Time Lotteries: Online Appendix

A Proofs

Proof of Proposition 2. The sequence $\{D(t)\}$ is monotone and bounded. Thus, by the Monotone Convergence Theorem, it converges to some number, say $\overline{d} \geq 0$. We need to show that the sequence $\{D(t+1) + D(t-1) - 2D(t)\}$ has no negative limit points:

$$\liminf_{t\to\infty} \left(D(t+1) + D(t-1) - 2D(t)\right) \geq 0.$$

Suppose this is not true. Then there exists $\epsilon > 0$ and a subsequence $\{D(t_k)\}$ such that

$$D(t_k+1) + D(t_k-1) - 2D(t_k) \leq -\epsilon$$

for all t_k. However, because $D(t_k)$ converges to $\overline{d}$, it follows that $D(t_k+1)+D(t_k-1)-2D(t_k)$ converges to zero. Thus, there exists $\overline{t}_k$ such that for all $t > \overline{t}_k$,

$$-\frac{\epsilon}{2} \leq D(t_k+1) + D(t_k-1) - 2D(t_k) \leq \frac{\epsilon}{2},$$

which contradicts the previous inequality. $\square$

Proof of Proposition 3. The proof will use a couple of Lemmas.

First notice that, because preferences are dynamically consistent, there is no loss in taking $t = 3$. To simplify the expressions, it is convenient to write $\lambda \equiv (c+x)/c > 1$ to denote the consumption with the prize as a proportion of consumption without it. Using the formula in the text, the utility of the safe lottery equals

$$V_0 = \left[(1-\beta)c\right]^{\frac{1}{1-\rho}} \cdot \left[1 + \beta + \lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}\right]^{\frac{1}{1-\rho}},$$

and the utility of the risky lottery is

$$V_0 = \left[(1-\beta)c\right]^{\frac{1}{1-\rho}} \left\{1 + \beta\left[\frac{\left(\lambda^{1-\rho} + \frac{\beta}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}} + \left(1+\beta+\lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2}\right]^{\frac{1-\rho}{1-\alpha}}\right\}^{\frac{1}{1-\rho}}.$$

Therefore, preferences are locally RSTL at t if and only if the following inequality holds:

$$\left\{1 + \beta\left[\frac{\left(\lambda^{1-\rho} + \frac{\beta}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}} + \left(1+\beta+\lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2}\right]^{\frac{1-\rho}{1-\alpha}}\right\}^{\frac{1}{1-\rho}} > \left(1+\beta+\lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}\right)^{\frac{1}{1-\rho}}. \tag{A1}$$

To simplify notation, let $f(x) \equiv x^{\frac{1-\alpha}{1-\rho}}$. In the proofs, we will repeatedly use the following result. The expected discounted payoff from the risky lottery exceeds the one from the safe lottery if and only if the intertemporal elasticity of substitution exceeds 1. Formally:

$$\frac{\lambda^{1-\rho} + \frac{\beta}{1-\beta} + 1 + \beta + \lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}}{2} \left\{ \begin{array}{c} > \\ < \end{array} \right\} 1 + \lambda^{1-\rho}\beta + \frac{\beta^2}{1-\beta} \iff \rho \left\{ \begin{array}{c} < \\ > \end{array} \right\} 1. \tag{A2}$$

We first verify that (A1) always holds when $\alpha \leq 1$.

Lemma 1. *Let $\alpha \leq 1$. Then, preferences are RSTL.*

Proof. There are three cases: (i) $\alpha \leq \rho \leq 1$, (ii) $\rho < \alpha \leq 1$, and (iii) $\alpha \leq 1 < \rho$.

Case i: $\alpha \leq \rho \leq 1$. Since $1 - \rho < 0$, inequality (A1) can be written as

$$\frac{\left(\lambda^{1-\rho} + \frac{\beta}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}} + \left(1 + \beta + \lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2} > \left(1 + \lambda^{1-\rho}\beta + \frac{\beta^2}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}.$$

Algebraic manipulations establish that the expected discounted payment of the risky lottery exceeds the one from the safe lottery. Because $\rho < 1$, inequality (A2) gives

$$\frac{\lambda^{1-\rho} + \frac{\beta}{1-\beta} + 1 + \beta + \lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}}{2} > 1 + \lambda^{1-\rho}\beta + \frac{\beta^2}{1-\beta}.$$

The result then follows from Jensen's inequality since $f(x)$ is increasing and convex when $\alpha, \rho \leq 1$.

Case ii: $\rho < \alpha \leq 1$. To simplify notation, perform the following change of variables: $\gamma \equiv \frac{1-\alpha}{1-\rho} \in (0,1)$ where $\gamma > 0$ since both α and ρ are lower than 1, and $\gamma < 1$ since $\alpha > \rho$. We can rewrite inequality (A1) substituting α for γ as

$$\frac{\left(\lambda^{1-\rho} + \frac{\beta}{1-\beta}\right)^{\gamma} + \left(1 + \beta + \lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}\right)^{\gamma}}{2} > \left(1 + \lambda^{1-\rho}\beta + \frac{\beta^2}{1-\beta}\right)^{\gamma}.$$

Rearrange this condition as

$$\left(\frac{1}{\frac{1}{\lambda^{1-\rho}+\frac{\beta}{1-\beta}} + \beta}\right)^{\gamma} + \left(\frac{1}{1 + \lambda^{1-\rho}\beta + \frac{\beta^2}{1-\beta}} + \beta\right)^{\gamma} > 2.$$

It is straightforward to verify that the expression on the left ("LHS") is a convex function of γ. Recall that $\gamma \in (0,1)$. Evaluating at $\gamma = 0$, we obtain

$$LHS|_{\gamma=0} = 2.$$

Since LHS is a convex function of γ, it suffices to show that its derivative wrt γ at zero is positive. We claim that this is true. To see this, notice that

$$\left.\frac{dLHS}{d\gamma}\right|_{\gamma=0} = \ln\left(\frac{\frac{1}{1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}} + \beta}{\frac{1}{\lambda^{1-\rho}+\frac{\beta}{1-\beta}} + \beta}\right), \tag{A3}$$

which, with some algebraic manipulations, can be shown to be strictly positive for any $\rho < 1$. Thus, $LHS > 2$ for all $\gamma \in (0,1]$, establishing RSTL.

Case iii: $\alpha \leq 1 < \rho$. Inequality (A1) can be simplified as

$$\left[\frac{\left(\lambda^{1-\rho}+\frac{\beta}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2}+\frac{\left(1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2}\right]^{\frac{1-\rho}{1-\alpha}} < 1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}.$$

Since $\frac{1-\alpha}{1-\rho} < 0$, this holds if

$$\frac{\left(\lambda^{1-\rho}+\frac{\beta}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}+\left(1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2} > \left(1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}. \tag{A4}$$

Notice that $f(x) = x^{\frac{1-\alpha}{1-\rho}}$ is convex since

$$f''(x) = \left(\frac{1-\alpha}{1-\rho}\right)\left(\frac{1-\alpha}{1-\rho}-1\right)x^{\frac{1-\alpha}{1-\rho}-2} > 0,$$

where we used $\frac{1-\alpha}{1-\rho} < 0$ and $\frac{1-\alpha}{1-\rho} - 1 < 0$. Thus, by Jensen's inequality,

$$\frac{\left(\lambda^{1-\rho}+\frac{\beta}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}+\left(1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2} > \left(\frac{\lambda^{1-\rho}+\frac{\beta}{1-\beta}+1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}}{2}\right)^{\frac{1-\alpha}{1-\rho}}. \tag{A5}$$

From condition (A2), we have

$$\frac{\lambda^{1-\rho}+\frac{\beta}{1-\beta}+1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}}{2} < 1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}.$$

Raising to $\frac{1-\alpha}{1-\rho} < 0$, gives

$$\left(\frac{\lambda^{1-\rho}+\frac{\beta}{1-\beta}+1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}}{2}\right)^{\frac{1-\alpha}{1-\rho}} > \left(1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}.$$

Substituting in (A5), we obtain

$$\frac{\left(\lambda^{1-\rho}+\frac{\beta}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}+\left(1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2} > \left(1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}},$$

which is precisely the condition for RSTL (A4).

□

Lemma 2. *Let $\alpha \leq \rho$. Then, preferences are RSTL.*

Proof. By Lemma 1, the result is immediate when $\alpha \leq 1$. Therefore, let $\alpha > 1$ (which, by the statement of the lemma, requires $\rho > 1$).

Rearranging inequality (A1), we obtain the following condition for RSTL:

$$\frac{\left(\lambda^{1-\rho}+\frac{\beta}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}+\left(1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}}{2} < \left(1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}\right)^{\frac{1-\alpha}{1-\rho}}. \tag{A6}$$

Moreover, from condition (A2), we have

$$\frac{\lambda^{1-\rho}+\frac{\beta}{1-\beta}+1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}}{2}<1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}.$$

Notice that $f(x)$ is increasing when $\alpha,\rho\geq 1$ and it is concave when $\rho\geq\alpha$. Then, condition (A6) follows by Jensen's inequality. □

We are now ready to prove the main result:

Proof of Proposition 3. First, suppose $\rho<1$. Let $\gamma\equiv-\frac{1-\alpha}{1-\rho}\in(0,+\infty)$ so we can rewrite inequality (A1) in terms of γ and ρ as

$$\frac{1}{\left(\lambda^{1-\rho}+\frac{\beta}{1-\beta}\right)^{\gamma}}+\frac{1}{\left(1+\beta+\lambda^{1-\rho}\beta^2+\frac{\beta^3}{1-\beta}\right)^{\gamma}}<\frac{2}{\left(1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}\right)^{\gamma}},$$

which can be simplified as:

$$\left(\frac{1}{\lambda^{1-\rho}+\frac{\beta}{1-\beta}}+\beta\right)^{\gamma}+\left(\frac{1}{\frac{1}{1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}}+\beta}\right)^{\gamma}<2.$$

The first term in the expression on the left ("LHS") is convex and decreasing in γ, because the term inside the first brackets is smaller than 1:

$$\rho\leq 1\implies\frac{1}{\lambda^{1-\rho}+\frac{\beta}{1-\beta}}+\beta\leq 1$$

The second term is convex and increasing in γ because the term inside the second brackets is greater than 1:

$$\rho\leq 1\implies\frac{1}{\frac{1}{1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}}+\beta}\geq 1.$$

Since the sum of convex functions is convex, it follows that LHS is a convex function of γ.

Evaluating γ at the extremes, we obtain:

$$LHS|_{\gamma=0}=\left(\frac{1}{\lambda^{1-\rho}+\frac{\beta}{1-\beta}}+\beta\right)^{0}+\left(\frac{1}{\frac{1}{1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}}+\beta}\right)^{0}=2,$$

and

$$\lim_{\gamma\to\infty}LHS=+\infty>2.$$

Moreover, we claim that the derivative of the LHS wrt γ at zero is negative. To see this, note that

$$\left.\frac{dLHS}{d\gamma}\right|_{\gamma=0}=\ln\left(\frac{\frac{1}{\lambda^{1-\rho}+\frac{\beta}{1-\beta}}+\beta}{\frac{1}{1+\lambda^{1-\rho}\beta+\frac{\beta^2}{1-\beta}}+\beta}\right),$$

which, following some algebraic manipulations, can be shown to be strictly negative.

Thus, there exists $\bar{\gamma}>0$ such that $LHS>2$ (RATL) if and only if $\gamma>\bar{\gamma}$. But, since $\gamma\equiv-\frac{1-\alpha}{1-\rho}$ (so that γ is strictly increasing in α), this establishes that there exists a finite $\bar{\alpha}_{\rho,\beta}>\max\{1,\rho\}$ such that we have RATL if $\alpha>\bar{\alpha}_{\rho,\beta}$ and RSTL if $\alpha<\bar{\alpha}_{\rho,\beta}$. This concludes the proof for $\rho<1$.

Now suppose that $\alpha > \rho \geq 1$ (the result is trivial if $\alpha \leq \rho$ from Lemma 2). Let $\gamma \equiv \frac{1-\alpha}{1-\rho} \geq 1$. Then, we have RSTL if and only if

$$\frac{\left(\lambda^{1-\rho} + \frac{\beta}{1-\beta}\right)^{\gamma} + \left(1 + \beta + \lambda^{1-\rho}\beta^2 + \frac{\beta^3}{1-\beta}\right)^{\gamma}}{2} < \left(1 + \lambda^{1-\rho}\beta + \frac{\beta^2}{1-\beta}\right)^{\gamma}.$$

Rearrange this condition as

$$\left(\frac{1}{\frac{1}{\lambda^{1-\rho}+\frac{\beta}{1-\beta}} + \beta}\right)^{\gamma} + \left(\frac{1}{1 + \lambda^{1-\rho}\beta + \frac{\beta^2}{1-\beta}} + \beta\right)^{\gamma} < 2. \tag{A7}$$

As before, it can be shown that the expression on the left ("LHS") is a convex function of γ. Notice that $\lim_{\gamma \to \infty} LHS = +\infty > 2$. Morevoer, $LHS|_{\gamma=1} < 2$ since, with some algebraic manipulations, one can show that

$$\lambda^{1-\rho} < 1 \iff \frac{1}{\frac{1}{\lambda^{1-\rho}+\frac{\beta}{1-\beta}} + \beta} + \frac{1}{1 + \lambda^{1-\rho}\beta + \frac{\beta^2}{1-\beta}} + \beta < 2.$$

Thus, there exists $\bar{\gamma} > 0$ such that $LHS > 2$ (RATL) if and only if $\gamma > \bar{\gamma}$. The result then follows from the fact that γ is increasing in α.

To conclude the proof, it remains to be shown that $\lim_{x \searrow 0} \bar{\alpha}_{\rho,\beta,x} = +\infty$. Both sides of (A1) are equal to $\left(\frac{1}{1-\beta}\right)^{\frac{1}{1-\rho}}$ when $\lambda = 1$. The derivative of the expression on the right (utility of the safe lottery) with respect to λ at $\lambda = 1$ is

$$\left(\frac{1}{1-\beta}\right)^{\frac{\rho}{1-\rho}} \beta^2. \tag{A8}$$

The derivative of the expression on the left (utility of the risky lottery) with respect to λ at $\lambda = 1$ is

$$\beta \frac{1+\beta^2}{2} \left(\frac{1}{1-\beta}\right)^{\frac{\rho}{1-\rho}}. \tag{A9}$$

With some algebraic manipulations, it can be shown that for any $\beta \in (0,1)$, the term in (A8) is lower than the one in (A9). $\square$

Proof of Proposition 4. The first claim was proved in the text. For the second claim, it is enough to show that there is a specific time lottery that will always be preferred to the safe lottery independently of x. For $k \leq t$ and payment x, consider the time lottery $\langle 0.5, (x, t-k)\,; 0.5, (x, t+k)\rangle \in \mathcal{P}_x$. Using the formula of DPWU, we have

$$\begin{aligned} V_{DPWU}\left(\delta_{(x,t)}\right) &\geq V_{DPWU}\left(\langle 0.5, (x, t-k)\,; 0.5, (x, t+k)\rangle\right) \Leftrightarrow \\ D(t) &\geq \pi(0.5)\, D(t-k) + (1 - \pi(0.5))\, D(t+k) \end{aligned}$$

Take $k = t$ and recall that $D(0) = 1$, this holds if and only if

$$D(k) \geq \pi(0.5) + (1 - \pi(0.5))\, D(2k)$$

or

$$D(k) - D(2k) \geq \pi(0.5)\,(1 - D(2k)) \tag{A10}$$

But D is a decreasing function which is bounded below by 0. By the the monotone convergence theorem, $\lim_{k \to \infty} D(k) - D(2k) = 0$, while the right hand side of equation (A10) is bounded below by $\pi(0.5)\left(1 - \lim_{k \to \infty} D(2k)\right) > 0$. $\square$

B RATL with Consumption Smoothing

In this appendix, we consider the choice between safe and risky time lotteries when the decision maker can freely save and borrow. While the main benchmark is the Discounted Expected Utility model (DEU), we will consider the more general Epstein-Zin model (EZ) we discuss in Section 3. EZ coincides with DEU when $\alpha = \rho$.

We study a standard consumption-savings model with no liquidity constraints. The decision maker allocates income between consumption and a riskless asset that pays a constant interest rate r. Let $D \equiv \frac{1}{1+r} > 0$ denote the market discount rate. In period t, the decision maker earns an income W_t. Let $\mathcal{W} \equiv \sum_{t=0}^{\infty} D^t W_t$ denote the net present value of lifetime income (in the absence of the time lottery). For existence, we assume that $\beta < D^{1-\rho}$, which always holds if $\rho \geq 1$.

As in the text, the decision maker faces a choice between a time lottery that pays \$$x$ in period t with certainty ("safe lottery") and a lottery that pays \$$x$ at either $t-1$ or $t+1$ with equal probabilities ("risky lottery"). We will determine the qualitative and quantitative ability of this model to reconcile a preference for the safe lottery. Our qualitative result states that the safe lottery is preferred if people are sufficiently risk averse and, moreover, as the prize decreases, the amount of risk aversion needed to make someone prefer the safe lottery goes to infinity. More precisely:

Proposition 1. *There exists a unique $\bar{\alpha}_{x,D,\mathcal{W}} > 1$ such that the safe time lottery is preferred if and only if $\alpha > \bar{\alpha}_{x,D,\mathcal{W}}$. Moreover, $\lim_{x \searrow 0} \bar{\alpha}_{x,D,\mathcal{W}} = +\infty$.*

Proof. It is helpful to consider the utility of deterministic streams of payments first. With deterministic incomes, the optimal consumption solves the following program:

$$\begin{array}{rl} \max_{\{C_t\}} & \left[(1-\beta)\sum_{t=0}^{\infty} \beta^t C_t^{1-\rho}\right]^{\frac{1}{1-\rho}} \\ \text{subject to} & \sum D^t C_t = \mathcal{W} \end{array}.$$

A variational argument establishes the following necessary optimality condition:

$$C_t = \mathcal{W}\left(1 - D^{1-\frac{1}{\rho}}\beta^{\frac{1}{\rho}}\right)\left(\frac{\beta}{D}\right)^{\frac{t}{\rho}}. \tag{A11}$$

Therefore, the utility from a deterministic stream of payments with net present value $\mathcal{W}$ is

$$\begin{aligned} \mathcal{V}(\mathcal{W}) &\equiv \left\{(1-\beta)\sum_{t=0}^{\infty}\beta^t\left(\mathcal{W}\left(1 - D^{1-\frac{1}{\rho}}\beta^{\frac{1}{\rho}}\right)\left(\tfrac{\beta}{D}\right)^{\frac{t}{\rho}}\right)^{1-\rho}\right\}^{\frac{1}{1-\rho}} \\ &= \mathcal{W}\left(1 - D^{1-\frac{1}{\rho}}\beta^{\frac{1}{\rho}}\right)\left\{(1-\beta)\left[\sum_{t=0}^{\infty}\left(\tfrac{\beta}{D^{1-\rho}}\right)^{\frac{t}{\rho}}\right]\right\}^{\frac{1}{1-\rho}}. \end{aligned}$$

Notice that this expression is finite if and only if $\beta < D^{1-\rho}$, which we assumed to be the case.

Recall that the safe time lottery pays x in period t and the risky lottery that pays x at either $t-1$ or $t+1$. By dynamic consistency, the choice between these lotteries does not depend on t. For notational simplicity, we therefore set $t = 2$. The utility from the safe lottery is

$$\mathcal{V}(\mathcal{W} + Dx) = (\mathcal{W} + D\Delta)\left(1 - D^{1-\frac{1}{\rho}}\beta^{\frac{1}{\rho}}\right)\left[\frac{1-\beta}{1-\left(\frac{\beta}{D^{1-\rho}}\right)^{\frac{1}{\rho}}}\right]^{\frac{1}{1-\rho}}.$$

The utility from the risky lottery is

$$\left\{\frac{[\mathcal{V}(\mathcal{W}+x)]^{1-\alpha}+[\mathcal{V}(\mathcal{W}+D^2x)]^{1-\alpha}}{2}\right\}^{\frac{1}{1-\alpha}}$$

$$=\left(1-D^{1-\frac{1}{\rho}}\beta^{\frac{1}{\rho}}\right)\left[\frac{1-\beta}{1-\left(\frac{\beta}{D^{1-\rho}}\right)^{\frac{1}{\rho}}}\right]^{\frac{1}{1-\rho}}\left[\frac{(\mathcal{W}+x)^{1-\alpha}+(\mathcal{W}+D^2x)^{1-\alpha}}{2}\right]^{\frac{1}{1-\alpha}}.$$

Comparing these two expressions, it follows that the risky lottery is preferred if and only if

$$\left[\frac{(\mathcal{W}+x)^{1-\alpha}+(\mathcal{W}+D^2x)^{1-\alpha}}{2}\right]^{\frac{1}{1-\alpha}}\geq\mathcal{W}+Dx. \tag{A12}$$

Notice that this condition relies only on risk aversion, not on the elasticity of intertemporal substitution. That is, disentangling IES from risk aversion clarifies that only risk aversion matters for the choice between the safe and the risky time lottery.

First, we claim that the risky lottery is always preferred when $\alpha<1$. To see this, rewrite condition (A12) as

$$\left(\frac{\mathcal{W}+x}{\mathcal{W}+Dx}\right)^{\xi}+\left(\frac{\mathcal{W}+D^2x}{\mathcal{W}+Dx}\right)^{\xi}\geq 2,$$

where $\xi\equiv 1-\alpha\in[0,1]$. The expression on the left is a convex function of ξ. The result then follows from the fact that, at $\xi=0$, the inequality holds and that the expression on the left is increasing. Evaluating the expression on the left at $\xi=0$, gives

$$\left(\frac{\mathcal{W}+x}{\mathcal{W}+Dx}\right)^{0}+\left(\frac{\mathcal{W}+D^2x}{\mathcal{W}+Dx}\right)^{0}=2. \tag{A13}$$

The derivative of the expression on the left at $\xi=0$ equals

$$\ln\left[\frac{(W+x)\,(W+D^2x)}{(W+Dx)^2}\right]\geq 0,$$

where the inequality follows from standard algebraic manipulations.

Next, let $\alpha>1$ and rewrite condition (A12) as

$$\left(\frac{\mathcal{W}+Dx}{\mathcal{W}+x}\right)^{\psi}+\left(\frac{\mathcal{W}+Dx}{\mathcal{W}+D^2x}\right)^{\psi}\leq 2,$$

where $\psi\equiv\alpha-1>0$. We claim that there exists a unique interior cutoff such that the inequality holds if and only if ψ lies below this cutoff. Notice that the expression on the left is again a convex function ψ. Moreover, it equals 2 at $\psi=0$ and it converges to $+\infty$ as $\xi\to\infty$. It suffices to show that the derivative at zero is negative. The derivative of the expression on the left $\psi=0$ is

$$\ln\left(\frac{(\mathcal{W}+Dx)^2}{(\mathcal{W}+x)\,(\mathcal{W}+D^2x)}\right),$$

which can be shown to be negative.

To show that $\lim_{x\to 0}\bar{\alpha}_{x,D,\mathcal{W}}=+\infty$, notice that, at $x=0$, both sides of (A13) equal 2. Moreover, tedious algebra establishes that the derivative of the the expression on the left of (A13) with respect to x evaluated at 0 is negative. $\square$

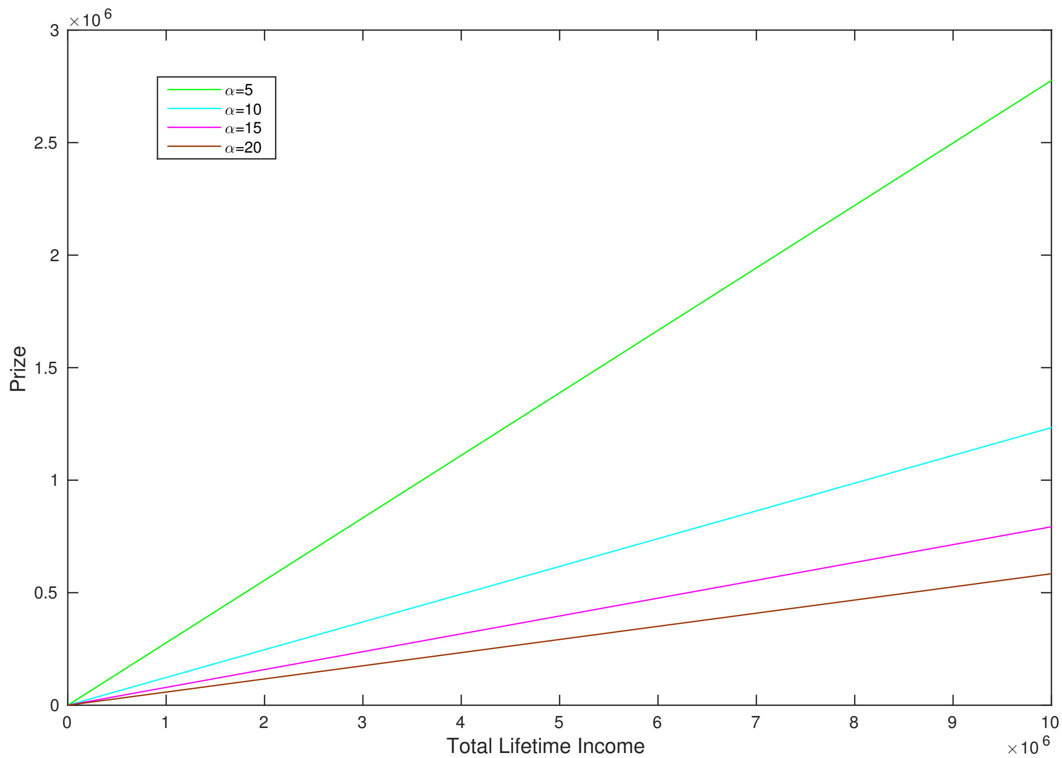

Figure 1: Regions of indifference between the safe and the risky time lotteries, with total lifetime incomes $\mathcal{W}$ on the horizontal axis and prizes x on the vertical axis, for different coefficients of relative risk aversion α (and discount parameter $D = .9$). The risky lottery is preferred at points below the line, and the safe lottery is preferred at points above it.

Next, we turn to the quantitative ability of this model to generate a preference for the safe time lottery. Since the condition for the safe lottery to be chosen depends on the risk aversion parameter but not on the elasticity of intertemporal substitution, all results also hold for DEU.

Rationalizing a preference for the safe lottery requires either unreasonably high levels of risk aversion or unreasonably low lifetime incomes. For example, with $D = 0.9$ and $\alpha = 10$ and a net present value of lifetime income of one million dollars, a person would only prefer the safe lottery if the prize exceeded \$123,500!

Figure 1 shows that this is a general pattern. It represents, for each lifetime income (horizontal axis), the prize that would make the individual indifferent between the risky and the safe time lotteries. The risky lottery is preferred if the prize lies below the depicted line, and the safe lottery is preferred if it lies above it. For $\alpha = 5$, the risky lottery is preferred as long as the prize does not exceed 27.7% of the total lifetime income ($\mathcal{W}$). For $\alpha = 10$, the risky lottery is chosen as long as the prize does not exceed 12.3% of $\mathcal{W}$. Even for $\alpha = 25$, a high risk aversion coefficient, the risky lottery is chosen for any prize below 4.6% of $\mathcal{W}$.

Thus, for moderate prizes (including any of the ones in our experiments) and reasonable risk aversion parameters, EZ with smoothing predicts a preference for the risky lottery.

C Additional Experimental Analysis

Table A1: Proportion of RATL subjects

Sample	No Cert. Bias (12-13)		No Cert. Bias (12-14)	
Treatment	Long	Short	Long	Short
Question 1	67.50	55.00	62.50	54.17
Majority in Q1-5	68.75*	50.00	63.89	47.22
MPL in Q10	47.50	51.90	45.83	50.00
MPL in Q11	54.43	48.10	56.94	48.61
Observations	80	80	72	72

Notes. Same as Table 6, including certainty bias measure from Questions 12 and 14 (see footnote 23).

Table A2: Probit Regressions: RATL and Atemporal Risk Aversion

Dep. Var.	RATL Q.1				RATL Majority Q.1-5			
Treatment	Long		Short		Long		Short	
(Probit)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cert. Bias		-.19		.18		-.21		.12
		(-1.56)		(1.20)		(-1.71)		(0.82)
Convexity	3.73*		-4.17		-.39		-10.60***	
	(1.68)		(-1.25)		(-0.19)		(-2.83)	
Constant	.22	.40***	.25*	.19	.41**	.37***	.15	.01
	(1.35)	(2.93)	(1.67)	(1.41)	(2.50)	(2.75)	(1.02)	(.09)
Pseudo-R^2	.02	.02	.01	.01	.01	.03	.07	.01
Obs.	101	95	88	88	101	95	88	88

Notes. Same as Table 7. Each regression excludes one dependent variable.

Table A3: Probit Regressions: RATL and Convexity and Certainty Bias

Dep. Var.	RATL Q.10				RATL Q.11			
Treatment	Long		Short		Long		Short	
(Probit)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Convexity	3.63*		-1.59		1.13		-7.59**	
	(1.73)		(-2.83)		(-0.53)		(-2.20)	
Cert. Bias		-.06		.45***		.19*	.18	
		(-0.52)		(2.84)		(1.71)		(1.23)
Constant	-.29*	-.11	.13	.13	.12	.24*	.12	.18
	(-1.79)	(-.88)	(.88)	(.92)	(0.75)	(1.80)	(.81)	(1.23)
Pseudo-R^2	.02	.01	.01	.07	.01	.02	.04	.01
Obs.	101	95	87	87	101	95	87	87

Notes. Same as Table 7. Each regression excludes one dependent variable.

D The Experiment

The following is an example of the questionnaire used in the experiment, in the Short treatment, followed by the instructions used in the experiment. Page breaks in the questionnaire are similar to those used in the actual experiment.

D.1 Questionnaire Part 1

QUESTIONNAIRE – PARTⅠ

Please indicate your lab id: _________

Please answer each of the following questions by checking the box of the preferred option.
If the question is selected for payment, you will get the payment specified above the question, with a payment date based on your choice and, in some cases, on chance.

Question 1

Payment: **$20.** Payment date:

Option A			Option B
2 weeks	☐	☐	75% chance of 1 week 25% chance of 5 weeks

Question 2

Payment: **$15.** Payment date:

Option A			Option B
3 weeks	☐	☐	50% chance of 1 week 50% chance of 5 weeks

Question 3

Payment: **$10.** Payment date:

Option A			Option B
2 weeks	☐	☐	50% chance of 1 week 50% chance of 3 weeks

Question 4

Payment: **$20.** Payment date:

Option A			Option B
50% chance of 2 weeks 50% chance of 3 weeks	☐	☐	75% chance of 2 weeks 25% chance of 4 weeks

Question 5

Payment: **$10.** Payment date:

Option A			Option B
50% chance of 2 weeks 50% chance of 5 weeks	☐	☐	75% chance of 3 weeks 25% chance of 5 weeks

D.2 Questionnaire Part 2

QUESTIONNAIRE – PART II

Please indicate your lab id: __________

Please answer each of the following questions by checking the box of the preferred option for every row:

Question 6

Row	**Option A**			**Option B**
1	$10.00 today	☐	☐	$10.00 in 2 weeks
2	$10.00 today	☐	☐	$10.25 in 2 weeks
3	$10.00 today	☐	☐	$10.50 in 2 weeks
4	$10.00 today	☐	☐	$10.75 in 2 weeks
5	$10.00 today	☐	☐	$11.00 in 2 weeks
6	$10.00 today	☐	☐	$11.25 in 2 weeks
7	$10.00 today	☐	☐	$11.50 in 2 weeks
8	$10.00 today	☐	☐	$11.75 in 2 weeks
9	$10.00 today	☐	☐	$12.00 in 2 weeks
10	$10.00 today	☐	☐	$12.25 in 2 weeks
11	$10.00 today	☐	☐	$12.50 in 2 weeks
12	$10.00 today	☐	☐	$12.75 in 2 weeks
13	$10.00 today	☐	☐	$13.00 in 2 weeks
14	$10.00 today	☐	☐	$13.25 in 2 weeks
15	$10.00 today	☐	☐	$13.50 in 2 weeks
16	$10.00 today	☐	☐	$13.75 in 2 weeks
17	$10.00 today	☐	☐	$14.00 in 2 weeks
18	$10.00 today	☐	☐	$14.25 in 2 weeks
19	$10.00 today	☐	☐	$14.50 in 2 weeks
20	$10.00 today	☐	☐	$14.75 in 2 weeks
21	$10.00 today	☐	☐	$15.00 in 2 weeks

Question 7

Row	**Option A**			**Option B**
1	$10.00 in 1 week	☐	☐	$10.00 in 2 weeks
2	$10.00 in 1 week	☐	☐	$10.25 in 2 weeks
3	$10.00 in 1 week	☐	☐	$10.50 in 2 weeks
4	$10.00 in 1 week	☐	☐	$10.75 in 2 weeks
5	$10.00 in 1 week	☐	☐	$11.00 in 2 weeks
6	$10.00 in 1 week	☐	☐	$11.25 in 2 weeks
7	$10.00 in 1 week	☐	☐	$11.50 in 2 weeks
8	$10.00 in 1 week	☐	☐	$11.75 in 2 weeks
9	$10.00 in 1 week	☐	☐	$12.00 in 2 weeks
10	$10.00 in 1 week	☐	☐	$12.25 in 2 weeks
11	$10.00 in 1 week	☐	☐	$12.50 in 2 weeks
12	$10.00 in 1 week	☐	☐	$12.75 in 2 weeks
13	$10.00 in 1 week	☐	☐	$13.00 in 2 weeks
14	$10.00 in 1 week	☐	☐	$13.25 in 2 weeks
15	$10.00 in 1 week	☐	☐	$13.50 in 2 weeks
16	$10.00 in 1 week	☐	☐	$13.75 in 2 weeks
17	$10.00 in 1 week	☐	☐	$14.00 in 2 weeks
18	$10.00 in 1 week	☐	☐	$14.25 in 2 weeks
19	$10.00 in 1 week	☐	☐	$14.50 in 2 weeks
20	$10.00 in 1 week	☐	☐	$14.75 in 2 weeks
21	$10.00 in 1 week	☐	☐	$15.00 in 2 weeks

Question 8

Row	**Option A**			**Option B**
1	$10.00 in 1 week	☐	☐	$10.00 in 3 weeks
2	$10.00 in 1 week	☐	☐	$10.25 in 3 weeks
3	$10.00 in 1 week	☐	☐	$10.50 in 3 weeks
4	$10.00 in 1 week	☐	☐	$10.75 in 3 weeks
5	$10.00 in 1 week	☐	☐	$11.00 in 3 weeks
6	$10.00 in 1 week	☐	☐	$11.25 in 3 weeks
7	$10.00 in 1 week	☐	☐	$11.50 in 3 weeks
8	$10.00 in 1 week	☐	☐	$11.75 in 3 weeks
9	$10.00 in 1 week	☐	☐	$12.00 in 3 weeks
10	$10.00 in 1 week	☐	☐	$12.25 in 3 weeks
11	$10.00 in 1 week	☐	☐	$12.50 in 3 weeks
12	$10.00 in 1 week	☐	☐	$12.75 in 3 weeks
13	$10.00 in 1 week	☐	☐	$13.00 in 3 weeks
14	$10.00 in 1 week	☐	☐	$13.25 in 3 weeks
15	$10.00 in 1 week	☐	☐	$13.50 in 3 weeks
16	$10.00 in 1 week	☐	☐	$13.75 in 3 weeks
17	$10.00 in 1 week	☐	☐	$14.00 in 3 weeks
18	$10.00 in 1 week	☐	☐	$14.25 in 3 weeks
19	$10.00 in 1 week	☐	☐	$14.50 in 3 weeks
20	$10.00 in 1 week	☐	☐	$14.75 in 3 weeks
21	$10.00 in 1 week	☐	☐	$15.00 in 3 weeks

Question 9

Row	Option A			Option B
1	$10.00 in 1 week	☐	☐	$10.00 in 4 weeks
2	$10.00 in 1 week	☐	☐	$10.25 in 4 weeks
3	$10.00 in 1 week	☐	☐	$10.50 in 4 weeks
4	$10.00 in 1 week	☐	☐	$10.75 in 4 weeks
5	$10.00 in 1 week	☐	☐	$11.00 in 4 weeks
6	$10.00 in 1 week	☐	☐	$11.25 in 4 weeks
7	$10.00 in 1 week	☐	☐	$11.50 in 4 weeks
8	$10.00 in 1 week	☐	☐	$11.75 in 4 weeks
9	$10.00 in 1 week	☐	☐	$12.00 in 4 weeks
10	$10.00 in 1 week	☐	☐	$12.25 in 4 weeks
11	$10.00 in 1 week	☐	☐	$12.50 in 4 weeks
12	$10.00 in 1 week	☐	☐	$12.75 in 4 weeks
13	$10.00 in 1 week	☐	☐	$13.00 in 4 weeks
14	$10.00 in 1 week	☐	☐	$13.25 in 4 weeks
15	$10.00 in 1 week	☐	☐	$13.50 in 4 weeks
16	$10.00 in 1 week	☐	☐	$13.75 in 4 weeks
17	$10.00 in 1 week	☐	☐	$14.00 in 4 weeks
18	$10.00 in 1 week	☐	☐	$14.25 in 4 weeks
19	$10.00 in 1 week	☐	☐	$14.50 in 4 weeks
20	$10.00 in 1 week	☐	☐	$14.75 in 4 weeks
21	$10.00 in 1 week	☐	☐	$15.00 in 4 weeks

Question 10

Payment: **$25.** Payment date:

Row	Option A			Option B		
1	In 3 weeks	☐	☐	0% 100%	chance of chance of	2 weeks 5 weeks
2	In 3 weeks	☐	☐	5% 95%	chance of chance of	2 weeks 5 weeks
3	In 3 weeks	☐	☐	10% 90%	chance of chance of	2 weeks 5 weeks
4	In 3 weeks	☐	☐	15% 85%	chance of chance of	2 weeks 5 weeks
5	In 3 weeks	☐	☐	20% 80%	chance of chance of	2 weeks 5 weeks
6	In 3 weeks	☐	☐	25% 75%	chance of chance of	2 weeks 5 weeks
7	In 3 weeks	☐	☐	30% 70%	chance of chance of	2 weeks 5 weeks
8	In 3 weeks	☐	☐	35% 65%	chance of chance of	2 weeks 5 weeks
9	In 3 weeks	☐	☐	40% 60%	chance of chance of	2 weeks 5 weeks
10	In 3 weeks	☐	☐	45% 55%	chance of chance of	2 weeks 5 weeks
11	In 3 weeks	☐	☐	50% 50%	chance of chance of	2 weeks 5 weeks
12	In 3 weeks	☐	☐	55% 45%	chance of chance of	2 weeks 5 weeks
13	In 3 weeks	☐	☐	60% 40%	chance of chance of	2 weeks 5 weeks
14	In 3 weeks	☐	☐	65% 35%	chance of chance of	2 weeks 5 weeks
15	In 3 weeks	☐	☐	70% 30%	chance of chance of	2 weeks 5 weeks
16	In 3 weeks	☐	☐	75% 25%	chance of chance of	2 weeks 5 weeks
17	In 3 weeks	☐	☐	80% 20%	chance of chance of	2 weeks 5 weeks
18	In 3 weeks	☐	☐	85% 15%	chance of chance of	2 weeks 5 weeks
19	In 3 weeks	☐	☐	90% 10%	chance of chance of	2 weeks 5 weeks
20	In 3 weeks	☐	☐	95% 5%	chance of chance of	2 weeks 5 weeks
21	In 3 weeks	☐	☐	100% 0%	chance of chance of	2 weeks 5 weeks

Question 11

Payment: **$25.** Payment date:

Row	Option A			Option B		
1	In 2 weeks	☐	☐	0% 100%	chance of chance of	1 week 5 weeks
2	In 2 weeks	☐	☐	5% 95%	chance of chance of	1 week 5 weeks
3	In 2 weeks	☐	☐	10% 90%	chance of chance of	1 week 5 weeks
4	In 2 weeks	☐	☐	15% 85%	chance of chance of	1 week 5 weeks
5	In 2 weeks	☐	☐	20% 80%	chance of chance of	1 week 5 weeks
6	In 2 weeks	☐	☐	25% 75%	chance of chance of	1 week 5 weeks
7	In 2 weeks	☐	☐	30% 70%	chance of chance of	1 week 5 weeks
8	In 2 weeks	☐	☐	35% 65%	chance of chance of	1 week 5 weeks
9	In 2 weeks	☐	☐	40% 60%	chance of chance of	1 week 5 weeks
10	In 2 weeks	☐	☐	45% 55%	chance of chance of	1 week 5 weeks
11	In 2 weeks	☐	☐	50% 50%	chance of chance of	1 week 5 weeks
12	In 2 weeks	☐	☐	55% 45%	chance of chance of	1 week 5 weeks
13	In 2 weeks	☐	☐	60% 40%	chance of chance of	1 week 5 weeks
14	In 2 weeks	☐	☐	65% 35%	chance of chance of	1 week 5 weeks
15	In 2 weeks	☐	☐	70% 30%	chance of chance of	1 week 5 weeks
16	In 2 weeks	☐	☐	75% 25%	chance of chance of	1 week 5 weeks
17	In 2 weeks	☐	☐	80% 20%	chance of chance of	1 week 5 weeks
18	In 2 weeks	☐	☐	85% 15%	chance of chance of	1 week 5 weeks
19	In 2 weeks	☐	☐	90% 10%	chance of chance of	1 week 5 weeks
20	In 2 weeks	☐	☐	95% 5%	chance of chance of	1 week 5 weeks
21	In 2 weeks	☐	☐	100% 0%	chance of chance of	1 week 5 weeks

D.3 Questionnaire Part 3

QUESTIONNAIRE – PART III

Please indicate your lab id: __________

Please answer each of the following questions by checking the box of the preferred option for every row:

Question 12

Row	Option A					
1	$15	☐	☐	0% 100%	chance of chance of	$20 $8
2	$15	☐	☐	5% 95%	chance of chance of	$20 $8
3	$15	☐	☐	10% 90%	chance of chance of	$20 $8
4	$15	☐	☐	15% 85%	chance of chance of	$20 $8
5	$15	☐	☐	20% 80%	chance of chance of	$20 $8
6	$15	☐	☐	25% 75%	chance of chance of	$20 $8
7	$15	☐	☐	30% 70%	chance of chance of	$20 $8
8	$15	☐	☐	35% 65%	chance of chance of	$20 $8
9	$15	☐	☐	40% 60%	chance of chance of	$20 $8
10	$15	☐	☐	45% 55%	chance of chance of	$20 $8
11	$15	☐	☐	50% 50%	chance of chance of	$20 $8
12	$15	☐	☐	55% 45%	chance of chance of	$20 $8
13	$15	☐	☐	60% 40%	chance of chance of	$20 $8
14	$15	☐	☐	65% 35%	chance of chance of	$20 $8
15	$15	☐	☐	70% 30%	chance of chance of	$20 $8
16	$15	☐	☐	75% 25%	chance of chance of	$20 $8
17	$15	☐	☐	80% 20%	chance of chance of	$20 $8
18	$15	☐	☐	85% 15%	chance of chance of	$20 $8
19	$15	☐	☐	90% 10%	chance of chance of	$20 $8
20	$15	☐	☐	95% 5%	chance of chance of	$20 $8
21	$15	☐	☐	100% 0%	chance of chance of	$20 $8

Question 13

Row	Option A					Option B		
1	50%	chance of	$15	☐	☐	0%	chance of	$20
	50%	chance of	$8			100%	chance of	$8
2	50%	chance of	$15	☐	☐	5%	chance of	$20
	50%	chance of	$8			95%	chance of	$8
3	50%	chance of	$15	☐	☐	10%	chance of	$20
	50%	chance of	$8			90%	chance of	$8
4	50%	chance of	$15	☐	☐	15%	chance of	$20
	50%	chance of	$8			85%	chance of	$8
5	50%	chance of	$15	☐	☐	20%	chance of	$20
	50%	chance of	$8			80%	chance of	$8
6	50%	chance of	$15	☐	☐	25%	chance of	$20
	50%	chance of	$8			75%	chance of	$8
7	50%	chance of	$15	☐	☐	30%	chance of	$20
	50%	chance of	$8			70%	chance of	$8
8	50%	chance of	$15	☐	☐	35%	chance of	$20
	50%	chance of	$8			65%	chance of	$8
9	50%	chance of	$15	☐	☐	40%	chance of	$20
	50%	chance of	$8			60%	chance of	$8
10	50%	chance of	$15	☐	☐	45%	chance of	$20
	50%	chance of	$8			55%	chance of	$8
11	50%	chance of	$15	☐	☐	50%	chance of	$20
	50%	chance of	$8			50%	chance of	$8
12	50%	chance of	$15	☐	☐	55%	chance of	$20
	50%	chance of	$8			45%	chance of	$8
13	50%	chance of	$15	☐	☐	60%	chance of	$20
	50%	chance of	$8			40%	chance of	$8
14	50%	chance of	$15	☐	☐	65%	chance of	$20
	50%	chance of	$8			35%	chance of	$8
15	50%	chance of	$15	☐	☐	70%	chance of	$20
	50%	chance of	$8			30%	chance of	$8
16	50%	chance of	$15	☐	☐	75%	chance of	$20
	50%	chance of	$8			25%	chance of	$8
17	50%	chance of	$15	☐	☐	80%	chance of	$20
	50%	chance of	$8			20%	chance of	$8
18	50%	chance of	$15	☐	☐	85%	chance of	$20
	50%	chance of	$8			15%	chance of	$8
19	50%	chance of	$15	☐	☐	90%	chance of	$20
	50%	chance of	$8			10%	chance of	$8
20	50%	chance of	$15	☐	☐	95%	chance of	$20
	50%	chance of	$8			5%	chance of	$8
21	50%	chance of	$15	☐	☐	100%	chance of	$20
	50%	chance of	$8			0%	chance of	$8

Question 14

Row	Option A					Option B		
1	20%	chance of	$15	☐	☐	0%	chance of	$20
	80%	chance of	$8			100%	chance of	$8
2	20%	chance of	$15	☐	☐	5%	chance of	$20
	80%	chance of	$8			95%	chance of	$8
3	20%	chance of	$15	☐	☐	10%	chance of	$20
	80%	chance of	$8			90%	chance of	$8
4	20%	chance of	$15	☐	☐	15%	chance of	$20
	80%	chance of	$8			85%	chance of	$8
5	20%	chance of	$15	☐	☐	20%	chance of	$20
	80%	chance of	$8			80%	chance of	$8
6	20%	chance of	$15	☐	☐	25%	chance of	$20
	80%	chance of	$8			75%	chance of	$8
7	20%	chance of	$15	☐	☐	30%	chance of	$20
	80%	chance of	$8			70%	chance of	$8
8	20%	chance of	$15	☐	☐	35%	chance of	$20
	80%	chance of	$8			65%	chance of	$8
9	20%	chance of	$15	☐	☐	40%	chance of	$20
	80%	chance of	$8			60%	chance of	$8
10	20%	chance of	$15	☐	☐	45%	chance of	$20
	80%	chance of	$8			55%	chance of	$8
11	20%	chance of	$15	☐	☐	50%	chance of	$20
	80%	chance of	$8			50%	chance of	$8
12	20%	chance of	$15	☐	☐	55%	chance of	$20
	80%	chance of	$8			45%	chance of	$8
13	20%	chance of	$15	☐	☐	60%	chance of	$20
	80%	chance of	$8			40%	chance of	$8
14	20%	chance of	$15	☐	☐	65%	chance of	$20
	80%	chance of	$8			35%	chance of	$8
15	20%	chance of	$15	☐	☐	70%	chance of	$20
	80%	chance of	$8			30%	chance of	$8
16	20%	chance of	$15	☐	☐	75%	chance of	$20
	80%	chance of	$8			25%	chance of	$8
17	20%	chance of	$15	☐	☐	80%	chance of	$20
	80%	chance of	$8			20%	chance of	$8
18	20%	chance of	$15	☐	☐	85%	chance of	$20
	80%	chance of	$8			15%	chance of	$8
19	20%	chance of	$15	☐	☐	90%	chance of	$20
	80%	chance of	$8			10%	chance of	$8
20	20%	chance of	$15	☐	☐	95%	chance of	$20
	80%	chance of	$8			5%	chance of	$8
21	20%	chance of	$15	☐	☐	100%	chance of	$20
	80%	chance of	$8			0%	chance of	$8

Question 15

Row	Option A			Option B		
1	$20	☐	☐	0% 100%	chance of chance of	$30 $5
2	$20	☐	☐	5% 95%	chance of chance of	$30 $5
3	$20	☐	☐	10% 90%	chance of chance of	$30 $5
4	$20	☐	☐	15% 85%	chance of chance of	$30 $5
5	$20	☐	☐	20% 80%	chance of chance of	$30 $5
6	$20	☐	☐	25% 75%	chance of chance of	$30 $5
7	$20	☐	☐	30% 70%	chance of chance of	$30 $5
8	$20	☐	☐	35% 65%	chance of chance of	$30 $5
9	$20	☐	☐	40% 60%	chance of chance of	$30 $5
10	$20	☐	☐	45% 55%	chance of chance of	$30 $5
11	$20	☐	☐	50% 50%	chance of chance of	$30 $5
12	$20	☐	☐	55% 45%	chance of chance of	$30 $5
13	$20	☐	☐	60% 40%	chance of chance of	$30 $5
14	$20	☐	☐	65% 35%	chance of chance of	$30 $5
15	$20	☐	☐	70% 30%	chance of chance of	$30 $5
16	$20	☐	☐	75% 25%	chance of chance of	$30 $5
17	$20	☐	☐	80% 20%	chance of chance of	$30 $5
18	$20	☐	☐	85% 15%	chance of chance of	$30 $5
19	$20	☐	☐	90% 10%	chance of chance of	$30 $5
20	$20	☐	☐	95% 5%	chance of chance of	$30 $5
21	$20	☐	☐	100% 0%	chance of chance of	$30 $5

Question 16

Row	Option A					Option B		
1	50%	chance of	$20	☐	☐	0%	chance of	$30
	50%	chance of	$5			100%	chance of	$3
2	50%	chance of	$20	☐	☐	5%	chance of	$30
	50%	chance of	$5			95%	chance of	$3
3	50%	chance of	$20	☐	☐	10%	chance of	$30
	50%	chance of	$5			90%	chance of	$3
4	50%	chance of	$20	☐	☐	15%	chance of	$30
	50%	chance of	$5			85%	chance of	$3
5	50%	chance of	$20	☐	☐	20%	chance of	$30
	50%	chance of	$5			80%	chance of	$3
6	50%	chance of	$20	☐	☐	25%	chance of	$30
	50%	chance of	$5			75%	chance of	$3
7	50%	chance of	$20	☐	☐	30%	chance of	$30
	50%	chance of	$5			70%	chance of	$3
8	50%	chance of	$20	☐	☐	35%	chance of	$30
	50%	chance of	$5			65%	chance of	$3
9	50%	chance of	$20	☐	☐	40%	chance of	$30
	50%	chance of	$5			60%	chance of	$3
10	50%	chance of	$20	☐	☐	45%	chance of	$30
	50%	chance of	$5			55%	chance of	$3
11	50%	chance of	$20	☐	☐	50%	chance of	$30
	50%	chance of	$5			50%	chance of	$3
12	50%	chance of	$20	☐	☐	55%	chance of	$30
	50%	chance of	$5			45%	chance of	$3
13	50%	chance of	$20	☐	☐	60%	chance of	$30
	50%	chance of	$5			40%	chance of	$3
14	50%	chance of	$20	☐	☐	65%	chance of	$30
	50%	chance of	$5			35%	chance of	$3
15	50%	chance of	$20	☐	☐	70%	chance of	$30
	50%	chance of	$5			30%	chance of	$3
16	50%	chance of	$20	☐	☐	75%	chance of	$30
	50%	chance of	$5			25%	chance of	$3
17	50%	chance of	$20	☐	☐	80%	chance of	$30
	50%	chance of	$5			20%	chance of	$3
18	50%	chance of	$20	☐	☐	85%	chance of	$30
	50%	chance of	$5			15%	chance of	$3
19	50%	chance of	$20	☐	☐	90%	chance of	$30
	50%	chance of	$5			10%	chance of	$3
20	50%	chance of	$20	☐	☐	95%	chance of	$30
	50%	chance of	$5			5%	chance of	$3
21	50%	chance of	$20	☐	☐	100%	chance of	$30
	50%	chance of	$5			0%	chance of	$3

Question 17

Row	Option A					Option B		
1	10%	chance of	$20	☐	☐	0%	chance of	$30
	90%	chance of	$5			100%	chance of	$3
2	10%	chance of	$20	☐	☐	5%	chance of	$30
	90%	chance of	$5			95%	chance of	$3
3	10%	chance of	$20	☐	☐	10%	chance of	$30
	90%	chance of	$5			90%	chance of	$3
4	10%	chance of	$20	☐	☐	15%	chance of	$30
	90%	chance of	$5			85%	chance of	$3
5	10%	chance of	$20	☐	☐	20%	chance of	$30
	90%	chance of	$5			80%	chance of	$3
6	10%	chance of	$20	☐	☐	25%	chance of	$30
	90%	chance of	$5			75%	chance of	$3
7	10%	chance of	$20	☐	☐	30%	chance of	$30
	90%	chance of	$5			70%	chance of	$3
8	10%	chance of	$20	☐	☐	35%	chance of	$30
	90%	chance of	$5			65%	chance of	$3
9	10%	chance of	$20	☐	☐	40%	chance of	$30
	90%	chance of	$5			60%	chance of	$3
10	10%	chance of	$20	☐	☐	45%	chance of	$30
	90%	chance of	$5			55%	chance of	$3
11	10%	chance of	$20	☐	☐	50%	chance of	$30
	90%	chance of	$5			50%	chance of	$3
12	10%	chance of	$20	☐	☐	55%	chance of	$30
	90%	chance of	$5			45%	chance of	$3
13	10%	chance of	$20	☐	☐	60%	chance of	$30
	90%	chance of	$5			40%	chance of	$3
14	10%	chance of	$20	☐	☐	65%	chance of	$30
	90%	chance of	$5			35%	chance of	$3
15	10%	chance of	$20	☐	☐	70%	chance of	$30
	90%	chance of	$5			30%	chance of	$3
16	10%	chance of	$20	☐	☐	75%	chance of	$30
	90%	chance of	$5			25%	chance of	$3
17	10%	chance of	$20	☐	☐	80%	chance of	$30
	90%	chance of	$5			20%	chance of	$3
18	10%	chance of	$20	☐	☐	85%	chance of	$30
	90%	chance of	$5			15%	chance of	$3
19	10%	chance of	$20	☐	☐	90%	chance of	$30
	90%	chance of	$5			10%	chance of	$3
20	10%	chance of	$20	☐	☐	95%	chance of	$30
	90%	chance of	$5			5%	chance of	$3
21	10%	chance of	$20	☐	☐	100%	chance of	$30
	90%	chance of	$5			0%	chance of	$3

D.4 Instructions: General Instructions

INSTRUCTIONS

OVERVIEW

This is an experiment in the economics of decision-making. The instructions are simple, and if you follow them carefully you may earn a considerable amount of money.

There are **three** parts in this experiment. In each part, you will be asked to answer some questions in a questionnaire that we will distribute. Please answer **all** the questions. We will hand out specific instructions for each part before it begins, and we will read these instructions aloud and answer any question you may have. After you have filled out the questionnaire of a given part, please put it to the side to indicate that you are done.

In the first page of all questionnaires you will be asked to write your '**lab id**. This is the identifier given to you by the Wharton Behavioral Lab. Please write this number on all questionnaires: this will be essential to ensure appropriate payment.

After you have answered all the questions in the experiment, we will ask you a brief survey with some additional questions about your experience.

Notice that in this experiment **there are no right or wrong answers**. We are interested in studying **your preferences**.

CHANCE

As we shall describe in details in each part of the experiment, some of the options you will be offered during the experiment return a payment that depends on **chance**. In particular, chance might determine the amount of cash that a given option pays, or the date on which this payment will be made.

For example, you might face an option that returns benefit A with probability 50%, and benefit B with probability 50%.

To determine this, we will use the **roll of a die**. In particular, after all three parts of the experiment are completed, at the very end of the experiment, one of the participants will be randomly selected to act as the **assistant**, and his/her task will be exactly to roll a die to determine the benefits returned by a given option.

To illustrate, consider the example above the option that returns benefit A with probability 50%, and benefit B with probability 50%. Then, the assistant will roll a 6-faced die, and if he/she obtains faces 1-2-3 you will receive benefit A; if instead he/she obtains faces 4-5-6, you will receive benefit B.

Depending on the questions, the probabilities involved could be different e.g., 5%, 30%, etc. but the outcome will always be determined by the roll of a die. We may use a 6-faced, 8-faced, 10-faced, or 12-faced dice depending on the question. You will be able to observe this process, and, if you wish, to inspect the dice used by the assistant.

PAYMENTS

Your payoff in the experiment will be determined as follows:

- After youve answered all the questions in all parts of the experiments, we will choose randomly, with equal probability, one question from all the questions youve answered. This will be done by the roll of a die by the assistant, as described above. You will then receive the benefit paid by the option that you have chosen for that question (which may depend on chance).

- Your total earning will consist of the amounts above plus a $10 participation fee if you complete the experiment. This participation fee will paid to you at the end of the experiment **today** independently of the benefit received in the rest of the experiment. The benefit paid by the selected option could either be paid today, or be paid in the future, depending on the question.

PAYMENTS IN FUTURE DATES

Some of the options in the experiment involve payments to be made in **future** dates. For example, you might face an option that pays $15 in 2 weeks. To receive this payment, you will be allowed to pick up the cash from **this** lab, at any point during office hours starting from the day specified onwards.

For example, if you receive the option that pays $15 in 2 weeks, you can come and pick up the cash in this lab at any point during office hours, starting from 2 weeks from today.

You will receive an email to remind you of the approaching date. All possible payment dates will coincide with a day that the school is open.

To guarantee an accurate payment, we will save all the payment information until the date of the payment, but we will keep it **separately** from the rest of the data collected from the experiment, and it will be destroyed once all payments have been made.

You will also be provided with the contact details of Prof. **Daniel Gottlieb**, who is one of the persons conducting this research, and who will be responsible to ensure that you receive your payment. Please feel free to contact Prof. Gottlieb if any problem arises with your payment.

D.5 Instructions for Part 1

Instructions for Part I

There are 5 questions in this part. Please answer all of them. In each question you are asked to choose between two options by checkmarking your preferred one. If this question is selected for payment, the chosen option will pay a given amount of money on some date of the future.

The questions may look similar to this:

Question EXAMPLE

Payment: **$16.** Payment date:

Option A			Option B
13 days	☐	☐	75% chance of 20 days 25% chance of 10 days

Both options above will pay $16, as written above the question. Where they differ is on the date of the future payment.

Option A above will pay in 13 days. This means that if you choose this option, and this question is selected for payment, then you will receive $16 in 13 days.

Option B instead involves a payment date that will depend on chance: it above pays in 10 days with probability 25%, and in 20 days with probability 75%. If you choose this option, and this question is selected for payment, then chance will determine the payment date.

Recall that this payment date will be determined by the roll of a die done at the end of the experiment. At that point you will learn the payment date and the amount. This means that even if this date of payment is unknown before you answer, **at the end of the experiment you will learn exactly when the payment will be made.**

D.6 Instructions for Part 2

Instructions for Part II

There are 6 questions in this part. Each question is a list of **21 choices**, one in each row. For each decision row you will be asked to choose either Option A, on the left, or Option B, on the right. You make your decision by checking the box next to the option that you want. You may choose Option A for some decision rows and Option B for other rows.

In all questions, the 21 choices are presented as a list, in which Option A (on the left) **remains the same**, while Option B (on the right) **changes in each row**. For example, you might face the following question:

Row	**Option A**			**Option B**
1	\$8.00 in 10 days	☐	☐	\$8.00 in 20 days
2	\$8.00 in 10 days	☐	☐	\$8.25 in 20 days
3	\$8.00 in 10 days	☐	☐	\$8.50 in 20 days
4	\$8.00 in 10 days	☐	☐	\$8.75 in 20 days
5	\$8.00 in 10 days	☐	☐	\$9.00 in 20 days
6	\$8.00 in 10 days	☐	☐	\$9.25 in 20 days
7	\$8.00 in 10 days	☐	☐	\$9.50 in 20 days
8	\$8.00 in 10 days	☐	☐	\$9.75 in 20 days
9	\$8.00 in 10 days	☐	☐	\$10.00 in 20 days
10	\$8.00 in 10 days	☐	☐	\$10.25 in 20 days
11	\$8.00 in 10 days	☐	☐	\$10.50 in 20 days
12	\$8.00 in 10 days	☐	☐	\$10.75 in 20 days
13	\$8.00 in 10 days	☐	☐	\$11.00 in 20 days
14	\$8.00 in 10 days	☐	☐	\$11.25 in 20 days
15	\$8.00 in 10 days	☐	☐	\$11.50 in 20 days
16	\$8.00 in 10 days	☐	☐	\$11.75 in 20 days
17	\$8.00 in 10 days	☐	☐	\$12.00 in 20 days
18	\$8.00 in 10 days	☐	☐	\$12.25 in 20 days
19	\$8.00 in 10 days	☐	☐	\$12.50 in 20 days
20	\$8.00 in 10 days	☐	☐	\$12.75 in 20 days
21	\$8.00 in 10 days	☐	☐	\$13.00 in 20 days

As you can see, Option A, on the left is always the same, while Option B, on the right, changes: the amount of money it pays **increases** as you proceed down the rows. Your task is to choose **in each row** whether you prefer Option A or Option B.

Some of these questions, like the ones above, involve different amounts to be paid at different dates. These dates could be in the future, or could be marked as ‘today: in this case, they would be paid at the end of the experiment today.

Other questions involve a fixed amount of money to be paid, but with a payment date that depends on **chance**. Consider for example the following question:
Payment: **$15.** Payment date:

Row	Option A			Option B		
1	In 28 days	☐	☐	0% 100%	chance of chance of	15 days 45 days
2	In 28 days	☐	☐	5% 95%	chance of chance of	15 days 45 days
3	In 28 days	☐	☐	10% 90%	chance of chance of	15 days 45 days
4	In 28 days	☐	☐	15% 85%	chance of chance of	15 days 45 days
5	In 28 days	☐	☐	20% 80%	chance of chance of	15 days 45 days
6	In 28 days	☐	☐	25% 75%	chance of chance of	15 days 45 days
7	In 28 days	☐	☐	30% 70%	chance of chance of	15 days 45 days
8	In 28 days	☐	☐	35% 65%	chance of chance of	15 days 45 days
9	In 28 days	☐	☐	40% 60%	chance of chance of	15 days 45 days
10	In 28 days	☐	☐	45% 55%	chance of chance of	15 days 45 days
11	In 28 days	☐	☐	50% 50%	chance of chance of	15 days 45 days
12	In 28 days	☐	☐	55% 45%	chance of chance of	15 days 45 days
13	In 28 days	☐	☐	60% 40%	chance of chance of	15 days 45 days
14	In 28 days	☐	☐	65% 35%	chance of chance of	15 days 45 days
15	In 28 days	☐	☐	70% 30%	chance of chance of	15 days 45 days
16	In 28 days	☐	☐	75% 25%	chance of chance of	15 days 45 days
17	In 28 days	☐	☐	80% 20%	chance of chance of	15 days 45 days
18	In 28 days	☐	☐	85% 15%	chance of chance of	15 days 45 days
19	In 28 days	☐	☐	90% 10%	chance of chance of	15 days 45 days
20	In 28 days	☐	☐	95% 5%	chance of chance of	15 days 45 days
21	In 28 days	☐	☐	100% 0%	chance of chance of	15 days 45 days

In this question, all options available involve a payment of a fixed amount of money, \$15, as written on top. In the case of Option A, in all rows the payment will be made in 28 days. In the case of Option B the payment date will instead depend on chance: for example, Option B in row 17 involves a payment in 15 days with probability 80

Notice that as we proceed down the rows, Option B changes by **increasing the probability that the payment is made on the sooner date**.

If one of these questions is selected for payment at the end of the experiment, then one row will then be chosen randomly, with equal probability, using the roll of a die (made by the assistant). You will then receive the Option you have selected for that row. If the Option you have selected depends on chance, as in Options B in the example above, then again this will be resolved using the roll of a die made by the assistant (just like in the rest of the experiment).

Finally, recall that in this experiment **there are no right or wrong answers**. We are interested in studying **your preferences**.

D.7 Instructions for Part 3

Instructions for Part III

There are 6 questions in this part. As opposed to the previous parts of the experiment, in this part all questions involve options that, if selected for payment, will be paid out **today** at the end of the experiment. Like in Part II, each question is a list of **21 choices**, one in each row. Again, for each decision row you will be asked to choose either Option A, on the left, or Option B, on the right. As before, in all questions Option A remains the same, while Option B varies.

Consider for example the following question:

Row	Option A					
1	$9	☐	☐	0% 100%	chance of chance of	$15 $4
2	$9	☐	☐	5% 95%	chance of chance of	$15 $4
3	$9	☐	☐	10% 90%	chance of chance of	$15 $4
4	$9	☐	☐	15% 85%	chance of chance of	$15 $4
5	$9	☐	☐	20% 80%	chance of chance of	$15 $4
6	$9	☐	☐	25% 75%	chance of chance of	$15 $4
7	$9	☐	☐	30% 70%	chance of chance of	$15 $4
8	$9	☐	☐	35% 65%	chance of chance of	$15 $4
9	$9	☐	☐	40% 60%	chance of chance of	$15 $4
10	$9	☐	☐	45% 55%	chance of chance of	$15 $4
11	$9	☐	☐	50% 50%	chance of chance of	$15 $4
12	$9	☐	☐	55% 45%	chance of chance of	$15 $4
13	$9	☐	☐	60% 40%	chance of chance of	$15 $4
14	$9	☐	☐	65% 35%	chance of chance of	$15 $4
15	$9	☐	☐	70% 30%	chance of chance of	$15 $4
16	$9	☐	☐	75% 25%	chance of chance of	$15 $4
17	$9	☐	☐	80% 20%	chance of chance of	$15 $4
18	$9	☐	☐	85% 15%	chance of chance of	$15 $4
19	$9	☐	☐	90% 10%	chance of chance of	$15 $4
20	$9	☐	☐	95% 5%	chance of chance of	$15 $4
21	$9	☐	☐	100% 0%	chance of chance of	$15 $4

As you can see, in this question Option A remains the same in all rows, at \$9, while Option B varies: it pays an amount of dollars that depends on **chance**. It pays two different amounts, \$4 and \$15, with varying probabilities. In particular, as we proceed down the rows, **the probability of receiving the higher payment increases**. This means that, as we proceed down the rows, Option B pays the higher amount with a higher and higher probability. In particular, notice that in the **first** row Option B pays **with certainty \$4**, while in the **last** row it pays **with certainty \$15**. Your task is to choose **in each row** whether you prefer Option A or Option B.

Notice that in the example above, Option A does not depend on chance. However, there will be questions in this part in which also Option A depends on chance.

If one of these questions is selected for payment at the end of the experiment, then one row will be selected at random, with equal probability. This will be done again using the roll of a die (made by the assistant). You will then receive the option you have selected for that row. If this option involves chance, this will also be resolved using the roll of a die (made by the assistant). For example, if you choose 80% chance of \$15 and 20% chance of \$4 for row 17, and this question and this row are selected for payment, then with probability 80% you will receive \$15, while with probability 20% you will receive \$4. These payments will be made today at the end of the experiment.

Finally, recall that in this experiment **there are no right or wrong answers**. We are interested in studying **your preferences**.