calculate the average distance $\bar{d}_i$ for each individual separately. Therefore, if someone consistently splits allocations 50-50, then the average distance $\bar{d}_i$ of her decisions is zero EU. Instead the average distance is maximum for someone who consistently allocates all her resource to the same session. Finally, we classify types according to the average distance $\bar{d}_i$: "positive discounters" if $\bar{d}_i > 0.5$ EU, "negative discounters" if $\bar{d}_i < 0.5$ EU, "smoothers and others" otherwise (0.5 EU is an arbitrarily small margin of error).

D Experimental instructions

SESSION 1

Instruction sheet (1)

Welcome! Thank you for participating in our experiment. We will begin shortly.

Eligibility for this study:

To be in this study, you need to meet these criteria:

You must participate to all the three scheduled sessions. Participation will require your presence at the LEEM (Laboratoire d'Economie Expérimentale de Montpellier) on ***DATE*** and ***DATE***, for about 90 minutes each session.

At the end of each session you will be refund of the transportation fees according to the following rule: 2€ if you study in a department at Richter, 6€ otherwise. In addition to this refund, you will receive a 25€ completion payment to thank you for your participation to all three sessions. The completion payment will take place at the end of the Session 3 (***DATE***). You must be willing to not expect other participation fees in Session 1 (today) and Session 2 (***DATE***). You will earn additional money during sessions 2 and 3. The amount will depend on your answers during the study.

Thus, the payment configuration is as follows :
Session 1: transportation refunding
Session 2: transportation refunding + money according to your choices
Session 3: transportation refunding + money according to your choices + 25€ completion fee.

If you do not meet these criteria or accept these conditions, please inform us of this now.

Anonymity
Your anonymity in this study is assured. Your name will never be connected to any decision you make here today. However, we will give an identifier, in order to correctly match your decisions across different sessions. This 10-digit identifier is made of the 6 digits from your date of birth (DDMMYY format) and the last 4 digits of your phone number.

Example:
A person with the characteristics below: date of birth: 01/04/1998 phone number: 06.23.39.17.4 has the following identifier : 0104981745.

Identifier:......................................

Rules

Please turn your cell phones off. If you have a question at any point, just raise your hand. Please put away any books, papers, computers, etc.

Your Earnings

You will be given a thank-you payment, just for participating in this study! If you complete all three sessions of participation, a completion payment of 25€ will be provided. You will receive additional earnings during the experiment. All payments are made in cash. If you choose to end your participation before the third session is complete, please report this to the study administrators by using the following email address: leem-contact@umontpellier.fr.

Activities

In this study there are three types of activities: questionnaires, waiting and allocations.

In sessions 2 and 3 you will be required to complete some questionnaires. Along the way we will discuss how these questionnaires work.

After the questionnaires are completed, waiting time start and you will be asked to wait in the laboratory. During waiting time you are not allowed to do anything except sitting quietly at your seat. You cannot read, write, access the Internet or use any electronic device. Waiting time cannot exceed 60 minutes per session.

Sessions 2 and 3 may last up to 90 minutes each. However, you may be able to shorten your waiting time and leave the laboratory sooner, depending on your choices and chance. We denote by free time the amount of minutes subtracted from your waiting time.

Example:

If in session 2 you have 5 minutes of free time, you are allowed to wait 5 minutes less and therefore leave the session 5 minutes before its end.

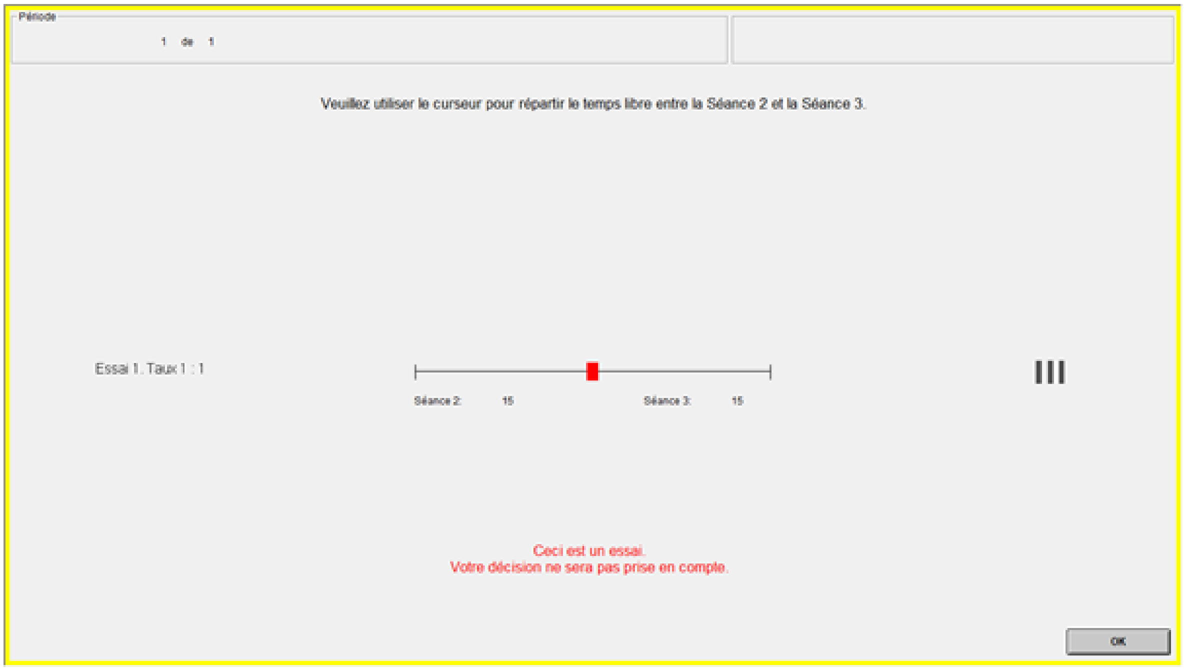
Today, you will be required to make some allocations. Today's activity is described in detail below.

Today (session 1):

You will be asked to make a series of 19 decisions for how sooner you would like to leave the laboratory in session 2 and 3. In these decisions you are asked to allocate free time between three weeks from today (Session 2) and six weeks from today (Session 3).

In each decision you can allocate free time as you choose. You will choose by moving a slider to your desired allocation. Below is an illustration of the layout which will be displayed on your screen.

Figure D.1: Example



According to the position of the slider, the computer displays the amount of free time allocated to each session. Free time is expressed in minutes. By moving the slider to the left you can increase free time allocated to Session 2. By moving the slider to the right you can increases free time allocated to Session 3. You are free to move the slider and see how the allocation changes, until you choose your favorite allocation.

In this example, the person decides to allocate 25 minutes of free time to Session 2 and 5 minutes of free time to Session 3. It means he/she will be free to leave the laboratory 25 minutes earlier in Session 2 and 5 minutes earlier in Session 3.

We will now practice on the computer.

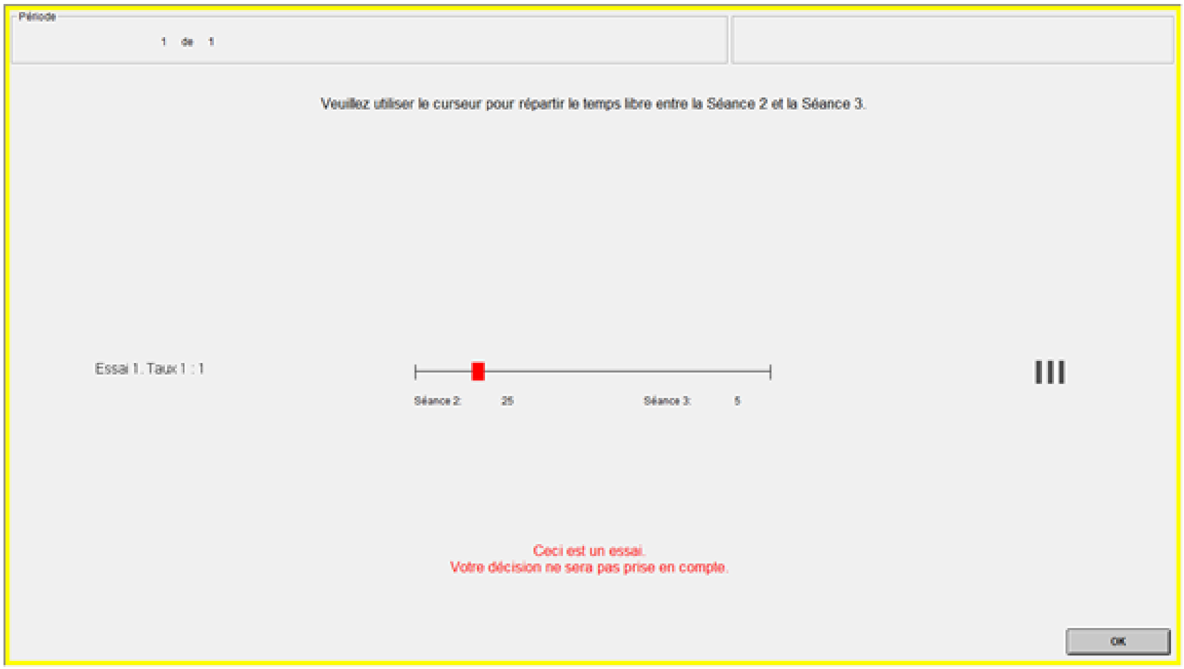
Rates:

In the example decision above every free time you allocate to Session 2 reduces the amount of free time allocated to Session 3 by one. This is what we will refer to as a 1:1 rate. The symbol ||| on the right of the slider denotes the 1:1 rate. The rate will vary across your decisions.

You may face four different kinds of trade-off between the sooner free time and the later free time, which are represented respectively as 1:X, X:1, $1_x : 1_x$ and $1^x : 1^x$.

- The 1:X rate means that every minute of free time you allocate to Session 2 reduces the free time you can allocate to Session 3 by X minutes. Conversely, when you allocate X minutes to Session 3, you reduce the free time you can allocate to Session 2 by 1 minute. The case is denoted by the symbol ||| .

Figure D.2: Example



- The X:1 rate means that every minute of free time you allocate to Session 3 reduces the free time you can allocate to Session 2 by X minutes. Conversely, when you allocate X minutes to Session 2, you reduce the free time you can allocate to Session 3 by 1 minute. The case is denoted by the symbol |||.
- The $1_x : 1_x$ rate indicates that the total free time increases when you make a more equal distribution between sessions 2 and 3. The number X is always greater than 1, so the larger X, the faster the total free time increases. The total free time is multiplied up to X times when half of the free time is allocated to session 2 and the other half to session 3. The symbol ||| . indicates that the $1_x : 1_x$ rate is applied.
- The $1^x : 1^x$ rate indicates that the total free time decreases when you make a more equal distribution between sessions 2 and 3. The number X is always less than 1, so the smaller X is, the faster the total free time decreases. The total free time is multiplied up to X times when half of the free time is allocated to session 2 and the other half to session 3. The symbol ||| . indicates that the $1_x : 1_x$ rate is applied.

Examples:

- If the rate is 1:1.5, then every free minute you allocate to Session 2 reduces the number of free minutes allocated to Session 3 by 1.5.

- If the rate is 1.5:1, then every free minute you allocate to Session 3 reduces the number of free minutes allocated to Session 2 by 1.5.

- If the rate is $1_{1.3} : 1_{1.3}$, then every free minute you do not allocate to the same session increases the number of total free minutes, by up to 30%.

- If the rate is $1^{0.7} : 1^{0.7}$, then every free minute you do not allocate to the same session reduces the number of total free minutes, by up to 30%.

As in the previous example, you will choose by moving a slider to your desired allocation. The computer automatically computes how the rates apply and let you move the slider until you choose your favorite allocation. We will now practice on the computer. You should use the slider to understand how the rates work and how you will take your decisions.

Multiple decisions

On each screen, you will be asked to make several allocations for free time at different rates. Each row is a decision and is numbered from 1 to 19. Each row will feature a series of options. The computer automatically computes how the rates apply and let you move the slider until you choose your favorite allocation.

You must take your decisions row by row, in the order they are shown on the display, from the top to the bottom. At each row, you are free to move the slider until you choose your favorite allocation. Once you are satisfied with your decision, you can move on to the following row. As soon as you click on the slider of the following row, the previous decision will be saved and you will not be able to change it anymore.

As in the previous examples, all you have to do for each decision is to choose which combination of sooner and later free time you prefer the most by moving the slider to that location. Now you can practice with the different allocations using the computer.

IMPORTANT: in this task you will be allocating free time. The higher the amount of free time allocated to a session is, the earlier you will be free to leave the session.

IMPORTANT: There is no good answer or bad answer. You should choose your favorite allocation.

You can now practice on the computer.

Implementation

Exactly one of your 19 total allocation decisions will be randomly selected and implemented. That is, we will implement one decision from Session 1 which will determine your free time in Sessions 2 and 3. Remember that this free time will be subtracted from your waiting time and thus shorten the length of your session. Please, note that each decision has equal probability to be selected and implemented.

Session 2, three weeks from today, will occur at the same time and in the same place as the current session.

Session 3, six weeks from today, will occur at the same time and in the same place as the current session.

REMEMBER: EACH DECISION COULD BE SELECTED AND IMPLEMENTED SO

TREAT EACH DECISION AS IF IT WAS THE ONE DETERMINING YOUR FREE TIME.

Recap:

- You will be participating in a 3-session study. Next sessions will be on ***DATE*** and ***DATE***, at the same time and same place, and will last about 90 minutes each.
- In Session 1, today, you will be asked to make a series of allocation decisions for how earlier you will leave the laboratory in Session 2 and Session 3. You will allocate free time to Sessions 2 and 3 at various rates.
- One of your allocation decisions will be chosen at random and will determine the length of Session 2 and 3.
- In Session 2, you will complete some questionnaires and wait in the laboratory the required amount of time less the free time.
- Session 3 mirrors Session 2.
- You will receive a completion payment of 25€, by cash, at the end of Session 3.

If you have a question, just raise your hand. Otherwise, please fill up the quiz in the next page.

Instruction sheet (2)

Consent
Now that we have explained the study, you are free to leave if you would like to choose not to participate in the study.

Allocations
Now you will complete the allocation decisions. In the sliders on the screen, you will be asked to make several allocations for free time at different rates. Overall, you will see 4 screens and make 19 decisions.

Remember each decision could be randomly selected and implemented, so please make each decision as if it were the one that determines your free time.

Instruction sheet (3)

Thank you for completing your allocations. On the following screens we would like to ask you several additional questions allocating money over time. Your decisions in this portion of the study are completely unrelated to your allocations about free time and to the participation fee. Your gains in this portion of the study sum up with your refunding for transportation and with your 25€ completion fee.

Earning Money
In this portion of the study, you will take 19 decisions over how to allocate bonus money between three weeks from today (Session 2) and six weeks from today (Session 3). In each decision, you will allocate money between two of these dates. The payment will take place in cash at the end of the corresponding session.

The decision environment is the same as the one you used to make your previous allocation decisions, but now you are free to allocate money. You will choose by moving a slider to your desired allocation. As before, according to different rates there are different trade-off between the sooner payment and the later payment. All you have to do for each decision is choose which combination of sooner and later payment you prefer the most by moving the slider to that location. Money is expressed in euros. Please, take your decisions row by row, in the order they are shown on the display, from the top to the bottom.

Once all 19 decisions have been made, we will randomly select one of the 19 decisions and implement it. That is, we will use it to determine your actual earnings and the timing of your earnings. Note, since all decisions are equally likely to be chosen, you should make each decision as if it was the one determining your earnings.

IMPORTANT: All payments you receive will be paid in cash in the LEEM. On the scheduled day of payment, you will receive your payment at the end of the session.

IMPORTANT: There is no good answer or bad answer. You should choose your favorite allocation.

Remember that each decision could be the one which is randomly selected! It is in your interest to treat each decision as if it could be the one that determines your payment.

Allocations
Now you will complete the allocation decisions. In the sliders on the screen, you will be asked to allocate bonus money at different rates. Overall, you will see 4 screens and make 19 decisions.

After these 19 decisions, you will be asked to answer a questionnaire.

Computerized Instructions

(instruction sheet (1))

Thank you for your participation in this experiment. Please provide your ID:

NEXT SCREEN

Please copy it on the instruction sheet.

NEXT SCREEN

Please read the instruction sheet given to you carefully. It will also be read aloud by the instructor. If you have any questions, don't hesitate to raise your hand.

(trial 1)

Please return to the instruction sheet.

(trials 2-9)

Please complete the quiz to make sure that you understand the allocation decisions and the timeline of the study.

(short quiz, instruction sheet (2) and leisure decisions)

Please read the instruction sheet carefully. It will also be read aloud by the instructor. If you have any questions, don't hesitate to raise your hand.

(instruction sheet (3) and money decisions)

Now we'd like to ask you a few questions about the decisions you've made about the allocation of free time.

IMPORTANT: Your answers in this phase of the study will not influence the decision that will be selected and implemented. The decision will be selected at random.

NEXT SCREEN

In Decision 3, the rate for allocating free time was 1:1. You chose the following allocation:
Number of minutes of free time for Session 2:
Number of minutes of free time for Session 3:

Can you tell us how confident you are of your decision on a scale from 1 to 7? (where 1 represents "not at all sure" and 7 "completely sure")

Can you give us the reasons why you chose this allocation in Decision 3?

NEXT SCREEN

At decision 16, the rate for allocating free time was 1^0.5: 1^0.5. You chose the following allocation:
Number of minutes of free time for Session 2:
Number of minutes of free time for Session 3:

Can you tell us how confident you are of your decision on a scale from 1 to 7? (where 1 represents "not at all sure" and 7 "completely sure")

Can you give us the reasons why you chose this allocation in Decision 16?

NEXT SCREEN

Now we'd like to ask you a few questions about the decisions you've made regarding the allocation of bonus money.

IMPORTANT: Your answers in this phase of the study will not influence the decision that will be selected and implemented. The decision will be selected at random.

NEXT SCREEN

In Decision 3, the rate for distributing bonus money was 1:1. You chose the following allocation:
Amount (in euros) of bonus money for session 2:
Amount (in euros) of bonus money for session 3:
Can you tell us how confident you are of your decision on a scale from 1 to 7? (where 1 represents "not at all sure" and 7 "completely sure")

Can you give us the reasons why you chose this allocation in Decision 3?

NEXT SCREEN

At the time of decision 16, the rate for distributing bonus money was $1^{0}.5$: $1^{0}.5$. You chose the following allocation:
Amount (in euros) of bonus money for session 2:
Amount (in euros) of bonus money for session 3:

Can you tell us how confident you are of your decision on a scale from 1 to 7? (where 1 represents "not at all sure" and 7 "completely sure")

Can you give us the reasons why you chose this allocation in Decision 16?

NEXT SCREEN

Please find below the decision that was randomly selected for the allocation of your free time between Session 2 and Session 3.

Selected decision:
Number of minutes of free time for Session 2:
Number of minutes of free time for Session 3:

NEXT SCREEN Please find below the decision that was randomly selected for the allocation of your bonus money between Session 2 and Session 3.

Selected decision:
Amount (in euros) of bonus money for session 2:
Amount (in euros) of bonus money for session 3:

NEXT SCREEN

Today's session is almost over. Before you leave we would like you to fill out a final questionnaire about you. Remember that your answers to these questions are anonymous.

(socio-demographic survey)

NEXT SCREEN

Thank you for your participation in today's session. The instructor will now stop by so that you can then leave your desk. Please leave the instructions on the desk. We'll meet again in 3 weeks.

SESSION 2

Instruction sheet

Welcome! Thank you for returning to the experiment. We will begin shortly.

Eligibility for this study
To be in this study, you need to meet these criteria:

Your presence is required to all the three scheduled sessions. It means that you must have participated to the session which took place at the LEEM on ***DATE*** and that you are willing to participate to the next session, on ***DATE***.

If you do not meet these criteria, please inform us of this now.

Anonymity
Your anonymity in this study is assured. Your name will never be connected to any decision you make here today. However, in session 1 you were given an identifier, in order to correctly match your decisions across

different sessions. This 10-digit identifier was made of the 6 digits from your date of birth (DDMMYY format) and the last 4 digits of your phone number.

Example:
A person with the characteristics below: date of birth: 01/04/1998 phone number: 06.23.39.17.4 has the following identifier : 0104981745.

Now please take a moment to write down your identifier on the computer. Then copy the identifier below.

Identifier:. . . . .

Rules

Please turn your cell phones off. If you have a question at any point, just raise your hand. Please put away any books, papers, computers, etc.

Your Earnings

You will be given a thank-you payment, just for participating in this study! If you complete all three sessions of participation, a completion payment of 25€ will be provided. You may receive additional earnings during the experiment. All payments are made in cash. If you choose to end your participation before the third session is complete, please report this to study administrators by using the following email address: leem-contact@umontpellier.fr.

Your previous decisions

Remember that in Session 1 you took 19 allocation decisions about free time. Remember that free time determines how sooner you can leave the laboratory in a session. One of your decisions was randomly selected. You have been informed of which decision was selected. Today's session length depends on the one among your free-time decisions in Session 1 which was randomly selected.

Remember that in Session 1 you also took 19 allocation decisions about bonus money. One of your decisions was randomly selected. You have been informed of which decision was selected. At the end of today's session you will receive a payment determined by the one among your monetary decisions in Session 1 which was randomly selected. You may receive additional earnings during today's session.

Today (Session 2)

Today you will be required to complete two types of activities: questionnaires and waiting. Some questionnaires may provide you with additional earnings, according to your answers. If this is the case, the payment rule will be clearly stated each time.

Today's session is timed, so please be careful you answer the questions within the allowed time, which is displayed on the top right of your screen.

To move on to the next screen click on the button “page suivante”. Once you have moved to the next screen, your answers in the previous screen are saved and you are not allowed to change them anymore.

After the questionnaires are completed, waiting time will start and you will be asked to wait in the laboratory. During waiting time you are not allowed to do anything except sitting quietly at your seat. You cannot read, write, access the Internet or use any electronic device. If you do not comply with these rules, a 10-minute penalty will be imposed per violation. Waiting time cannot exceed 60 minutes (except for penalties).

When waiting time has ended, a few last questions will appear on your screen. After you have answered those last questions, your session will be ended.

Session 3 (*DATE***):**
Session 3, three weeks from today, will occur at the same time and in the same place as the current session.

IMPORTANT: Today's session is timed, so please be careful you answer the questions before the timer on your screen gets to zero.

If you have any question, please rise your hand. The first questionnaire will appear on your screen in a few moments.

Computerized Instructions

(instruction sheet)

Hello! Thank you for participating in the second session of this experiment. Please provide your ID:

NEXT SCREEN

Please read carefully the instructions that have been given to you. They will also be read aloud by the instructor.
If you have any questions, don't hesitate to raise your hand.

(cognitive tests, consumer survey, psychometric survey)

NEXT SCREEN

Now the waiting time will begin.
During the waiting time, you can do nothing but wait patiently at your seat. You will not be able to read,

write, access the internet or use any electronic device.
If you do not comply with these rules, you will have a 10-minute penalty for each offence.

NEXT SCREEN

For today's session, your waiting time is calculated as follows: 40 minutes - free time
We remind you that the free time you allocated for today's session is (in minutes):
So your waiting time for this session will be (in minutes):

NEXT SCREEN

A stopwatch on your screen will indicate how long you'll have to wait. When the waiting time is over, a few final questions will appear on the screen. Once you have answered these last questions, the session will be over. The experimenter will join you and make the payment for today's session.

IMPORTANT: During the waiting time, there you can do nothing. You have to wait patiently at your seat.

(stopwatch)

Bonus money allocated to this session:
Money earned during this session:
Your total gain at the end of this session:

NEXT SCREEN

Thank you for your participation in today's session.
The experimenter will join you soon and accompany you so that you receive your earnings before leaving the laboratory.
We'll meet again in three weeks.

SESSION 3

Instruction sheet

Welcome! Thank you for returning to the experiment. We will begin shortly.

Eligibility for this study
To be in this study, you need to meet these criteria:

Your presence is required to all the three scheduled sessions. It means that you must have participated to the session which took place at the LEEM three weeks ago and six weeks ago.

If you do not meet this criterion, please inform us of this now.

Anonymity

Your anonymity in this study is assured. Your name will never be connected to any decision you make here today. However, in session 1 you were given an identifier, in order to correctly match your decisions across different sessions. This 10-digit identifier was made of the 6 digits from your date of birth (DDMMYY format) and the last 4 digits of your phone number.

Example: A person with the characteristics below: date of birth: 01/04/1998 phone number: 06.23.39.17.4 has the following identifier : 0104981745.

Now please take a moment to write down your identifier on the computer. Then copy the identifier below.

Identifier:......................................

IMPORTANT: if the computer displays an error message, please do not press any button and raise your hand to call the experimenter.

Rules

Please turn your cell phones off. If you have a question at any point, just raise your hand. Please put away any books, papers, computers, etc.

Your Earnings

Today, you will receive your 25€ completion payment, to thank you for your participation. You may receive additional earnings during today's session, according to your answers. All payments are made in cash and privately.

Your previous decisions

Remember that in Session 1 you took 19 allocation decisions about free time. Remember that free time determines how sooner you can leave the laboratory in a session. One of your decisions was randomly selected. You have been informed of which decision was selected. Today's session length depends on the one among your free-time decisions in Session 1 which was randomly selected.

Remember that in Session 1 you also took 19 allocation decisions about bonus money. One of your decisions was randomly selected. You have been informed of which decision was selected. At the end of today's session you will receive a payment determined by the one among your monetary decisions in Session 1 which was randomly selected. You may receive additional earnings during today's session.

Today (Session 3)

Today's session is organized in four parts. In part 1, you will fill up some questionnaires. In part 2 you will watch some video clips. In part 3, you will be asked to answer again some questionnaires. In part 4, you will wait. Parts are independent from each other, so that your answers in a questionnaire do not affect the following parts of the experiment.

Some questionnaires may provide you with additional earnings, according to your answers. If this is the case, the payment rule will be clearly stated each time.

To move on to the next screen click on the button "next page". Once you have moved to the next screen, your answers in the previous screen are saved and you are not allowed to change them anymore.

After the questionnaires are completed, waiting time will start and you will be asked to wait in the laboratory. During waiting time you are not allowed to do anything except sitting quietly at your seat. You cannot read, write, access the Internet or use any electronic device. If you do not comply with these rules, a 10-minute penalty will be imposed per violation. Waiting time cannot exceed 60 minutes (except for penalties).

When waiting time has ended, you will be informed of today's earning and your session will be ended.

If you have any question, please raise your hand. The description of the first activity will appear on your screen in a few moments.

Computerized Instructions

(instruction sheet)

Hello! Thank you for participating in the last session of this experiment.

Please provide your ID:

NEXT SCREEN

Please read carefully the instructions that have been given to you.

They will also be read aloud by the instructor. If you have any questions, don't hesitate to raise your hand.

(time preference survey, mood task, mood survey)

NEXT SCREEN

The waiting time will soon begin.

During the waiting time, you can do nothing but wait patiently at your seat. You will not be able to read, write, access the internet or use any electronic device.

If you do not comply with these rules, you will have a 10-minute penalty for each offence.

NEXT SCREEN

For today's session, your waiting time is calculated as follows: 60 minutes - free time

We remind you that the free time you allocated for today's session is (in minutes):

So your waiting time for this session will be (in minutes):

NEXT SCREEN

A stopwatch on your screen will indicate how long you'll have to wait. When the waiting time is over, you will be informed of your earnings today and the session will be over. The experimenter will join you and make the payment for today's session.

IMPORTANT: During the waiting time, you can do nothing. You have to wait patiently at your seat.

(stopwatch)

Bonus money allocated to this session:

Money earned during this session:

Your total gain at the end of this session:

NEXT SCREEN

Thank you for your participation in this experiment.

The instructor will join you soon and accompany you so that you receive your earnings before leaving the lab.