Supplementary Materials to:

Risk and time preferences interaction: An experimental measurement

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Appendix A: Stimuli and procedure

The stimuli and the instructions were in French. The english translation is provided below the stimuli.

Stimuli section I

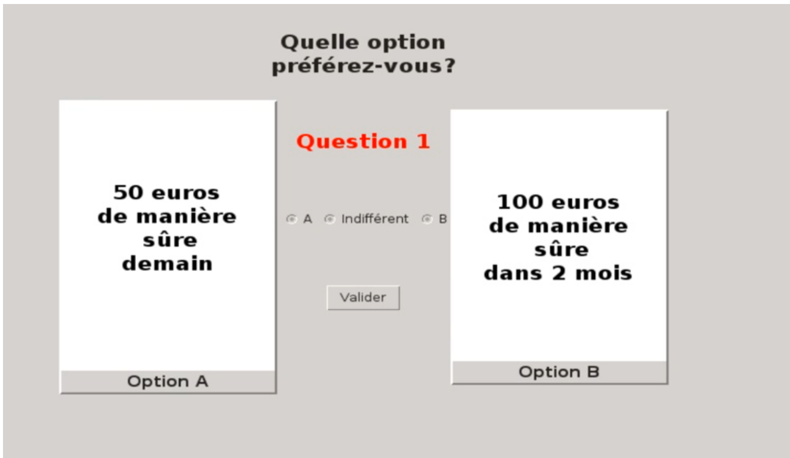


Figure 4: Eliciting certainty equivalent of future sure outcome (Option B) by varying the sooner sure outcome (Option A)

English translation: Which option do you prefer? 50 euros for sure tomorrow (Option A) or 100 euros for sure in 2 months (Option B).

Stimuli section II

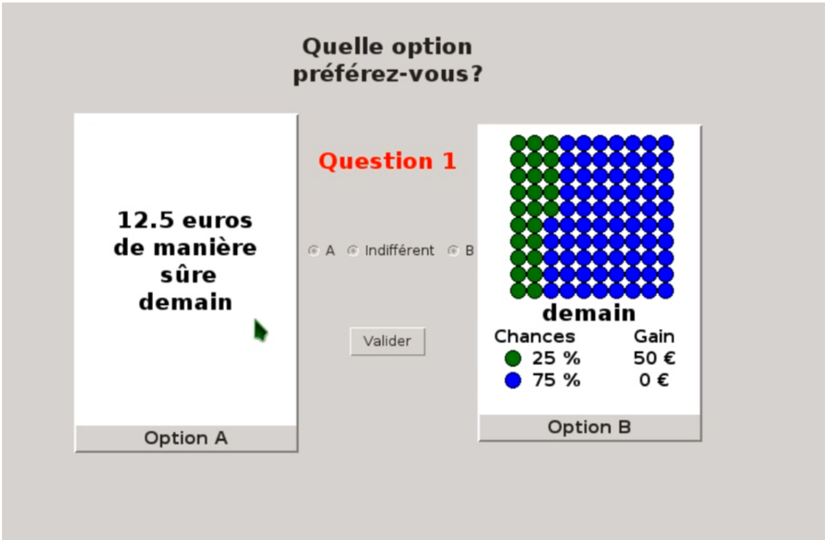


Figure 5: Eliciting certainty equivalent of the risky prospect paid tomorrow (Option B) by varying the sure outcome paid tomorrow (Option A)

English translation: Which option do you prefer? 12.5 euros for sure tomorrow (Option A) or 25% chance to win 50 euros tomorrow (Option B)

Stimuli section III

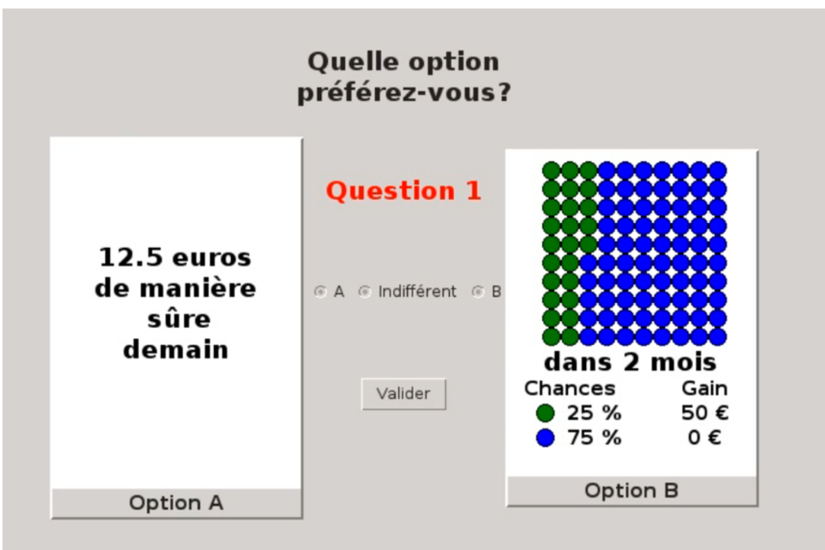


Figure 6: Eliciting certainty equivalent of the risky prospect paid in the future (Option B) by varying the sure outcome paid tomorrow (Option A)

English translation: Which option do you prefer? 12.5 euros for sure tomorrow (Option A) or 25% chance to win 50 euros in 2 months (Option B)

Bisection method

The purpose of the bisection method is to help the subject find his certainty equivalent for a particular prospect. To illustrate bisection method, we consider a typical choice in section I of the experiment. The subjects were typically presented a choice between a sure payment tomorrow and a sure payment in the future. If the subject chose the sure payment tomorrow (resp., future payment), the sure payment tomorrow was decreased (resp., increased) and the subject was asked to make choice again. The subjects made choices until they expressed indifference or when the number of questions in a bisection exceeded 4. Table 12 discusses an example.

#	**Questions**	**Choice of the subject**
1	€100 in 2 months vs €50 tomorrow	100 in 2 months
2	€100 in 2 months vs €75 tomorrow	75
3	€100 in 2 months vs €62.5 tomorrow	62.5
4	€100 in 2 months vs €56.25 tomorrow	56.25

Table 12: Illustration of the bisection method

The certainty equivalent for €100 in 2 months for the choices above is estimated to be 53.125 (the indifference value is between 50 and 56.25). In case the subject expressed indifference for any of the questions in the bisection method, the indifference value was taken as the certainty equivalent.

Choice list

After the subject's certainty equivalents were elicited using the bisection method, a pre-filled choice list was presented to the subject to confirm his choices. Basically Option B is the prospect whose certainty equivalent we are eliciting. Option A is the range of sure amounts paid tomorrow. The choices and indifference point was prefilled based on the subject's answers to the bisection questions. The subjects were allowed to modify their choices in the choice list. The subject's answers to the choice list was used to calculate the final certainty equivalents for the incentive payment and analysis. A typical choice list presented to the subjects is shown in Figure 7.

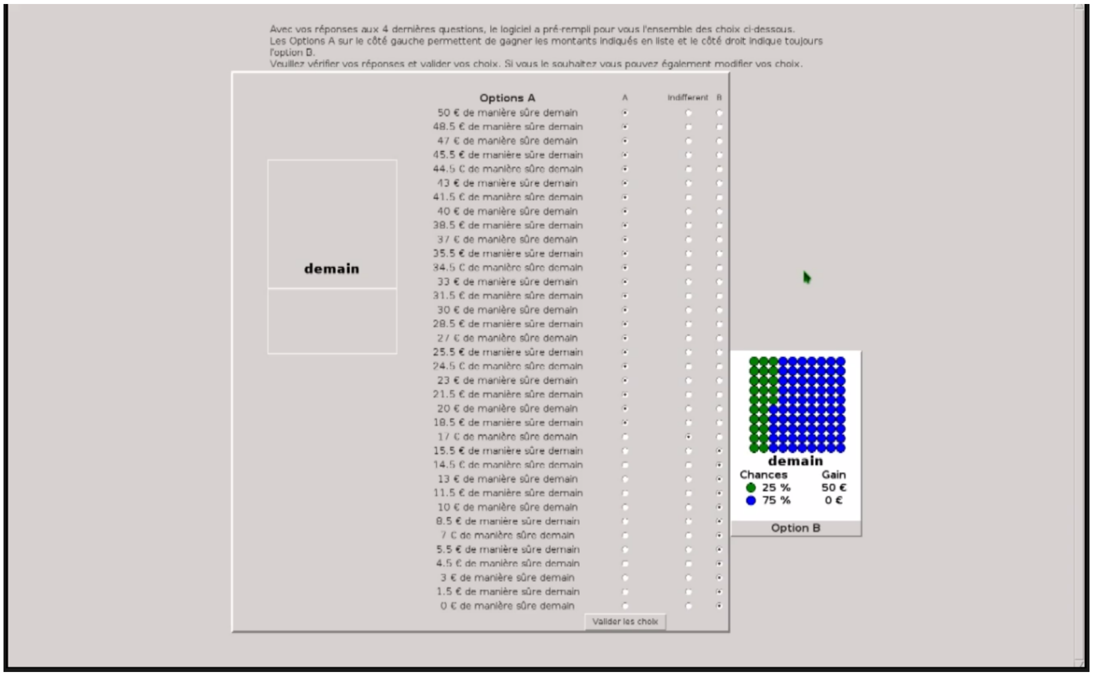


Figure 7: Typical pre-filled choice list presented to the subject

English translation: With your answers to the last 4 questions the software has pre-filled the set of choices below for you. The options A on the left side allow you to earn the sure amounts indicated in the list and the right side always indicates the risky option. Please check your responses and validate your choices. If you wish you can also modify your choices.

Appendix B: Risk attitudes of the subjects

The risk attitudes of the subjects were analyzed by comparing their certainty equivalents for prospects $5, \ldots, 14$ with the expected value of the prospects. In Table 13, we can observe that the subjects are majorly risk averse for seven out of ten prospects.

Prospect	# subjects	
i	Risk averse	Risk seeking
5	31**	16
6	33**	14
7	19	27
8	14	32**
9	18	28
10	20	15
11	42**	4
12	43**	4
13	42**	5
14	43**	4

Table 13: Risk attitude of the subjects
Note: Proportions are significantly higher: *- significant at $\alpha = 0.1$, * *- significant at $\alpha = 0.05$,

Appendix C

Estimating the models using maximum likelihood

For each subject we elicited the certainty equivalents for the 44 prospects. We represent the certainty equivalent of subject i for prospect j using CE_j^i . We assume a statistical model as follows:

$$CE_j^i = f(\theta_i) + \epsilon_{ij},$$

where f corresponds to particular decision model under consideration, and θ_i corresponds to the vector of parameters of that decision model for a particular subject i and ϵ_{ij} is the independently and normally distributed random variable with mean $E(CE_j^i) = f(\theta_i)$ and $Var(CE_j^i) = \sigma^2$. The probability distribution function for the normal distribution is given by $p(x|\mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/2\sigma^2}$. The likelihood function given the sample outcome CE_j^i is

$$L(\theta_i|CE_i^j) = \prod_{j=1}^{44} p(CE_j^i|f(\theta_i), \sigma^2)$$

$$= \frac{1}{(\sqrt{2\pi\sigma^2})^{44}} e^{-\left(\frac{\sum_{j=1}^{44}(CE_i^j - f(\theta_i))^2}{2\sigma^2}\right)}$$

Taking the natural logarithm of the above equation and simplifying we get

$$ln(L(\theta_i|CE_i^j)) = -\frac{N}{2}ln(2\pi) - N\ ln(\sigma)\text{-}\frac{\sum_{j=1}^{44}(CE_i^j - f(\theta_i))^2}{2\sigma^2}$$

To calculate the AIC, we need to find the maximum likelihood θ_{MLE} .

$$\frac{\partial}{\partial\theta}ln(L(\theta_i|CE_i^j))\ |_{\theta_i=\theta_{MLE}} = 0$$

The θ_{MLE} is the same as the least square estimate, i.e.,

$$arg\ max_\theta(ln(L(\theta_i|CE_i^j)) = arg\ min_\theta(\sum_{j=1}^{44}(CE_i^j - f(\theta_i))^2)$$

Once the θ_{MLE} is computed, the log likelihood is equal to:

$$ln(L(\theta_{MLE}|CE_i^j)) = \frac{-44}{2}ln(2\pi) - 44ln(\sigma) - \left(\frac{\sum_{j=1}^{44}(CE_i^j - f(\theta_i^{MLE}))^2}{2\sigma^2}\right) \tag{A1}$$

To find the maximum likelihood estimate $\hat{\sigma}_{MLE}$ of σ, we evaluate

$$\frac{\partial}{\partial\sigma}ln(L(\theta|CE_i^j))\ |_{\theta=\theta_{MLE}} = 0 \tag{A2}$$

Taking the partial derivative of Eq.(A1) and equating to zero we get

$$\sigma_{MLE}^2 = \frac{1}{44}\sum_{j=1}^{44}(CE_i^j - f(\theta_i^{MLE}))^2 \tag{A3}$$

Substituting the estimates from Eq.(A3) into Eq.(A1), we can compute the log likelihood and the akaike information criterion (AIC):

$$ln(L(\theta_{MLE}|CE_i^j)) = -22 \times (ln(2\pi) + 1) - 22 \times ln\left(\frac{\sum_{j=1}^{44}(CE_i^j - f(\theta_i^{MLE}))^2}{44}\right) \tag{A4}$$

The AIC is $-2ln(L(\theta_{MLE}|CE_i^j)) + 2(\#parameters + 1)$. Therefore,

$$AIC = 44(\ ln(2\pi) + 1) + 44 \times ln\left(\frac{\sum_{j=1}^{44}(CE_i^j - f(\theta_i^{MLE}))^2}{44}\right) + 2(\#parameters + 1)$$

Lower the AIC, better the model fits the data. For the aggregate level estimation, the certainty equivalents of the 44 prospects were elicited from the 47 subjects (in total $44 \times 47 = 2068$ CEs) to estimate the parameters of one model.

Extending PTT and WTU model to two non-zero outcome prospects

Originally the PTT and WTU model have been defined for single non-zero outcome prospects of form $L_1 = (x, p; 0)$. We extend the PTT model without magnitude effect and the WTU model to two-outcome prospects below. The DM perceives the prospect $L_2 = (x, p; y)$ as ternary prospect with outcomes $(x, pe^{-rt}; y, (1-p)e^{-rt}; 0, 1-e^{-rt})$. The value of L_2 under PTT (without the magnitude effect) is given by

$$v(L_2) = w(pe^{-rt})u(x) + (w(e^{-rt}) - w(pe^{-rt}))u(y),$$

We assume that in WTU, the interaction between probability and time is captured by the weighting function $w(pe^{-rt})$ as in the PTT model (without magnitude effect). In addition, we assume that the utility function varies with time delay. The value of L_2 under WTU is given by

$$v(L_2) = w(pe^{-rt})u_t(x) + (w(e^{-rt}) - w(pe^{-rt}))u_t(y).$$

Aggregate RSU model estimated for alternate specifications of discount rate

Table 14 reports the estimation of RSU model for alternate specifications of the discount rate. First, we estimate the RSU model when discount rate $r_{x,y}$ depends on the highest outcome x, i.e., $r_{x,y} = r_0 + M/x$. We find that the value of $M = 1.15$ and the fit is poorer than when $r_{x,y} = r_0 + M/(x+y)$. We also consider an alternate specification for discount rate, i.e., $r_{x,y} = r_0\left(1 + \frac{M}{x+y}\right)$ (Baucells et al. 2019). The M is 979.31 indicating that the sum of outcomes needs to be 979.31 for the base discount rate r_0 to double.

$r_{x,y}$	$r_0 + \frac{M}{x}$	$r_0\left(1 + \frac{M}{x+y}\right)$
α	0.70	0.70
r_0	0%	0.1%
β	1.16	1.15
γ	0.45	0.48
M	1.15	979.31
MSE	208.4	201.8
LL	−8647.5	−8613.5
AIC	−17308	−17239

Table 14: Estimated parameters of RSU model

Pairwise comparison between the models

Table 15 displays the pairwise comparison between the models. Each number in the table corresponds to the number of subjects for whom the model in the row fits the data better (lower AIC) than the model in the column. RSU is the best performing model in all pairwise comparisons.

	DEU	RDEU	Halevy	WTU	RSU
DEU	–	22	18	16	13
RDEU	25	–	18	9	16
Halevy	31	29	–	7	15
WTU	31	38	40	–	20
RSU	34	31	32	27	–

Table 15: Pairwise comparison between the models

Note: The numbers in the table corresponds to the number of subjects (out of 47) for whom the model in the row fits the data better (lower AIC) than the model in the column.

Appendix D

Testing the probability-time tradeoff (PTT) axiom

The probability-time trade off axiom implies that for prospects (x, p_1, t_1) and (x, p_2, t_2), time delay $\triangle \in (0, \infty)$ and $\theta \in (0, 1)$, if $(x, p_1, t_1 + \triangle) \sim (x, p_1\theta, t_1)$, then $(x, p_2, t_2 + \triangle) \sim (x, p_2\theta, t_2)$. In order to test the axiom, we compare the present certainty equivalents (CEs) of the following prospects we elicited in the experiment: For the PTT axiom to hold

1. $Sign[CE(100, 1, 4) - CE(100, 0.5, 2)] = Sign[CE(100, 0.5, 4) - CE(100, 0.25, 2)]$

2. $Sign[CE(100, 1, 4) - CE(100, 0.5, 2)] = Sign[CE(100, 1, 2) - CE(100, 0.5, 0)]$

The conditions essentially imply that the preference between the two prospects on the left side of the equality should be identical to the preference between the two prospects on the right side of the equality. We find that, 34 out of 47 subjects in our data, violate condition 1 above. However, only 7 out of 47 subjects in our data violate condition 2 above. Thus the probability-time tradeoff axiom is violated in condition 1. A similar evidence of PTT violation was also observed in Andreoni et al (2012).

Appendix E

Follow-up study

We conducted a follow-up online study replicating important features of the first experiment.

Study logistics

The study was conducted online among Master in Management (MIM) students of IE Business School in Madrid, Spain. 198 MIM students (47% Female, Age$\sim$ 23) participated in the study.[1] After consenting to participate in the study, the students answered a total of 28 questions. In each question, the subject has to make a maximum of four choices (or express indifference) between a prospect and a sure outcome. The sure outcomes in the choices were varied based on the bisection method (Table 12) and the CE of the subject for each of the 28 prospects were elicited (see Figure 10-12 for example stimuli). The prospects used in the study are described in the Table 16. The prospects in Table 16 were paid at time t and the CE of the prospects were elicited at time T ($t > T$). The t and T in Table 16 correspond to month of payment and the month at which the CE is elicited (respectively). Just as in the first experiment, the $t = 0, 2, 4$ corresponds to outcomes paid tomorrow, 2 months from now, and 4 months from now (respectively). Note that the 28 questions in Table 16 are a subset of the 44 questions used in Table 1. We reduced the number of questions to make the task easier for the subjects as the follow-up study was conducted online and not an individual computer-based interview. However, the 28 questions were sufficient to replicate the core findings of the first experiment.

<table>
<tr><th>Prospects</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th></tr>
<tr><td>x_i</td><td>100</td><td>100</td><td>100</td><td>50</td><td>100</td><td>100</td><td>25</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td></tr>
<tr><td>p_i</td><td>1</td><td>1</td><td>1</td><td>0.25</td><td>0.25</td><td>0.25</td><td>0.25</td><td>0.25</td><td>0.05</td><td>0.25</td><td>0.5</td><td>0.75</td><td>0.95</td></tr>
<tr><td>y_i</td><td>0</td><td>0</td><td>0</td><td>0</td><td>25</td><td>50</td><td>0</td><td>75</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>t</td><td>2</td><td>4</td><td>4</td><td colspan="5">0/2</td><td colspan="5">0/2/4</td></tr>
<tr><td>CE at T</td><td>0</td><td>0</td><td>2</td><td colspan="10">0</td></tr>
</table>

Table 16: CE elicited at time T for prospect paid at time t

All subjects were given class credits for participation. In addition 5% of the subjects were paid in the form of Amazon voucher based on their choices. The selected subjects were paid 47 Euros on average. Note that once the subjects completed the survey, the uncertainty was resolved on the same day and the selected subjects were informed via e-mail the amount they have won. Only the payments happened at a later date depending on the time delay of the chosen lottery.

[1] The study was approved by the institutional review board (IRB).

Results

Analysis of certainty equivalents

We indicate the CEs of prospects $1, \ldots, 3$ by $y_1, \ldots, y_3$. We indicate the CEs for prospects $4, \ldots, 13$ with different time delays ($t = 0, 2$, and 4 months) by $y_4^t, \ldots, y_{13}^t$. The CEs are reported in Table 17.

Time preferences

The CEs $y_1, \ldots, y_3$ allow us to evaluate if time-preferences are non-stationary. We observe that y_3 is not different from y_1 (p-value = 0.59), therefore there is no evidence of present bias at aggregate level. However, comparing y_1 and y_3 with y_2, we find that there is a support for sub-additivity (p-value = 0.058). At the individual level, 43% exhibited present bias and 35% exhibited negative present bias (p-value = 0.19). On the other hand, consistent with our first experiment, majority (61%) exhibited sub-additive discounting (p-value < 0.001).

Risk preferences

Risk preferences are analyzed considering the CEs $y_4^0, \ldots, y_{13}^0$. When the probability is fixed at probability $p = 0.25$ and the outcomes are varied (prospects $4, \ldots, 8$), the subjects are risk seeking in aggregate (meaning the mean certainty equivalent is greater than expected value) for 2 prospects and risk averse for 2 prospects. When the outcome is fixed and the probabilities are varied (prospects $9, \ldots, 13$), consistent with the first experiment and the literature, the subjects are risk seeking for small probabilities ($p \leq 0.25$) but risk averse for large probabilities ($p \geq 0.75$).

Risk and time preferences interaction.

We now focus on CEs $y_4, \ldots, y_{13}$ for different time delays $t = 0, 2, 4$. A 3×10 ANOVA with repeated measures rejected the null hypothesis that certainty equivalents are not influenced by the time delay (p-value < 0.001). A one-way ANOVA test with repeated measures failed to reject the null hypothesis that certainty equivalents are not influenced by the time delay only for prospect $i = 4$, 7.

Certainty equivalents		y_i/y_i^0			y_i^2			y_i^4		
i	EV_i	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
1	100	67.69	71.88	26.03	–	–	–	–	–	–
2	100	54.06	46.88	27.90	–	–	–	–	–	–
3	100	69.05	71.88	23.57	–	–	–	–	–	–
4	12.5	18.18***	12.5	12.7	17.48***	12.5	14.99	–	–	–
5	43.75	44.38	42.58	19.87	40.8**	40.24	18.3	–	–	–
6	62.5	59.55**	62.5	20.67	53.93***	58.98	19.82	–	–	–
7	6.25	10.88***	7.42	9.9	10.71***	7.42	11.73	–	–	–
8	81.25	70.82***	80.88	21.34	64.62***	77.72	22.73	–	–	–
9	5	22.38***	10.95	23.12	16.33***	5	19.53	17.91***	5	22.1
10	25	33.83***	29.7	22.12	24.74	20.33	19.13	22.06**	18.75	17.45
11	50	50.65	46.88	20.65	41.76***	40.63	21.06	38.7***	35.94	22.23
12	75	69.7***	75	19.84	60.69***	60.95	22	56.27***	60.95	21.92
13	95	83.17***	89.08	19.99	75.73***	80.17	21.72	69.6***	77.2	25.42

Table 17: Mean, Median, and SD of certainty equivalents for different probabilities of winning €100 Mean different from EV for $i = 4, ..., 13$: *- significant at $\alpha = 0.1$, * *- significant at $\alpha = 0.05$, *** - significant at $\alpha = 0.01$

To understand more precisely the effect of probability on sensitivity to time delay, we now compare the certainty equivalents of the prospects $9, \dots, 13$ for different delays t. We can observe from Figure 8 and paired t-tests reported in Table 18 that y^2, and y^4 are not significantly different from one another for small probabilities ($p = 0.05, 0.25, 0.5$). However, for large probabilities ($p > 0.5$), the certainty equivalents become significantly different. Thus, the results indicate that the sensitivity to time delay depends on probabilities: Subjects are less sensitive to time delay for small probabilities (especially when comparing two future payments) but become progressively more sensitive to time delay for large probabilities. The subsequent sections will estimate the model in Eq.(1) and capture the risk-time preferences interaction.

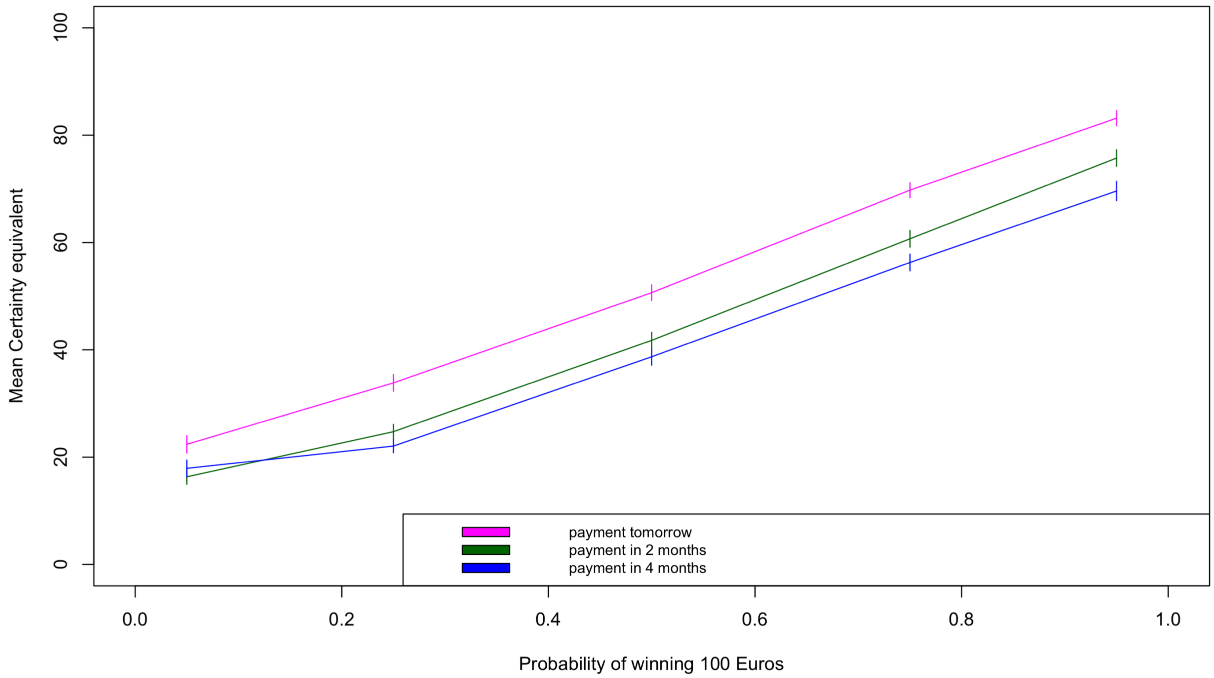


Figure 8: Mean certainty equivalents for different probabilities of winning €100
Note: The vertical lines are the standard error bars.

i	$y^0 - y^2$	$y^0 - y^4$	$y^2 - y^4$
9	6.05***	4.47**	−1.57
10	9.09***	11.78***	2.68
11	8.88***	11.95***	3.06
12	9.07***	13.48***	4.41**
13	7.43***	13.57***	6.13**

Table 18: Differences of mean certainty equivalents.
Note: Results reported are for paired t-tests: *- significant at $\alpha = 0.1$, * *- significant at $\alpha = 0.05$, *** - significant at $\alpha = 0.01$

Estimating Eq.(1)

Utility function

The Eq.(1) assumes that the utility u of outcomes does not vary with the time of payment. Below, we estimate the utility function u of Eq.(1) and test if different utility functions u_t are required to explain choices for different time delays ($t = 0, 2$). We follow the same procedure as described in the first experiment to elicit the power parameters of the utility functions. Consistent with the first experiment, paired t-test shows that there is no difference between the power parameters of the utility u elicited for immediate payment and u_2 elicited for 2 month delay (p-value = 0.64).[2]

Power parameter (α)				
	Mean	Median	S.D.	Concave utility %
u	1.31	1	1.27	50%
u_2	1.2	0.96	1.13	52%

Table 19: Power parameters of the utility function

Weighting function

The certainty equivalents y_i^t elicited for prospects $i = 9, \ldots, 13$ allows estimating the probability weights without any parametric assumptions. The probability weight w_t for probabilities $p = 0.05, \ldots, 0.95$ is given by $w_t(p) = \frac{u(y_i^t)}{u(100)}$ for $i = 9, \ldots, 13$. Table 20 lists the probability weights. We can observe that mean w_0 is inverse-s shaped. A 3×5 ANOVA test with repeated measures rejected the null hypothesis that probability weights are not influenced by the time delay (p-value = 0.0003). The paired t-tests for differences in weighting function at various probability level is reported in Table 21. We find that for small probabilities ($p \leq 0.5$), there is no difference in weighting function for payment delays of 2 and 4 months. However for larger probability levels ($p \geq 0.75$), the weighting function for future payment delays are significantly different. Thus consistent with our model free evidence and results of the first experiment, subjects are insensitive to time delay for small probabilities but become progressively more sensitive to time delay as the probability of gain increases. Figure 9 plots the mean probability weight w with standard error bars for different probabilities.

[2]The results reported for utility function and weighting function are for 177 subjects, excluding 21 for whom the algorithm did not converge.

Probability		0.05	0.25	0.5	0.75	0.95
w_0	Mean	0.24	0.34	0.51	0.68	0.82
	Median	0.11	0.29	0.53	0.75	0.94
	S.D.	0.02	0.019	0.02	0.018	0.017
w_2	Mean	0.19	0.28	0.42	0.58	0.73
	Median	0.08	0.19	0.38	0.6	0.82
	S.D.	0.018	0.019	0.02	0.02	0.019
w_4	Mean	0.20	0.26	0.40	0.55	0.68
	Median	0.07	0.16	0.38	0.6	0.79
	S.D.	0.019	0.018	0.021	0.02	0.02

Table 20: Weighting function for different payment delays

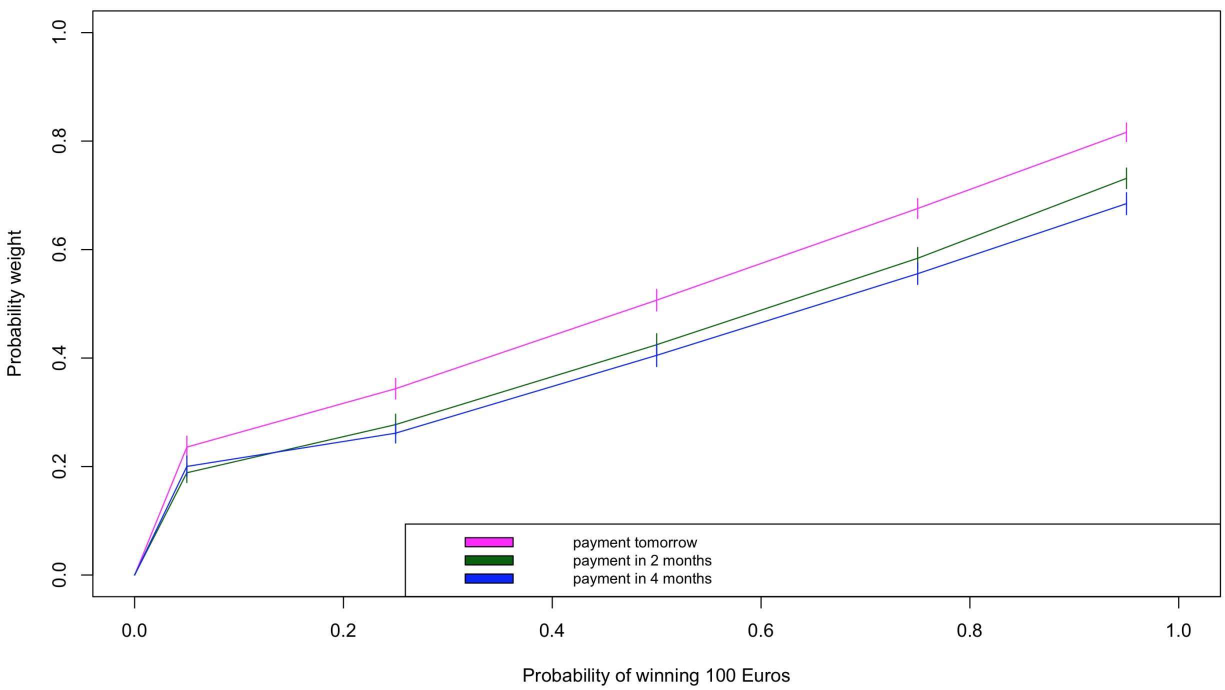


Figure 9: Probability weights for different payment delays
Note: The vertical lines are the standard error bars.

p	$w_0 - w_2$	$w_0 - w_4$	$w_2 - w_4$
0.05	0.05***	0.04**	-0.01
0.25	0.06***	0.08***	0.02
0.5	0.09***	0.11***	0.02
0.75	0.1***	0.13***	0.03**
0.95	0.09***	0.14***	0.05**

Table 21: Testing the difference between probability weights for different payment delays
Note: Results reported are for paired t-tests: *- significant at $\alpha = 0.1$, * *- significant at $\alpha = 0.05$, *** - significant at $\alpha = 0.01$

Parametric model fitting

We estimate the models described in Section 2 using maximum likelihood by assuming normally distributed standard errors (as described in Section 4). The elicitation procedure is identical to the first experiment. The results are reported in the Table 22. We find that consistent with the first experiment we can observe that models that assume no risk-time preferences interaction (DEU and DRDU) have a high AIC and therefore does not fit the data very well compared to the PTT model without the magnitude effect parameter and the Halevy (2008) model, which capture the risk-time interaction. As in the first experiment, we also show that accounting for magnitude effect is important: RSU and WTU have a better fit than Halevy and PTT without magnitude effect (PTT*). We also observe that the monthly discount rate becomes smaller when we start accounting for the risk-time preferences interaction.

Parameters	**DEU**	**DRDU**	**PTT***	**Halevy**	**RSU**	**WTU**
Utility curvature (α)	1.32	1.82	1.52	1.57	2.17	2.18
Monthly discount rate ($r = -ln\ \delta$)	16.2%	19.8%	10.3%	4.08%	9.4%	9.9%
Probabilistic pessimism (β)		1.4	1.3	1.32	1.99	1.91
Probabilistic sensitivity (γ)		0.69	0.64	0.68	0.59	0.64
Magnitude effect (M)					0.69	
α variation with time (K)						-0.5
Mortality risk (P)				0.066		
Mean square error	473.27	459.27	441.40	441.06	159.35	430.57
Log likelihood	-12399.95	-12363.83	-12316.02	-12315.09	-11089.45	-12286.12
AIC	24793.9	24737.66	24642.04	24642.18	22190.9	24584.24

Table 22: Aggregate level results
Note: DEU refers to the discounted expected utility model, DRDU refers to the discounted rank dependent utility model, PTT* refers to the probability-time tradeoff model without the magnitude effect, Halevy refers to the model in Halevy (2008), RSU refers to the range and sign dependent utility model, WTU refers to the weighted temporal utility model. For detailed description of the models refer Section 2.

Summary of the main results of the follow-up study

We successfully replicated the results of the first experiment with a larger sample size of 198 subjects. Consistent with our first experiment (1) our model free evidence in Figure 8 shows that, certainty equivalents of the subjects for future time delays are not significantly different from one another for small probabilities ($p \leq 0.5$). However, for large probabilities ($p > 0.5$), the certainty equivalents for different time delays become significantly different. (2) there is no difference in utility function elicited for different time delays (Table 19) but the probability weights are impacted by time delay i.e., the probability weights are insensitive to time delay for small probability of gains but become progressively more sensitive to time delay as the probability of gain increases (Figure 9 and Table 21). (3) Based on model fitting, we also show that models that account for risk-time preferences interaction and for the magnitude effect fit the data better than other models (Table 22).

Stimuli used in the follow-up study

For each question, a maximum of 4 choices were used to elicit the certainty equivalents. The sure outcome in the choices were varied based on the bisection method. For a particular choice, if the subjects expressed indifference, they proceeded to the next question.

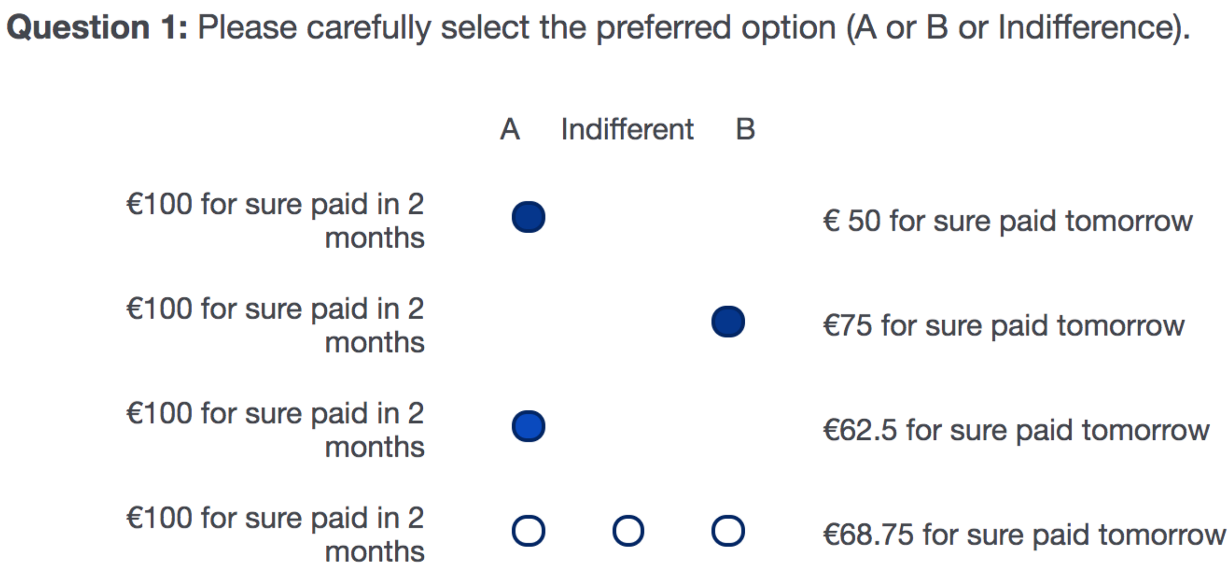
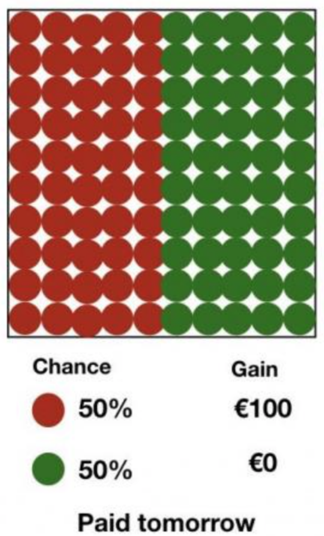


Figure 10: Eliciting certainty equivalent of future sure outcome (Option A) by varying the sooner sure outcome (Option B)

Question 6:

Consider a box that consist of **50** red balls and **50** green balls. If a red ball is drawn you win **€100** and if a green ball is drawn you win **€0** . In other words, you have **50% chance to win €100 and 50% chance to win €0** if you choose to draw a ball from the box.

In a series of choices you will be asked to choose between Option A - drawing a ball from the box (i.e., **50% chance to win €100 and 50% chance to win €0 paid tomorrow**) and Option B - **sure outcome paid tomorrow.**



Please carefully select the preferred option (A or B or indifference). Note here that both **the sure outcome (Option B)** and the **lottery (Option A) are paid tomorrow.**

	A	Indifferent	B	
50% chance of €100 & 50% chance of 0 (paid tomorrow)	●			€50 for sure paid tomorrow
50% chance of €100 & 50% chance of 0 (paid tomorrow)			●	€75 for sure paid tomorrow
50% chance of €100 & 50% chance of 0 (paid tomorrow)	●			€62.5 for sure paid tomorrow
50% chance of €100 & 50% chance of 0 (paid tomorrow)	○	○	○	€68.75 for sure paid tomorrow

Figure 11: Eliciting certainty equivalent of risky prospect paid tomorrow (Option A) by varying the sooner sure outcome paid tomorrow (Option B)

Question 17:
Consider a box that consist of **50** red balls and **50** green balls. If a red ball is drawn you win **€100** and if a green ball is drawn you win **€0** . In other words, you have **50% chance to win €100 and 50% chance to win €0** if you choose to draw a ball from the box.
In a series of choices you will be asked to choose between Option A - drawing a ball from the box (i.e., **50% chance to win €100 and 50% chance to win €0 paid in 2 months**) and Option B - **sure outcome paid tomorrow.**

Please carefully select the preferred option (A or B or indifference). Note here that **the sure outcome (Option B) is paid tomorrow and the lottery (Option A)** is resolved now and **paid in 2 months.**

	A	Indifferent	B	
50% chance of €100 & 50% chance of 0 (paid in 2 months)	●			€50 for sure paid tomorrow
50% chance of €100 & 50% chance of 0 (paid in 2 months)			●	€75 for sure paid tomorrow
50% chance of €100 & 50% chance of 0 (paid in 2 months)	●			€62.5 for sure paid tomorrow
50% chance of €100 & 50% chance of 0 (paid in 2 months)	○	○	○	€68.75 for sure paid tomorrow

Figure 12: Eliciting certainty equivalent of risky prospect paid in two months (Option A) by varying the sooner sure outcome paid tomorrow (Option B)