# APPENDIX - NOT FOR PUBLICATION

## A Theoretical Structure and Identification Appendix

In the intertemporal allocation of effort and money, discounting and additional parameters can be identified at either the aggregate or individual level under various structural assumptions. In the following three appendix subsections we describe our theoretical environment, explore the demand for commitment, demonstrate which experimental variation provides identification of specific parameters of interest, and lay out methodology for estimation. A fourth subsection presents estimation details for monetary discounting.

### A.1 Effort Discounting

#### A.1.1 Allocation Timing

In the working over time experiment, subjects allocate effort to an earlier date, $e_t$, and a later date, $e_{t+k}$, subject to the intertemporal budget constraint described in (1). Subjects make allocations at two points in time, one at time $s < t$, and one at time $t$. The allocation-that-counts is randomly implemented from time $s$ with probability $p$ and from time $t$ with probability $1-p$.[60] Let $e_{t,s}$ be the allocation of effort to time $t$ chosen at time $s$. Let $e^{s*}_{t,t}$ be the allocation of effort to time $t$ forecasted to be chosen at time $t$ from the perspective of time $s$. That is, $e^{s*}_{t,t}$ captures what an individual at time $s$ believes they will optimally choose at time $t$.

#### A.1.2 Preferences

To develop our theory, we assume an instantaneous cost function, $c(e)$, for effort, $e$, that is time separable, stationary, and of an expected utility form with respect to the probability that an allocation is implemented. To aid our development and foreshadow our empirical

[60]We abstract from the fact that subjects make multiple allocations. Given the assumed separability over time and in probabilities, this abstraction is innocuous.

implementation we also make a functional form assumption for the shape of $c(\cdot)$. We assume

$$c(e) = (e + \omega)^\gamma,$$

where $\gamma > 1$ represents the stationary parameter on the convex instantaneous cost of effort function. The additive term $\omega$ in the cost function could be interpreted as a Stone-Geary minimum or as some background level of required work. Such parameters are used in monetary discounting studies (Andersen et al., 2008; Andreoni and Sprenger, 2012a), and are either taken from some external data source on background consumption or estimated from experimental choices. For simplicity, we interpret $\omega$ as the required minimum work of the experiment and set $\omega = 10$ for our effort analysis.[61]

We assume discounting follows the quasi-hyperbolic partially sophisticated form proposed by O'Donoghue and Rabin (2001). For two periods, $t$ and $t + k$, discounting, $D(t, t + k)$, is captured by

$$D(t, t+k) = \begin{cases} \beta\delta^k & \text{if } k > 0 \\ 1 & \text{if } k = 0. \end{cases}$$

The parameter $\beta$ captures the degree of present bias while the parameter $\delta$ captures long run discounting. $\beta = 1$ nests the standard model of exponential discounting. From period $s < t$, the discounted costs of effort at times $t$ and $t + k$ can be written as

$$\beta\delta^{t-s}(e_{t,s} + \omega)^\gamma + \beta\delta^{t+k-s}(e_{t+k,s} + \omega)^\gamma.$$

[61] Andreoni and Sprenger (2012a) provide estimates for $\omega$ based on non-linear least squares techniques and analyze the extent to which different assumptions for $\omega$ influence remaining parameter estimates. Though utility curvature and discounting are sensitive to varying assumptions for $\omega$, present bias, $\beta$, is largely unaffected. Andersen et al. (2008) also provide some sensitivity analysis.

Eliminating common terms, the decision problem at time $s$ can be written as

$$\begin{aligned} min_{e_{t,s}.e_{t+k,s}} \quad & p \cdot [(e_{t,s} + \omega)^{\gamma} + \delta^k (e_{t+k,s} + \omega)^{\gamma}] + \\ & (1-p) \cdot [(e^{s*}_{t,t} + \omega)^{\gamma} + \delta^k (e^{s*}_{t+k,t} + \omega)^{\gamma}] \\ s.t. \quad & e_{t,s} + R \cdot e_{t+k,s} = m, \end{aligned}$$

which yields the intertemporal Euler equation satisfied by the optimal allocation, $(e^*_{t,s}, e^*_{t+k,s})$,

$$(\frac{e^*_{t,s} + \omega}{e^*_{t+k,s} + \omega})^{\gamma-1} \frac{1}{\delta^k} = \frac{1}{R}.$$

Note that the forecasted allocation, $(e^{s*}_{t,t}, e^{s*}_{t+k,t})$, and the probability of implementation, $p$, do not feature in the intertemporal Euler due to the assumed separability. Similarly, the decision problem at time $t$ can be written

$$\begin{aligned} min_{e_{t,t}.e_{t+k,t}} \quad & p \cdot [(e^*_{t,s} + \omega)^{\gamma} + \beta\delta^k (e^*_{t+k,s} + \omega)^{\gamma}] + \\ & (1-p) \cdot [[(e_{t,t} + \omega)^{\gamma} + \beta\delta^k (e_{t+k,t} + \omega)^{\gamma}]] \\ s.t. \quad & e_{t,t} + R \cdot e_{t+k,t} = m, \end{aligned}$$

with corresponding Euler equation satisfied by the optimal allocation, $(e^*_{t,t}, e^*_{t+k,t})$,

$$(\frac{e^*_{t,t} + \omega}{e^*_{t+k,t} + \omega})^{\gamma-1} \frac{1}{\beta\delta^k} = \frac{1}{R}$$

The prior allocation, $(e^*_{t,s}, e^*_{t+k,s})$, and the probability of implementation do not feature in the intertemporal Euler. Any differences in allocations between time $s$ and time $t$ are delivered by the present bias term, $\beta$.[62]

[62] A recent discussion of non-expected utility behavior in intertemporal settings has demonstrated that apparently present-biased behavior can be delivered by deviations from expected utility (see, e.g., Halevy, 2008). Under discounted expected utility, allocations over two periods should depend on the ratio of probabilities with which the allocations are realized. In two important conditions Andreoni and Sprenger (2012b) demonstrate in the monetary domain that if sooner and later payments are paid independently with probability 0.5, behavior deviates from the common ratio counterpart of all payments being certain. Under expected utility and atempo-

Combining our Euler equations we have

$$(\frac{e^*_{t,D}+\omega}{e^*_{t+k,D}+\omega})^{\gamma-1}\frac{1}{\beta^{\mathbf{1}_{D=t}}\delta^k}=\frac{1}{R} \tag{7}$$

where $D \in \{s,t\}$ represents whether the allocation decision was made at time $t$ or time $s$. Note that for $\beta < 1$, an allocation made at time $t$ at a given $R$ will have a lower value of $e^*_{t,D}$ than an allocation made at time $s$. A present-biased individual allocates less work to time $t$ at time $t$ than they did at time $s$.

Naturally, the prediction that dynamically inconsistent behavior depends only on $\beta$ relies on the assumption of a stationary cost function. Changes in the cost function through time could easily lead to differences in allocations between time $s$ and $t$. Such changing costs could be delivered by a variety of sources. For example, there could be permanent shocks to the cost function, perhaps due to a misforecasting of task difficulty. There could also be temporary shocks due to some random events that impose time constraints or leave subjects more tired and exhausted than they normally are. In section C we address these concerns directly and provide evidence that such possibilities are unlikely to drive observed behavior.

#### A.1.3 Partial Sophistication

We allow for the fact that individuals may be partially sophisticated with respect to their own present bias. The nature of sophistication follows that of O'Donoghue and Rabin (2001), where $\widehat{\beta}$ captures the belief an individual has on his future present bias: $\widehat{\beta}=\beta$ represents full sophistication, $\widehat{\beta}=1$ represents full naivete, and $\widehat{\beta}\in(\beta,1)$ represents partial sophistication.

ral applications of prospect theory, the deviations cannot be rationalized. An intuition for the effect is that the independent payment probabilities give subjects the opportunity to hedge through time. Cheung (Forthcoming) and Miao and Zhong (2012) demonstrate the importance of this intuition, as they show in the Andreoni and Sprenger (2012b) setup that when one makes the two 0.5 realization probabilities perfectly correlated behavior is closer to the expected utility benchmark. In our environment, the implementation probability applies equally to both the sooner and later work date, creating perfect correlation through time. Hence, the effects of Andreoni and Sprenger (2012b) are unlikely to be present. Additionally, because the same implementation probability applies to both work dates, any non-linear treatment of $p$ or $1-p$ must be applied equally, and so drop out of marginal conditions in exactly the same way that undistorted probabilities do. Further potential concerns with respect to the asymmetry of $p$ and $1-p$ in the design are addressed in our replication exercise where initial and subsequent allocations are implemented with equal probability. See section 3.5 for detail.

This means that allocations at time $t$, forecasted at time $s < t$ are

$$
\begin{aligned}
(e^{s*}_{t,t}, e^{s*}_{t+k,t}) = \quad & argmin\ p \cdot [(e^{*}_{t,s} + \omega)^{\gamma} + \widehat{\beta}\delta^{k}(e^{*}_{t+k,s} + \omega)^{\gamma}] + \\
& (1-p) \cdot [(e^{s}_{t,t} + \omega)^{\gamma} + \widehat{\beta}\delta^{k}(e^{s}_{t+k,t} + \omega)^{\gamma}] \\
s.t. \quad & \qquad e^{s}_{t,t} + R \cdot e^{s}_{t+k,t} = m.
\end{aligned}
$$

If $\widehat{\beta} \in (\beta, 1]$ an individual's forecasted allocation, $(e^{s*}_{t,t}, e^{s*}_{t+k,t})$ will not accord with their actual subsequent allocation, $(e^{*}_{t,t}, e^{*}_{t+k,t})$.

Note the sophistication parameter, $\widehat{\beta}$ is absent from the Euler formulations above. This is by construction both in the theory and the experimental design. An individual at time $s$ may forecast a level of present bias at time $t$ but is incapable of controlling behavior at that point in time. More importantly, this forecasted present bias at time $t$ does not influence his behavior at time $s$. The only actions available to the time $t$ self is to complete the time $s$ allocation with probability $p$, complete the time $t$ allocation with probability $1 - p$, or opt out of the experiment, foregoing \$90. Given the high penalty, an individual at time $s$ can appropriately forecast the third action will not be taken. The individual is aware that he cannot control the second action. Hence, he optimizes according to his time $s$ preference as above with $\widehat{\beta}$ absent from the formulation. The parameter $\widehat{\beta}$ will be important for our analysis of commitment in which an individual at time $s$ may indeed control time $t$ behavior.

## A.2 Commitment

In the second block of the experiment subjects are offered a probabilistic commitment device. The commitment device favors the initial allocations made at time $s$ over the subsequent allocations made at time $t$ by changing the time $s$ implementation probability from $p$ to $1 - p$ (i.e. from 0.1 to 0.9).

Recall that intertemporal Euler equations and allocations are independent of implementation probabilities. Hence, the value of commitment can be arrived at by comparing discounted costs. An individual prefers to commit if the discounted costs of the chosen allocation at time $s$ are smaller than the discounted costs of the forecasted allocation for time $t$ at time $s$.[63] The value of commitment is given as

$$V = (1 - 2p) \cdot \beta\delta^{t-s} \cdot \{[(e^{s*}_{t,t} + \omega)^\gamma + \delta^k c(e^{s*}_{t+k,t} + \omega)^\gamma] - [(e^*_{t,s} + \omega)^\gamma + \delta^k c(e^*_{t+k,s} + \omega)^\gamma]\}.$$

Note that the value of commitment, $V$, depends upon both actual allocations and forecasted allocations at time $s$. Hence, the value of commitment depends upon the degree of sophistication. Clearly, for naive individuals with $\widehat{\beta} = 1$, $(e^{s*}_{t,t}, e^{s*}_{t+k,t}) = (e^*_{t,s}, e^*_{t+k,s})$. Actual and forecasted allocations are identical and the value of commitment is zero.

For sophisticated individuals, $\widehat{\beta} \in [\beta, 1)$, actual allocations and forecasted allocations at time $s$ differ. By the definition of the minimum from the perspective of period $s$, $(e^{s*}_{t,t}, e^{s*}_{t+k,t})$ yields higher discounted costs than $(e^*_{t,s}, e^*_{t+k,s})$. This implies that the value of commitment should be positive provided $p < 0.5$, as in the experiment. As $\widehat{\beta}$ diverges from 1, the value of commitment increases. Appendix D provides further detail and corresponding simulated values. The extent of commitment demand, when combined with parametric measures for discounting and costs, can be informative for the extent of sophistication.

Naturally, there may be intrinsic benefits to flexibility. These unmodeled benefits to flexibility could have many sources including future uncertainty in costs or task difficulty.[64]

[63] The inequality between discounted costs

$$(1-p) \cdot [\beta\delta^{t-s}(e^*_{t,s} + \omega)^\gamma + \beta\delta^{t+k-s} c(e^*_{t+k,s} + \omega)^\gamma] + p \cdot [\beta\delta^{t-s}(e^{s*}_{t,t} + \omega)^\gamma + \beta\delta^{t+k-s} c(e^{s*}_{t+k,t} + \omega)^\gamma] <$$
$$p \cdot [\beta\delta^{t-s}(e^*_{t,s} + \omega)^\gamma + \beta\delta^{t+k-s} c(e^*_{t+k,s} + \omega)^\gamma] + (1-p) \cdot [\beta\delta^{t-s}(e^{s*}_{t,t} + \omega)^\gamma + \beta\delta^{t+k-s} c(e^{s*}_{t+k,t} + \omega)^\gamma],$$

reduces to the inequality,

$$(e^*_{t,s} + \omega)^\gamma + \delta^k c(e^*_{t+k,s} + \omega)^\gamma < (e^{s*}_{t,t} + \omega)^\gamma + \delta^k c(e^{s*}_{t+k,t} + \omega)^\gamma,$$

provided $p < 0.5$ as in the experiment. Subtracting the discounted costs one arrives at the value of commitment,

$$V = \{p \cdot [\beta\delta^{t-s}(e^*_{t,s} + \omega)^\gamma + \beta\delta^{t+k-s} c(e^*_{t+k,s} + \omega)^\gamma] + (1-p) \cdot [\beta\delta^{t-s}(e^{s*}_{t,t} + \omega)^\gamma + \beta\delta^{t+k-s} c(e^{s*}_{t+k,t} + \omega)^\gamma]\} -$$
$$\{(1-p) \cdot [\beta\delta^{t-s}(e^*_{t,s} + \omega)^\gamma + \beta\delta^{t+k-s} c(e^*_{t+k,s} + \omega)^\gamma] + p \cdot [\beta\delta^{t-s}(e^{s*}_{t,t} + \omega)^\gamma + \beta\delta^{t+k-s} c(e^{s*}_{t+k,t} + \omega)^\gamma]\}.$$

[64] Note that in the presence of such factors even sophisticated present-biased subjects may have low or even negative values for commitment. Hence, it is critical that our design elicits the demand for both flexibility and

The value of commitment, $V$, is measured in the same units as the discounted costs of effort. A potential shortfall of our design is that our experiment does not measure $V$ directly but rather measures its translation into dollars. Hence, we provide potential bounds on $V$ based upon assumptions for the transformation of $V$ to dollars.

## A.3 Identification

From the intertemporal Euler equation, (7), identification of discounting and the cost function is straightforward. Rearranging and taking logs yields

$$log(\frac{e_{t,D}+\omega}{e_{t+k.D}+\omega}) = \frac{log(\beta)}{\gamma-1} \cdot (\mathbf{1}_{D=t}) + \frac{log(\delta)}{\gamma-1} \cdot k - (\frac{1}{\gamma-1}) \cdot log(R), \tag{8}$$

which is linear in the key experimental parameters of whether allocations are made at time $t$, $\mathbf{1}_{D=t}$, and the log transform, $log(R)$. In our implementation, variation in $log(R)$ delivers identification of the cost function, $\gamma$; the allocation being made in Week 1 ($D = s$) rather than Week 2 ($D = t$) delivers identification of present bias, $\beta$; and the delay length, $k = 7$ days, gives identification of the discount factor, $\delta$.[65]

In order to estimate discounting and cost function parameters from aggregate data, we assume an additive error structure and estimate the linear regression implied by (8). To be specific, the regression equation is, for $k = 7$,

$$log(\frac{e_t+\omega}{e_{t+k}+\omega})_i = \eta_0 k + \eta_1 \cdot (\mathbf{1}_{D=t})_i + \eta_2 \cdot log(R)_i + \epsilon_i,$$

and we recover the parameters of interest as $\beta = exp(\hat{\eta}_1/-\hat{\eta}_2)$ and $\gamma = 1 + 1/-\hat{\eta}_2$. Note that $\hat{\delta} = exp(\hat{\eta}_0/-\hat{\eta}_2)$ is recovered from the constant as only one delay length was used in the experimental design.

The parameters of interest can be recovered from non-linear combinations of regression

commitment to assess the possible presence of such factors.

[65] Of course, with only one delay length of seven days considered in the experiment, we have limited confidence that our estimate of $\delta$ can be extrapolated to arbitrary delay lengths.

coefficients with standard errors calculated via the delta method. One important issue to consider in estimation is the potential presence of corner solutions. We provide estimates from two-limit tobit regressions designed to account for the possibility that the tangency condition implied by (8) does not hold with equality (Wooldridge, 2002).

Estimating (8) is easily extended to the study of individual parameters. To begin, (8) can be estimated at the individual level.[66] However, with limited numbers of individual choices it is helpful to consider alternative, more structured approaches. In particular, we allow for heterogeneous discounting across individuals, but assume all individuals have the same cost function. Consider a vector of fixed effects $(\mathbf{1}_j)_i$ which take the value 1 if observation $i$ was contributed by individual $j$. This leads to the fixed effects formulation

$$log(\frac{e_{t,D}+\omega}{e_{t+k,D}+\omega})_i = \frac{log(\overline{\delta})}{\gamma-1}\cdot k + \frac{(log(\boldsymbol{\delta}_j)-log(\overline{\delta}))}{\gamma-1}\cdot(\mathbf{1}_j)_i\cdot k + \frac{log(\overline{\beta})}{\gamma-1}\cdot(\mathbf{1}_{D=t})_i + \frac{(log(\boldsymbol{\beta}_j)-log(\overline{\beta}))}{\gamma-1}\cdot(\mathbf{1}_{D=t})_i\cdot(\mathbf{1}_j)_i - \frac{1}{\gamma-1}\cdot log(R)_i,$$

where $\overline{\delta}$, $\overline{\beta}$ refer to sample means, and $\delta_j, \beta_j$ refer to individual-specific discounting parameters. With an additive error structure this is easily estimable.[67] The individual fixed effect interacted with the decision being made in the present provides identification of the individual-specific $\beta_j$. In Appendix B we conduct simulation exercises under various correlation structures for the true parameters of interest and document that the implemented estimation methods perform well both at the aggregate and individual level.

## A.4 Monetary Discounting

Our methods for recovering monetary discounting parameters at both the aggregate and individual level closely follow those for effort. Following most of the literature, we abstract from standard arbitrage arguments for monetary discounting and assume laboratory administered

[66]Broadly similar conclusions are reached when estimating (8) at the individual level, however, parameter precision is greatly reduced and substantial estimate instability is uncovered in some cases.

[67]We allow both $\beta$ and $\delta$ to vary across individuals such that the implemented regression is a standard interaction with both level and slope effects.

rates are the relevant ones.[68] In particular, for monetary payments, $c_t$ and $c_{t+k}$, allocated subject to the constraint (2), we assume a quasi-hyperbolic constant relative risk averse utility function,

$$U(c_{t,D}, c_{t+k,D}) = (c_t + \omega)^{\alpha} + \beta^{\mathbf{1}_{D=t}} \delta^k (c_{t+k} + \omega)^{\alpha}. \tag{9}$$

Where $D \in \{s, t\}$ refers to the same notation as before for when the allocation decision is made. The utility function is assumed to be concave, $\alpha < 1$, such that first order conditions provided meaningful optima. Here, the parameter $\omega$ is a background parameter that we take to be the \$5 minimum payment of the monetary experiment.[69]

Maximizing (9) subject to the intertemporal budget constraint (2) yields an intertemporal Euler equation similar to that above for effort. Taking logs and rearranging we have

$$log(\frac{c_{t,D} + \omega}{c_{t+k,D} + \omega}) = \frac{log(\beta)}{\alpha - 1} \cdot (\mathbf{1}_{D=t}) + \frac{log(\delta)}{\alpha - 1} \cdot k + (\frac{1}{\alpha - 1}) \cdot log(P). \tag{10}$$

Again, assuming an additive error structure, this can be estimated at the aggregate or individual level via two-limit Tobit. Discounting and utility function parameters can be recovered via non-linear combinations of regression coefficients as above with standard errors estimated again via the delta method.

# B Simulation Appendix

This appendix focuses on two questions related to the estimation strategies laid out in Appendix A. First, we examine the extent to which the implemented estimators identify the true

[68]The assumptions that individuals narrowly bracket time-dated experimental payments, treat money effectively as consumption, and ignore extra-lab arbitrage have been standard in the literature. One prominent exception to this tradition is Harrison et al. (2002), who measure and account for extra-lab borrowing and savings opportunities.

[69]Andreoni and Sprenger (2012a) provide detailed discussion of the use of such background parameters and provide robustness tests with differing values of $\omega$ and differing assumptions for the functional form of utility in CTB estimates. They provide estimates for $\omega$ based on non-linear least squares techniques and analyze the extent to which different assumptions for $\omega$ influence remaining parameter estimates. Though utility curvature and discounting are sensitive to varying assumptions for $\omega$, present bias, $\beta$, is largely unaffected. Andersen et al. (2008) also provide some sensitivity analysis.

parameters of interest, $\beta$, $\delta$ and $\gamma$ at the aggregate and individual level. As our individual estimates restrict $\gamma$ to be constant across subjects, this exercise is conducted under various correlation structures for $\beta$ and $\gamma$ to understand the sensitivity of our parameter estimates to this restriction. Further, the correlation structure also helps to investigate the sensitivity of identifying $\beta$ via a non-linear combination involving $\gamma$ in the aggregate estimates.

Second, we investigate the sensitivity of aggregate and individual estimates to uncertainty. Subjects may make allocations in Week 1 that minimize their discounted *expected* cost in future weeks given the potential realizations of future parameters. This uncertainty may be subsequently resolved in Week 2, such that subjects minimize their discounted cost at specific realizations of key parameters. As the minimizer of the expectation need not be the expectation of the minimizer, such issues can lead to inconsistencies between initial allocations and subsequent allocations. To explore the extent to which this issue hampers identification of present bias, we conduct simulations under several uncertainty structures.

Our procedure for conducting the first simulation exercise is straightforward. We draw 100 samples of 80 individuals with underlying true parameters drawn from distributions centered roughly around our aggregate estimates. That is, for each sample $\beta$ is drawn from a normal distribution with mean 0.9 and standard deviation 0.2; $\delta$ is drawn from a normal distribution with mean 0.99 and standard deviation 0.2; and $\gamma$ is drawn from a normal distribution with mean 1.6 and standard deviation of 0.2. We introduce five correlation structures for the relationship between $\beta$ and $\gamma$, $\rho(\beta, \gamma) \in \{-0.75, -0.25, 0, 0.25, 0.75\}$. For simplicity and to focus attention on the sensitivity of present bias we assume $\rho(\beta, \delta) = 0$ and $\rho(\delta, \gamma) = 0$ when drawing each sample.

For each of these correlation structures we conduct two key analyses. First, for every sample we estimate the aggregate parameters, $\widehat{\beta}$, $\widehat{\delta}$ and $\widehat{\gamma}$. The empirical distribution of $\widehat{\beta}$ over the 100 samples is summarized by the empirical mean, $\overline{\widehat{\beta}}$, the empirical standard deviation, $s(\widehat{\beta})$. Similar values summarize the empirical distributions of $\widehat{\delta}$ and $\widehat{\gamma}$. We investigate the extent to which the estimated values for $\widehat{\beta}$ correspond to the underlying data generating process by comparing $\overline{\widehat{\beta}}$ to the true mean $\beta$ of 0.9. We also provide a measure of type I error in the form of the probability of rejecting $\beta = 0.9$ from each of our 100 drawn samples, $0.9 \notin CI(\beta)$, and a measure of type II error in the form of the probability of rejecting $\beta = 1$, $1 \notin CI(\beta)$. Table A1, Panel A provide these analyses. With zero correlation structure we precisely estimate all parameters close to the true underlying distribution. We reject the truth with probability around 0.10 and remain powered to reject $\beta = 1$. With extreme negative correlation of $\rho(\beta, \gamma) = -0.75$, this precision is largely unaffected, though with extreme positive correlation of $\rho(\beta, \gamma) = 0.75$ the aggregate estimator falters. We begin to overestimate the extent of present bias and reject the truth with frequency. This exercise documents the sensitivity of our aggregate estimates to extreme correlation structures.

Next, we focus on individual estimates. Table A1, Panel A provides the results. In each sample of 80 observations, we estimate individual parameters based on the fixed effects regression described in section A. We consider the median and mean level of the individual estimate $\widehat{\beta}_i$, $\overline{\widehat{\beta}_i}$ and $\widehat{\beta}_i^{med}$, and the correlation between the true draw of $\beta_i$ and the estimated value $\widehat{\beta}_i$, $r(\beta_i, \widehat{\beta}_i)$. For each of the 100 samples, we construct a correlation coefficient, and present the average value. Across correlation structures, we estimate broadly correct average and median values. Importantly, even when the accuracy of the level of behavior deteriorates due to extreme negative correlation between $\beta$ and $\gamma$, we find the correlation between the true $\beta_i$ and $\widehat{\beta}_i$ remains above 0.9. This indicates that the individual estimates remain capable of identifying differences across individuals in present bias, providing a solid foundation for our individual analysis.

The remainder of Table A1 analyzes the effect of uncertainty. We focus on uncertainty in $\gamma$ realized only in Week 2. Hence the Week 1 allocations are made under uncertainty that is resolved in Week 2. To operationalize this exercise we again have $\beta$ and $\delta$ drawn from the distributions above in advance. However, we assume that in Week 1, subjects do not know their true $\gamma$ but optimize subject to the knowledge that $\gamma$ is drawn from a normal distribution with mean 1.6 and standard deviation of $\sigma$. We consider five values of $\sigma \in \{0, 0.05, 0.1, 0.2\}$.

In Panel B, we provide aggregate and individual analysis.. Though the aggregate estimates and error rates are unaffected for the lower value of uncertainty, as parametric uncertainty is increased, we begin to overestimate $\beta$ and reject the truth with frequency. A similar pattern is observed in the individual estimates. Importantly, the presence of parametric uncertainty greatly reduces the correlation between between the true $\beta_i$ and $\widehat{\beta}_i$ which drops below 0.3 in the more extreme case.

A natural question is why parametric uncertainty leads towards upward-biased estimates of $\beta$, pushing away from present bias. Intuitively, a subject with parametric uncertainty attempts to avoid situations of high work under extremely convex cost functions that are rarely realized. As this encourages subjects to spread their initial allocations, we estimate a more convex cost function. When the uncertainty is realized, they allocate less evenly over time on average, but the cost function is required by the estimator to remain constant. This change in behavior in Week 2 winds up being captured partially in the form of an increased $\beta$ in our parameter space of interest.

Table A1: Simulation Exercises

| | Aggregate Estimates | | | | | | | Individual Estimates | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Panel A:* | Simulations: $\delta \sim N(0.99, 0.2^2)$, $\beta \sim N(0.9, 0.2^2)$, $\gamma \sim N(1.6, 0.2^2)$ Correlation Structure: $r(\beta,\gamma) \in \{-0.75, -0.25, 0, 0.25, 0.75\}$ | | | | | | | | | |
| | N | $\overline{\widehat{\beta}}$ | $s(\widehat{\beta})$ | $0.9 \notin CI(\beta)$ | $1 \notin CI(\beta)$ | $\widehat{\gamma}$ | $\widehat{\delta}$ | $\overline{\widehat{\beta}_i}$ | $\widehat{\beta}_i^{med}$ | $r(\beta_i, \widehat{\beta}_i)$ |
| $r(\beta,\gamma)$=0 | 80x100 | .8828 | .0242 | 11% | 95% | 1.552 | .9955 | .9080 | .9077 | 0.971 |
| $r(\beta,\gamma)$=-0.25 | 80x100 | .8884 | .0235 | 11% | 98% | 1.552 | .9960 | .9113 | .9029 | 0.965 |
| $r(\beta,\gamma)$=-0.75 | 80x100 | .9169 | .0235 | 13% | 86% | 1.537 | .9955 | .9359 | .9071 | 0.931 |
| $r(\beta,\gamma)$=+0.25 | 80x100 | .8712 | .0228 | 19% | 96% | 1.556 | .9957 | .8997 | .9116 | 0.971 |
| $r(\beta,\gamma)$=+0.75 | 80x100 | .8541 | .0265 | 45% | 96% | 1.545 | .9953 | .8872 | .9103 | 0.964 |
| *Panel B:* | Simulations: $\delta \sim N(0.99, 0.2^2)$, $\beta \sim N(0.9, 0.2^2)$, $\gamma \sim N(1.6, \sigma^2)$ Uncertainty Structure: $\sigma \in \{0, 0.05, 0.1, 0.2\}$, Unrealized at Initial Allocation | | | | | | | | | |
| | N | $\overline{\widehat{\beta}}$ | $s(\widehat{\beta})$ | $0.9 \notin CI(\beta)$ | $1 \notin CI(\beta)$ | $\widehat{\gamma}$ | $\widehat{\delta}$ | $\overline{\widehat{\beta}_i}$ | $\widehat{\beta}_i^{med}$ | $r(\beta_i, \widehat{\beta}_i)$ |
| $\sigma = 0$ | 80x100 | .8800 | .0202 | 13% | 94% | 1.601 | .9957 | .9044 | .9017 | 0.995 |
| $\sigma = 0.05$ | 80x100 | .9001 | .0287 | 7% | 92% | 1.608 | .9949 | .9336 | .9122 | 0.824 |
| $\sigma = 0.1$ | 80x100 | .9593 | .0369 | 26% | 17% | 1.632 | .9952 | 1.022 | .9539 | 0.590 |
| $\sigma = 0.2$ | 80x100 | 1.186 | .0823 | 98% | 58% | 1.736 | .9957 | 1.367 | 1.164 | 0.325 |

# C Discussion of Potential Confounds

Our effort discounting data address several key confounds present in monetary studies, such as fungibility and arbitrage issues. In this appendix section we address whether we can attribute the observed behavior for effort choices to dynamic inconsistency. Foremost, the ability to predict commitment demand based on present-biased allocations gives a degree of confidence that present-biased allocations are driven by dynamic inconsistency. In the following, we discuss four additional hypotheses that can generate time inconsistent effort allocations. These are (unanticipated) permanent shocks to the cost function of performing the tasks, unanticipated shocks to the cost function in Week 2, general uncertainty in cost functions, and simple mistakes. Though none of these explanations would predict a correlation between time inconsistency and commitment demand, we can also address these hypotheses directly.

First, subjects may make present-biased allocations in Week 2 not because they are present-biased, but because their cost function for the tasks changed permanently. Maybe upon returning to the tasks they find them to be more or less difficult than they previously envisioned. For example, this could be because they have an injury that makes typing harder, have a bigger and better (or smaller and worse) screen at home than in the lab, which makes the tasks less (more) onerous, etc.[70] Though we do attempt to give subjects a sense of the tasks, this is a plausible and critical confound. Our environment is able to address this confound as changes to perceived cost functions are separable from time preferences. The shape of the cost function is identified from changes in the value of $R$. Because both initial allocations and subsequent allocations are made at various interest rates, the cost function is identified at multiple points and time. In Appendix Table A10, we estimate cost functions and discounting parameters at each point in time. We do not find evidence that cost functions change over time.[71] This lends

[70]We see this channel as distinct from the role of uncertainty, as such changes in difficulty need not have been forecasted.

[71]The analysis of Appendix Table A10 can be conducted separately for committing and non-committing subjects to examine if those individuals identified to be dynamically inconsistent in their commitment choice have varying cost functions or varying discounting parameters over time. For committing subjects the weekly discount factor measured in Week 1 is 1.082 (s.e. = 0.051), while the weekly discount factor measured in Week 2 is 0.900 (0.037). This difference is significant at the 1% level, $\chi^2(1) = 6.38$ ($p = 0.01$). For committing subjects

credence to the notion that changes in cost functions are not driving the observed behavior.[72]

Second, subjects may reallocate fewer tasks to the present due to an unforeseen, local shock that resulted in an increase in the cost function in Week 2 only. This could be because the subject is unusually busy in Week 2 because of a surprise exam, or finds himself unusually exhausted and hence unusually irritated with the length of work to be done. There are several ways to address this concern. First, a simple way in which subjects may find it unusually difficult to complete the work in Week 2 is if they log on to the experimental website so late, just prior to midnight, that they have only a very limited opportunity to complete their tasks. We can check for this hypothesis because we recorded the time at which subjects made their allocations. The median subject completed their allocations in Week 2 with 10.3 hours remaining before the imposed midnight deadline. Only 4 of 80 subjects completed their allocations in Week 2 with less than 2 hours remaining before the imposed midnight deadline and 0 of 80 completed their allocations with less than 1 hour remaining. We therefore do not find evidence that a physical time constraint is a driving force in the allocations.

However, subjects logging on later may indeed be those who experienced an unanticipated shock in costs (even if their timing does not entail a physical constraint). We therefore examine whether subjects who log on to our experimental website later in the evening of their Week 2 work date exhibit more present bias. Individuals who log on with less than 4 hours before midnight (20 percent of our sample) are no more present-biased and have virtually identical allocation behavior as others.[73]

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the cost function parameter measured in Week 1 is $\gamma = 1.739$ (0.184), and in Week 2 is $\gamma = 1.519$ (0.121). This difference is not significant at conventional levels, $\chi^2(1) = 2.53$ ($p = 0.11$). This indicates that for subjects separately identified as present-biased through their commitment choice, changing behavior through time is more clearly linked to changing discounting parameters and not changing cost functions. No differences in either discounting or cost functions are observed between Weeks 1 and 2 for non-committing subjects.

[72] Note that if cost functions would change over time, and this were the unique driver for changes in allocations between Week 1 and Week 2, we would observe a specific pattern of allocations. If an individual moved from having an almost linear cost function to a very convex one, the corresponding allocations would shift from being very price sensitive to limited price sensitivity. When initial allocations asked for lot of work to be done in Week 2, we would indeed see a change that amounts to a reduction of work in Week 2. However, for allocations that asked for little work in Week 2, we would see an increase in work to be done in Week 2. This is not what we observe. The data show a universal reduction of work to be allocated in Week 2.

[73] Subjects logging on with more than 4 hours before midnight allocate an average of 23.80 (s.d = 15.91) tasks to the sooner work date in Week 2, while subjects logging on with less than 4 hours allocate 25.43 (14.06). Even

As a final way to assess whether some subjects may have had unusual shocks to their cost function (and whether these are subjects that generate our results of present-biased allocations), we can find a proxy for the costs of the tasks in Week 2. Specifically, we examine the amount of time it takes subjects to complete their minimum work in Week 2. Minimum work took the median subject around 18 minutes to complete. Those subjects who take longer than 25.7 minutes (20 percent of our sample) are no more present-biased and have virtually identical allocation behavior as others.[74] Naturally, these analyses may not give a fully satisfactory response to the potential confound presented by forecasting error and boredom. If indeed such a possibility is the source of our present-biased data patterns, a final question is whether or not such a hypothesis delivers the observed correlation between present-bias and commitment demand. We believe the answer to this question to be no.

A third class of explanations which can generate a pattern of present-biased behavior in the absence of time inconsistency concerns uncertainty in cost functions. When making initial allocations, subjects do so under a different informational environment than when making their subsequent allocations. There could be uncertainty for initial allocations, which is partially resolved when allocations are again made one week later. Several aspects of uncertainty warrant attention. First, individuals may carry preferences for the resolution of uncertainty (Kreps and Porteus, 1978; Epstein and Zin, 1989; Chew and Epstein, 1989). Unlike monetary designs, in our effort experiment such a preference may more naturally lead to a future bias.

without accounting for multiple observations this difference is not significant, $t(798) = 1.19,\ p = 0.24$. Subjects logging on with more than 4 hours before midnight have budget share differences between Weeks 1 and 2 of -0.049 (0.21), indicating they allocate around 5 percent less of the budget of tasks to the sooner work date in Week 2 than they allocated in Week 1. Subjects logging on with less than 4 hours have budget share differences between Weeks 1 and 2 of -0.052 (0.20). Even without accounting for multiple observations this difference is not significant, $t(798) = 0.15,\ p = 0.88$. Note however, that in general, subjects that log in later may be more present-biased, as they do everything a little later. And indeed, if we instead cut at the median log-in time, 10.3 hours before midnight, marginally significant differences are observed indicating that present-biased individuals may be logging in later. However, such individuals do not appear to be those particularly close to the deadline.

[74]Subjects taking less than 25.7 minutes allocate an average of 24.11 (s.d = 15.43) tasks to the sooner work date in Week 2, while subjects taking more than 25.7 minutes allocate 24.15 (16.11). Even without accounting for multiple observations this difference is not significant, $t(798) = 0.03,\ p = 0.98$. Subjects taking less than 25.7 minutes have budget share differences between Weeks 1 and 2 of -0.049 (0.20), indicating they allocate around 5 percent less of the budget of tasks to the sooner work date in Week 2 than they allocated in Week 1.Subjects taking more than 30 minutes have budget share differences between Weeks 1 and 2 of -0.053 (0.22). Even without accounting for multiple observations this difference is not significant, $t(798) = 0.23,\ p = 0.82$.

Subjects desiring to resolve uncertainty in their subsequent allocation choices could, in principle, choose to complete their tasks immediately when the present is available. Second, our discounting estimates do not account for subjects' potential uncertainty on their own parameters, such as uncertainty with regards to the future costliness of the task. Though the weekly parameter estimates provided in Table A10 help to alleviate some concerns, a deeper problem may exist. Subjects may make allocations in Week 1 that minimize their discounted *expected* cost in future weeks given the potential realizations of future parameters. This uncertainty may be subsequently resolved in Week 2, such that subjects minimize their discounted cost at specific realizations of key parameters. As the minimizer of the expectation need not be the expectation of the minimizer, such issues can lead to inconsistencies between initial allocations and subsequent allocations. To explore the extent to which this issue hampers identification of present bias, we conduct simulations under a variety of uncertainty structures in Appendix B. Uncertainty, unresolved at initial allocation and realized at the time of the subsequent allocation, does bias our estimates of $\beta$ both at the aggregate and individual level. However, the direction of bias is generally upward in the parameter regions of interest, leading to less estimated present bias.[75] Importantly, a subject with future uncertainty would benefit from flexibility, such that even if present bias was delivered by uncertainty of some form one would not expect a correlation between present bias and commitment demand.

Fifth, present-biased allocations of effort may be a simple decision error. Hence, present bias, or any dynamic inconsistency, may be an unstable phenomenon. The two blocks of our experiment speak to this possibility. Subjects have two opportunities to exhibit present-biased allocations. Indeed, present-biased behavior in Block 1 and Block 2 is significantly correlated.[76] At the allocation level, a subject who is present-biased in Block 1 is 58% more likely than others

[75] Intuitively, subjects with unresolved uncertainty on future parameters seek to avoid the extreme possibilities of working under a very convex cost structure that is only rarely realized. This leads initial allocations to be frequently lower than subsequent allocations, particularly at higher interest rates. Appendix B provides greater detail.

[76] Though the behavior is significantly correlated when examined as indicators for present bias, future bias and dynamic consistency; the budget share differences are not significantly correlated through time. This may be due to the sheer volume of data with budget share differences equal to zero and the relative lack of stability for future-biased behavior.

to be present-biased in Block 2, $F(1,79) = 6.94,\ (p = 0.010)$.[77] Additionally, an individual who is dynamically consistent in Block 1 is 85% more likely to be dynamically consistent in Block 2 than others $F(1,79) = 50.88,\ (p < 0.01)$.[78]

This discussion helps to clarify some of the potential confounds for our observed effects. We view it as unlikely that present-biased allocations of effort are driven by unanticipated permanent or temporary shocks, uncertainty, or decision error. Further, that present bias over effort exhibits stability and predicts commitment demand gives confidence that our observed effects are generated by dynamic inconsistency.

# D Commitment Value and Sophistication

We analyze the relationship between commitment valuations and sophistication by calculating

$$V = (1-2p) \cdot \beta\delta^{t-s} \cdot \{[(e^{s*}_{t,t} + \omega)^{\gamma} + \delta^k c(e^{s*}_{t+k,t} + \omega)^{\gamma}] - [(e^{*}_{t,s} + \omega)^{\gamma} + \delta^k c(e^{*}_{t+k,s} + \omega)^{\gamma}]\}.$$

at the estimated parameter values from Table 3, column (3) of $\gamma = 1.6,\ \delta = 1$, and $\beta = 0.9$ under various assumptions for the value of $\widehat{\beta}$. Differing values of $\widehat{\beta}$ deliver different forecasted allocations $(e^{s*}_{t,t}, e^{s*}_{t+k,t})$ and hence different values of $V$. As $\widehat{\beta}$ diverges from 1, forecasted allocations differ more dramatically from initial allocations and the value of commitment grows. For each value of $V$ we calculate the equivalent number of tasks as

$$T^{\gamma} = V.$$

[77] Test statistic from OLS regression of binary indicator for a present-biased allocation in Block 2 on matched indicator for present-biased allocation in Block 1 with standard errors clustered on the subject level. The estimated constant is 0.218 ($s.e. = 0.030$) and the coefficient on Block 1 present bias is 0.128 ($s.e. = 0.049$).

[78] Test statistic from OLS regression of binary indicator for a dynamically consistent allocation in Block 2 on matched indicator for a dynamically consistent allocation in Block 1 with standard errors clustered on the subject level. The estimated constant is 0.400 ($s.e. = 0.041$) and the coefficient on Block 1 dynamic consistency is 0.342 ($s.e. = 0.048$). Interestingly, somewhat less precision is found for future biased allocations. An individual who is future-biased in Block 1 is 54% more likely to be future-biased in Block 2 than others $F(1,79) = 3.07,\ (p = 0.08)$. Test statistic from OLS regression of binary indicator for a future-biased allocation in Block 2 on matched indicator for a future-biased allocation in Block 1 with standard errors clustered on the subject level. The estimated constant is 0.162 ($s.e. = 0.025$) and the coefficient on Block 1 future bias is 0.088 ($s.e. = 0.050$).

It is useful to go through the calculation similar to that in the main text, solving for $T$ given a set of parameters. Consider a subject with parameter values $\gamma = 1.6$, $\delta = 1, \beta = .9$, and $\omega = 10$ (our maintained assumption), optimizing at $R = 1$ with $m = 50$ and the experimental implementation probability of $p = .1$. Optimization at time $s$ yields $e^*_{t,s} = e^*_{t+k,s} = 25$. A subject with $\widehat{\beta}_e = .9$ perceives that she will choose $e^{s*}_{t,t} = 21.9$ and $e^{s*}_{t+k,t} = 28.1$. $V$ can then be calculated as

$$V = (0.8) \cdot 0.9 \cdot \{[(21.9 + 10)^{1.6} + (28.1 + 10)^{1.6}] - [(25 + 10)^{1.6} + (25 + 10)^{1.6}]\} = T^{1.6}$$

Solving for $T$ yields 1.32 tasks.

This calculation does not take into account the fact that subjects make 10 allocations at time $s$. Hence, the value of commitment should be expressed as the expectation of $V$ across these 10 allocations,

$$T^{\gamma} = E[V] = \sum_{i=1}^{10} \frac{1}{10} V_i.$$

For simplicity, we ignore the fact that the elicitation of commitment demand entails a second stage price list randomization procedure.

Using this calculation and the parameters above, it is possible to solve for the equivalent number of tasks, $T$, for a given value of $\widehat{\beta}$. In Table A2, we calculate $T$ for various values of $\widehat{\beta}$ at the parameter values noted above. For each $T$ we also provide the monetary value of commitment at a wide range of per-task values, $w$. Note that as $\widehat{\beta}$ decreases, the value of commitment increases and that only in the extremes do commitment valuations exceed one or two dollars.

Table A2: Commitment Values, $\widehat{\beta}$ and Per Task Valuations

| | Equiv. # of Tasks | Value of Commitment Given Different $\widehat{\beta}$ Monetary | | | | |
|---|---|---|---|---|---|---|
| | $T$ | $w = \$0.10$ (~\$6/hour) | $w = \$0.20$ (~\$12/hour) | $w = \$0.30$ (~\$18/hour) | $w = \$0.40$ (~\$24/hour) | $w = \$0.50$ (~\$30/hour) |
| $\widehat{\beta} = 1$ | 0 | \$0.00 | \$0.00 | \$0.00 | \$0.00 | \$0.00 |
| $\widehat{\beta} = .9$ | 1.2 | \$0.12 | \$0.23 | \$0.34 | \$0.46 | \$0.57 |
| $\widehat{\beta} = .8$ | 2.9 | \$0.29 | \$0.59 | \$0.88 | \$1.18 | \$1.47 |
| $\widehat{\beta} = .7$ | 5.3 | \$0.53 | \$1.06 | \$1.59 | \$2.12 | \$2.64 |
| $\widehat{\beta} = .6$ | 8.2 | \$0.82 | \$1.64 | \$2.46 | \$3.28 | \$4.10 |
| $\widehat{\beta} = .5$ | 11.7 | \$1.17 | \$2.35 | \$3.52 | \$4.69 | \$5.87 |

# E Additional Tables and Figures

## E.1 Tabulations of Dynamic Consistency

The following tables provide tabulations of each experimental interest rate or task rate for money and effort and two measures of dynamic inconsistency. First, the average budget share to either the sooner payment or sooner work date is contrasted across allocation timing and, second, the proportion of subjects who are present-biased, dynamically consistent, and future-biased is provided. Separate tables are provided for the the full set of experimental data and the replication exercise.

Table A3: Aggregate Behavior By Interest Rate, Full Data Set

| *Panel A: Monetary Choices* | | | | | | |
|---|---|---|---|---|---|---|
| $P$ | $t \neq 0$ Budget Share (1) | $t = 0$ Budget Share (2) | $t$-test (p-value) (3) | Proportion Present-Biased (4) | Proportion Dynamically Consistent (5) | Proportion Future-Biased (6) |
| 0.952 | 0.924 | 0.923 | 0.07 | 0.073 | 0.813 | 0.113 |
| | (0.228) | (0.189) | (p=0.94) | | | |
| 1 | 0.774 | 0.813 | 1.32 | 0.200 | 0.660 | 0.140 |
| | (0.368) | (0.323) | (p=0.19) | | | |
| 1.11 | 0.102 | 0.148 | 1.86 | 0.180 | 0.733 | 0.087 |
| | (0.259) | (0.300) | (p=0.06) | | | |
| 1.25 | 0.051 | 0.087 | 1.97 | 0.113 | 0.853 | 0.033 |
| | (0.177) | (0.239) | (p=0.05) | | | |
| 1.429 | 0.053 | 0.077 | 1.40 | 0.100 | 0.847 | 0.053 |
| | (0.182) | (0.228) | (p=0.16) | | | |
| Overall | 0.381 | 0.410 | 1.87 | 0.133 | 0.781 | 0.085 |
| | (0.461) | (0.458) | (p=0.07) | | | |
| *Panel B: Effort Choices* | | | | | | |
| $R$ | Initial Budget Share (1) | Subsequent Budget Share (2) | $t$-test (p-value) (3) | Proportion Present-Biased (4) | Proportion Dynamically Consistent (5) | Proportion Future-Biased (6) |
| 0.5 | 0.796 | 0.768 | 2.95 | 0.291 | 0.494 | 0.216 |
| | (0.179) | (0.207) | (p<0.01) | | | |
| 0.75 | 0.729 | 0.694 | 3.11 | 0.375 | 0.384 | 0.241 |
| | (0.208) | (0.240) | (p<0.01) | | | |
| 1 | 0.533 | 0.494 | 3.87 | 0.231 | 0.653 | 0.116 |
| | (0.152) | (0.181) | (p<0.01) | | | |
| 1.25 | 0.293 | 0.260 | 2.74 | 0.297 | 0.509 | 0.194 |
| | (0.232) | (0.235) | (p<0.01) | | | |
| 1.5 | 0.244 | 0.222 | 1.81 | 0.278 | 0.525 | 0.197 |
| | (0.234) | (0.231) | (p=0.07) | | | |
| Overall | 0.519 | 0.488 | 3.90 | 0.294 | 0.513 | 0.193 |
| | (0.301) | (0.311) | (p<0.01) | | | |

*Notes:* Panel A tabulates $t \neq 0$ and $t = 0$ budget shares for sooner payments for each $P$ in money. Each row calculates from 75 $t \neq 0$ allocations (one at each interest rate in the Week 4 vs. Week 7 prospective choices) and 150 $t = 0$ allocations (one at each interest rate in the Week 4 vs. Week 7 actual and Week 1 vs. Week 4) choices. Paired $t$-tests with 149 degrees of freedom presented. Panel B tabulates initial and subsequent budget shares for sooner tasks for each $R$ in effort. Each row calculates from 320 initial allocations (one each for tetris and greek at each task rate in each round) and 320 subsequent allocations. Paired $t$-tests with 159 degrees of freedom presented. Overall tests in both panels come from regression of budget share on allocation timing with standard errors clustered on individual level. Test statistic is $t$-statistic testing the null hypothesis of no effect of allocation timing, which controls for multiple comparisons.

Table A4: Aggregate Behavior By Interest Rate, Replication Exercise

| *Panel A: Monetary Choices* | | | | | | |
|---|---|---|---|---|---|---|
| $P$ | Initial Budget Share (1) | Subsequent Budget Share (2) | $t$-test (p-value) (3) | Proportion Present-Biased (4) | Proportion Dynamically Consistent (5) | Proportion Future-Biased (6) |
| 0.666 | 0.932 (0.174) | 0.935 (0.182) | 0.39 (p=0.70) | 0.091 | 0.879 | 0.030 |
| 0.8 | 0.929 (0.172) | 0.945 (0.153) | 1.77 (p=0.07) | 0.081 | 0.859 | 0.061 |
| 0.909 | 0.917 (0.186) | 0.917 (0.194) | 0.03 (p=0.97) | 0.101 | 0.828 | 0.071 |
| 0.952 | 0.908 (0.190) | 0.901 (0.206) | 0.55 (p=0.58) | 0.152 | 0.788 | 0.061 |
| 1 | 0.621 (0.336) | 0.695 (0.302) | 2.37 (p=0.02) | 0.232 | 0.667 | 0.101 |
| 1.053 | 0.105 (0.240) | 0.084 (0.212) | 1.05 (p=0.30) | 0.081 | 0.828 | 0.091 |
| 1.111 | 0.086 (0.207) | 0.088 (0.226) | 0.25 (p=0.81) | 0.081 | 0.869 | 0.051 |
| 1.25 | 0.064 (0.162) | 0.064 (0.182) | 0.07 (p=0.95) | 0.071 | 0.869 | 0.061 |
| 1.538 | 0.062 (0.171) | 0.048 (0.150) | 1.71 (p=0.09) | 0.020 | 0.879 | 0.101 |
| Overall | 0.514 (0.451) | 0.520 (0.456) | 0.92 (p=0.36) | 0.101 | 0.829 | 0.070 |

| *Panel B: Effort Choices* | | | | | | |
|---|---|---|---|---|---|---|
| $P$ | Initial Budget Share (1) | Subsequent Budget Share (2) | $t$-test (p-value) (3) | Proportion Present-Biased (4) | Proportion Dynamically Consistent (5) | Proportion Future-Biased (6) |
| 0.666 | 0.337 (0.203) | 0.318 (0.232) | 1.09 (p=0.27) | 0.400 | 0.305 | 0.295 |
| 0.8 | 0.385 (0.196) | 0.361 (0.223) | 1.25 (p=0.21) | 0.421 | 0.242 | 0.337 |
| 0.909 | 0.432 (0.191) | 0.405 (0.219) | 1.21 (p=0.23) | 0.453 | 0.189 | 0.358 |
| 0.952 | 0.458 (0.175) | 0.418 (0.220) | 1.96 (p=0.05) | 0.474 | 0.221 | 0.305 |
| 1 | 0.522 (0.153) | 0.507 (0.211) | 0.58 (p=0.56) | 0.337 | 0.358 | 0.305 |
| 1.053 | 0.581 (0.194) | 0.554 (0.235) | 1.18 (p=0.24) | 0.463 | 0.200 | 0.337 |
| 1.111 | 0.618 (0.195) | 0.566 (0.239) | 2.37 (p=0.02) | 0.474 | 0.211 | 0.316 |
| 1.25 | 0.658 (0.210) | 0.603 (0.255) | 2.29 (p=0.02) | 0.400 | 0.253 | 0.347 |
| 1.538 | 0.727 (0.220) | 0.667 (0.280) | 2.38 (p=0.02) | 0.400 | 0.305 | 0.295 |
| Overall | 0.524 (0.229) | 0.489 (0.260) | 1.95 (p=0.05) | 0.425 | 0.254 | 0.322 |

*Notes:* Panel A tabulates initial and subsequent budget shares for sooner payments for $P$ in money. Each row calculates from 99 initial allocations and 99 subsequent allocations choices. Paired $t$-tests with 98 degrees of freedom presented. Panel B tabulates initial and subsequent budget shares for sooner tasks for each $P$ in effort. Each row calculates from 95 initial allocations and 95 subsequent allocations. Paired $t$-tests with 94 degrees of freedom presented. Overall tests in both panels come from regression of budget share on allocation timing with standard errors clustered on individual level. Test statistic is $t$-statistic testing the null hypothesis of no effect of allocation timing, which controls for multiple comparisons.

## E.2 Individual Estimates

We contrast initial and subsequent allocations for work and for money within subjects for the 80 subjects in the primary study sample and the 75 subjects with complete monetary data. Estimates of present bias for each subject are also provided. Corresponding allocations and estimates also provided for between subjects replication study.

Table A5: Individual Estimates Subjects 1-45

| | *Effort Choices* | | | *Monetary Choices* | | |
|---|---|---|---|---|---|---|
| Subject # | Mean Initial Budget Share | Mean Subsequent Budget Share | $\beta_e$ | Mean Initial Budget Share | Mean Subsequent Budget Share | $\beta_m$ |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| 1 | .5 | .5 | 1 | .4 | .3 | 1.046 |
| 2 | .496 | .476 | .952 | .527 | .537 | .999 |
| 3 | .522 | .516 | .983 | .4 | .3 | 1.046 |
| 4 | .534 | .498 | .86 | .309 | .354 | .979 |
| 5 | .516 | .402 | .731 | .4 | .4 | 1 |
| 6 | .514 | .512 | .995 | .4 | .4 | 1 |
| 7 | .514 | .514 | 1 | .4 | .4 | 1 |
| 8 | .576 | .472 | .742 | . | . | . |
| 9 | .514 | .5 | .959 | . | . | . |
| 10 | .5 | .5 | 1 | .4 | .4 | 1 |
| 11 | .5 | .52 | 1.078 | .4 | .4 | 1 |
| 12 | .5 | .5 | 1 | .4 | .4 | 1 |
| 13 | .628 | .486 | .664 | .4 | .4 | 1 |
| 14 | .462 | .512 | 1.143 | .3 | .456 | .934 |
| 15 | .542 | .414 | .683 | .4 | .4 | 1 |
| 16 | .5 | .5 | 1 | .4 | .4 | 1 |
| 17 | .5 | .4 | .725 | .4 | .4 | 1 |
| 18 | .468 | .404 | .796 | .4 | .3 | 1.046 |
| 19 | .582 | .296 | .437 | .4 | .3 | 1.046 |
| 20 | .504 | .48 | .884 | .4 | .4 | 1 |
| 21 | .51 | .424 | .739 | .4 | .4 | 1 |
| 22 | .482 | .344 | .665 | .4 | .4 | 1 |
| 23 | .5 | .51 | 1.012 | .294 | .376 | .964 |
| 24 | .832 | .512 | .426 | .4 | .415 | .999 |
| 25* | .56 | .518 | .815 | .4 | .3 | 1.046 |
| 26 | .52 | .404 | .731 | . | . | . |
| 27 | .648 | .514 | .698 | .2 | .407 | .914 |
| 28 | .642 | .254 | .319 | .4 | .513 | .961 |
| 29 | .588 | .51 | .724 | .2 | .3 | .956 |
| 30 | .552 | .5 | .851 | .4 | .4 | 1 |
| 31 | .51 | .498 | .961 | .3 | .4 | .956 |
| 32* | .432 | 0 | .249 | .4 | .4 | 1 |
| 33 | .5 | .5 | 1 | .4 | .4 | 1 |
| 34 | .526 | .478 | .842 | .4 | .5 | .957 |
| 35 | .496 | .4 | .723 | .2 | .35 | .935 |
| 36* | .516 | .522 | 1.045 | .4 | .7 | .88 |
| 37 | .666 | .5 | .638 | .3 | .35 | .978 |
| 38 | .792 | .746 | .879 | .457 | .5 | .983 |
| 39 | .514 | .54 | 1.072 | .51 | .45 | 1.02 |
| 40 | .516 | .516 | 1 | .4 | .4 | 1 |
| 41 | .536 | .51 | .945 | .206 | .428 | .91 |
| 42 | .6 | .6 | 1 | .4 | .4 | 1 |
| 43 | .514 | .512 | .995 | .4 | .666 | .897 |
| 44 | .522 | .514 | .976 | .531 | .532 | 1 |
| 45 | .514 | .51 | .991 | .4 | .3 | 1.046 |

*Notes:* Tabulates initial and subsequent budget shares for both effort and money and corresponding present bias estimates for subjects 1-45 of 89 non-attriting subjects and 84 subjects with complete monetary data. Nine subjects excluded from primary sample marked with *. Subject 25 provided no variation in response in Weeks 4 or 5. Subject 32 provided no variation in Week 2. Subject 36 provided no variation in Week 5.

Table A6: Individual Estimates Subjects 46-89

| Subject # | *Effort Choices* Mean Initial Budget Share (1) | Mean Subsequent Budget Share (2) | $\beta_e$ (3) | *Monetary Choices* Mean Initial Budget Share (4) | Mean Subsequent Budget Share (5) | $\beta_m$ (6) |
|---|---|---|---|---|---|---|
| 46 | .512 | .36 | .654 | .509 | .743 | .91 |
| 47* | .34 | .27 | .818 | .4 | .3 | 1.046 |
| 48 | .508 | .518 | 1.024 | .4 | .4 | 1 |
| 49* | .514 | .516 | 1.006 | .4 | .4 | 1 |
| 50* | 1 | .844 | .603 | .4 | .3 | 1.046 |
| 51 | .59 | .692 | 1.174 | 0 | .2 | .913 |
| 52 | .548 | .5 | .979 | .4 | .4 | 1 |
| 53 | .506 | .38 | .686 | .403 | .306 | 1.044 |
| 54 | .5 | .5 | 1 | .4 | .4 | 1 |
| 55 | .514 | .514 | 1.003 | .4 | .147 | 1.121 |
| 56 | .354 | .444 | 1.32 | .201 | .256 | .976 |
| 57 | .896 | .502 | .291 | .4 | .4 | 1 |
| 58 | .512 | .504 | .983 | .203 | .405 | .92 |
| 59 | .474 | .48 | 1.027 | .4 | .4 | 1 |
| 60 | .24 | .21 | .876 | .4 | .4 | 1 |
| 61 | .5 | .6 | 1.379 | .4 | .4 | 1 |
| 62 | .518 | .5 | 1.086 | .4 | .8 | .842 |
| 63 | .57 | .5 | .788 | .4 | .45 | .979 |
| 64 | .55 | .6 | 1.174 | .2 | .4 | .914 |
| 65 | .5 | .4 | .725 | .2 | .3 | .956 |
| 66 | .604 | .524 | .788 | .4 | .4 | 1 |
| 67 | .42 | .4 | .957 | . | . | . |
| 68 | .546 | .552 | 1.019 | 0 | .471 | .814 |
| 69* | .4 | 0 | .238 | .4 | .4 | 1 |
| 70 | .47 | .5 | 1.132 | .6 | .4 | 1.092 |
| 71 | .46 | .476 | 1.092 | .6 | .5 | 1.045 |
| 72* | .22 | 0 | .429 | .539 | .851 | .873 |
| 73 | .512 | .516 | 1.005 | .2 | .198 | 1.001 |
| 74 | .5 | .5 | 1 | .4 | .4 | 1 |
| 75 | .44 | .51 | 1.203 | .4 | .35 | 1.023 |
| 76 | .544 | .506 | .802 | 1 | .5 | 1.236 |
| 77 | .594 | .626 | 1.114 | .2 | .2 | 1 |
| 78 | .52 | .5 | .964 | .4 | .4 | 1 |
| 79 | .53 | .518 | .973 | .52 | .5 | 1.007 |
| 80 | .72 | .056 | .14 | .9 | .959 | .973 |
| 81 | .542 | .508 | .912 | .499 | .409 | 1.041 |
| 82* | .754 | 1 | 2.629 | .2 | .1 | 1.047 |
| 83 | .5 | .49 | .973 | . | . | . |
| 84 | .512 | .5 | 1.107 | .4 | .4 | 1 |
| 85 | .504 | .538 | 1.091 | .4 | .4 | 1 |
| 86 | .46 | .504 | 1.12 | 0 | .303 | .87 |
| 87 | .514 | .458 | .935 | .4 | .4 | 1 |
| 88 | .51 | .51 | 1.003 | .4 | .4 | 1 |
| 89 | .5 | .5 | 1 | .4 | .5 | .957 |

*Notes:* Tabulates initial and subsequent budget shares for both effort and money and corresponding present bias estimates for subjects 51-89 of 89 non-attriting subjects and 84 subjects with complete monetary data. Nine subjects excluded from primary sample marked with *. Subject 47 provided no variation in response in Week 5. Subject 49 provided no variation in Week 5. Subject 50 provided no variation in Week 1. Subject 69 provided no variation in Week 2. Subject 72 provided no variation in Weeks 2, 4 or 5. Subject 82 provided no variation in Weeks 2 or 5.

Table A7: Replication Study Individual Estimates Subjects 1-50

| | *Effort Choices* | | | | *Monetary Choices* | | |
|---|---|---|---|---|---|---|---|
| Subject # | Mean Initial Budget Share | Mean Subsequent Budget Share | $\beta_e$ | Subject # | Mean Initial Budget Share | Mean Subsequent Budget Share | $\beta_m$ |
| | (1) | (2) | (3) | | (4) | (5) | (6) |
| 1 | .444 | .556 | 1.502 | 1 | .499 | .555 | .965 |
| 2 | .528 | .774 | 2.126 | 2 | .444 | .444 | 1 |
| 3 | .556 | .552 | .958 | 3 | .55 | .495 | 1.036 |
| 4 | .463 | .5 | 1.12 | 4 | .492 | .532 | .978 |
| 5* | .072 | 0 | .753 | 5 | .522 | .527 | .997 |
| 6* | .578 | .258 | .369 | 6 | .555 | .555 | 1 |
| 7 | .575 | .556 | .888 | 7 | .555 | .666 | .932 |
| 8 | .5 | .5 | 1 | 8 | .497 | .502 | .997 |
| 9* | .258 | .606 | 2.835 | 9 | .555 | .555 | 1 |
| 10 | .509 | .501 | .98 | 10 | .499 | .499 | 1 |
| 11 | .542 | .423 | .703 | 11 | .489 | .499 | .991 |
| 12 | .484 | .523 | 1.129 | 12 | .555 | .555 | 1 |
| 13 | .427 | .25 | .586 | 13 | .555 | .555 | 1 |
| 14 | .502 | .502 | 1 | 14 | .555 | .555 | 1 |
| 15 | .579 | .593 | 1.043 | 15 | .301 | .444 | .909 |
| 16 | .556 | .444 | .666 | 16 | .499 | .499 | 1 |
| 17 | .693 | .553 | .647 | 17 | .555 | .555 | 1 |
| 18* | .499 | .504 | 1.002 | 18 | .499 | .499 | 1 |
| 19 | .665 | .603 | .84 | 19 | .507 | .438 | 1.044 |
| 20 | .509 | .362 | .644 | 20* | .497 | .499 | .999 |
| 21 | .526 | .31 | .527 | 21 | .345 | .363 | .989 |
| 22 | .558 | .441 | .674 | 22 | .555 | .555 | 1 |
| 23 | .494 | .487 | .976 | 23 | .5 | .501 | 1 |
| 24 | .423 | .475 | 1.144 | 24 | .499 | .499 | 1 |
| 25 | .508 | .53 | 1.076 | 25 | .499 | .555 | .965 |
| 26 | .502 | .506 | 1.022 | 26 | .499 | .499 | 1 |
| 27 | .402 | .39 | .963 | 27 | .499 | .499 | 1 |
| 28 | .5 | .5 | 1 | 28 | .499 | .499 | 1 |
| 29 | .529 | .553 | 1.072 | 29 | .555 | .418 | 1.097 |
| 30 | .283 | .486 | 1.824 | 30 | .499 | .501 | .999 |
| 31 | .551 | .486 | .827 | 31 | .444 | .555 | .931 |
| 32* | .498 | .83 | 2.87 | 32 | .499 | .488 | 1.006 |
| 33* | .509 | 1 | 6.087 | 33 | .499 | .555 | .965 |
| 34 | .598 | .621 | 1.103 | 34 | .444 | .555 | .931 |
| 35 | .518 | .505 | .959 | 35 | .499 | .499 | 1 |
| 36 | .527 | .407 | .727 | 36 | .499 | .499 | 1 |
| 37 | .604 | .659 | 1.181 | 37 | .555 | .499 | 1.036 |
| 38 | .814 | .798 | .906 | 38 | .555 | .555 | 1 |
| 39 | .509 | .52 | 1.04 | 39 | .499 | .499 | 1 |
| 40 | .528 | .537 | .98 | 40 | .555 | .555 | 1 |
| 41 | .507 | .506 | .999 | 41 | .444 | .555 | .931 |
| 42* | .52 | 0 | .153 | 42 | .499 | .555 | .965 |
| 43* | .747 | 0 | .071 | 43 | .494 | .555 | .96 |
| 44 | .561 | .504 | .818 | 44 | .499 | .499 | 1 |
| 45* | .68 | 0 | .091 | 45 | .555 | .555 | 1 |
| 46 | .517 | .598 | 1.422 | 46 | .666 | .452 | 1.148 |
| 47 | .486 | .518 | 1.157 | 47 | .499 | .499 | 1 |
| 48 | .5 | .502 | 1.005 | 48 | .499 | .499 | 1 |
| 49 | .568 | .742 | 1.776 | 49 | .444 | .444 | 1 |
| 50 | .488 | .51 | 1.064 | 50 | .499 | .555 | .965 |

*Notes:* Tabulates initial and subsequent budget shares and corresponding present bias estimates for both effort and money for between subjects data for first 50 of 99 money subjects and first 50 of 94 effort subjects

Table A8: Replication Study Individual Estimates Subjects 51-99

| | *Effort Choices* | | | | *Monetary Choices* | | |
|---|---|---|---|---|---|---|---|
| Subject # | Mean Initial Budget Share (1) | Mean Subsequent Budget Share (2) | $\beta_e$ (3) | Subject # | Mean Initial Budget Share (4) | Mean Subsequent Budget Share (5) | $\beta_m$ (6) |
| 51 | .505 | .741 | 2.438 | 51 | .503 | .481 | 1.013 |
| 52 | .493 | .493 | 1 | 52 | .465 | .536 | .961 |
| 53 | .632 | .591 | .863 | 53 | .555 | .555 | 1 |
| 54 | .5 | .502 | 1 | 54 | .555 | .555 | 1 |
| 55 | .411 | .333 | .805 | 55 | .493 | .534 | .977 |
| 56 | .588 | .542 | .866 | 56* | .699 | .337 | 1.199 |
| 57 | .296 | .334 | 1.112 | 57 | .555 | .555 | 1 |
| 58 | .538 | .526 | .924 | 58 | .555 | .555 | 1 |
| 59 | .574 | .514 | .826 | 59 | .555 | .555 | 1 |
| 60 | .502 | .499 | .985 | 60 | .555 | .555 | 1 |
| 61 | .574 | .586 | 1.027 | 61 | .555 | .499 | 1.036 |
| 62 | .685 | .654 | .831 | 62 | .555 | .555 | 1 |
| 63 | .794 | .528 | .369 | 63 | .555 | .555 | 1 |
| 64 | .448 | .46 | 1.043 | 64 | .499 | .499 | 1 |
| 65 | .554 | .53 | .892 | 65 | .555 | .555 | 1 |
| 66 | .493 | .491 | .992 | 66 | .444 | .499 | .965 |
| 67 | .5 | .498 | 1 | 67 | .555 | .555 | 1 |
| 68 | .505 | .516 | 1.03 | 68 | .562 | .617 | .971 |
| 69 | .574 | .632 | 1.188 | 69 | .499 | .499 | 1 |
| 70 | .433 | .348 | .777 | 70 | .555 | .545 | 1.009 |
| 71 | .489 | .499 | 1.028 | 71 | .444 | .555 | .931 |
| 72 | .595 | .551 | .885 | 72 | .476 | .515 | .973 |
| 73 | .496 | .516 | 1.053 | 73 | .555 | .555 | 1 |
| 74 | .512 | .176 | .353 | 74 | .72 | .749 | .976 |
| 75 | .462 | .476 | .994 | 75 | .444 | .555 | .931 |
| 76 | .49 | .603 | 1.39 | 76 | .499 | .555 | .965 |
| 77* | .67 | .67 | 1.011 | 77 | .444 | .444 | 1 |
| 78 | .572 | .553 | .983 | 78 | .555 | .555 | 1 |
| 79 | .755 | .273 | .231 | 79 | .555 | .555 | 1 |
| 80 | .503 | .512 | 1.016 | 80 | .499 | .499 | 1 |
| 81* | .283 | 0 | .308 | 81 | .777 | .666 | 1.073 |
| 82 | .477 | .503 | 1.076 | 82 | .503 | .512 | .995 |
| 83 | .634 | .341 | .424 | 83 | .499 | .499 | 1 |
| 84* | .344 | .501 | 1.577 | 84 | .384 | .477 | .953 |
| 85* | .667 | .667 | 1 | 85 | .555 | .555 | 1 |
| 86 | .517 | .509 | .982 | 86 | .499 | .499 | 1 |
| 87 | .497 | .48 | .955 | 87 | .444 | .499 | .965 |
| 88* | .516 | .597 | 1.321 | 88 | .444 | .499 | .965 |
| 89 | .505 | .504 | .995 | 89 | .555 | .555 | 1 |
| 90 | .528 | .539 | 1.033 | 90 | .533 | .533 | 1.006 |
| 91 | .503 | .401 | .753 | 91 | .289 | .281 | 1.005 |
| 92 | .641 | .506 | .677 | 92 | .444 | .555 | .931 |
| 93 | .514 | .495 | .951 | 93 | .555 | .555 | 1 |
| 94 | .571 | .518 | .862 | 94 | .499 | .499 | 1 |
| 95 | .581 | .243 | .364 | 95 | .499 | .499 | 1 |
| | | | | 96 | .472 | .383 | 1.048 |
| | | | | 97 | .499 | .499 | 1 |
| | | | | 98 | .444 | .444 | 1 |
| | | | | 99 | .666 | .555 | 1.073 |

*Notes:* Tabulates initial and subsequent budget shares and corresponding present bias estimates for both effort and money for between subjects data for subjects 51-99 of 99 money subjects and first 51-94 of 94 effort subjects

## E.3 Estimates Including Nine Subjects With Limited Effort Allocation Variation

We re-conduct the primary aggregate analysis including 9 subjects with limited variation in their effort allocation choices.

Table A9: Parameter Estimates Including 9 Additional Subjects

| | Monetary Discounting | | Effort Discounting | | |
|---|---|---|---|---|---|
| | (1) All Delay Lengths | (2) Three Week Delay Lengths | (3) Job 1 Greek | (4) Job 2 Tetris | (5) Combined |
| Present Bias Parameter: $\beta$ | 0.975 | 0.988 | 0.870 | 0.848 | 0.858 |
| | (0.008) | (0.008) | (0.045) | (0.042) | (0.040) |
| Weekly Discount Factor: $(\delta)^7$ | 0.988 | 0.979 | 0.996 | 1.014 | 1.002 |
| | (0.002) | (0.003) | (0.034) | (0.035) | (0.032) |
| Monetary Curvature Parameter: $\alpha$ | 0.976 | 0.977 | | | |
| | (0.006) | (0.005) | | | |
| Cost of Effort Parameter: $\gamma$ | | | 1.666 | 1.580 | 1.621 |
| | | | (0.122) | (0.101) | (0.109) |
| # Observations | 1680 | 1260 | 890 | 890 | 1780 |
| # Clusters | 84 | 84 | 89 | 89 | 89 |
| Job Effects | | | | | Yes |
| $H_0 : \beta = 1$ | $\chi_2(1) = 9.09$ | $\chi_2(1) = 2.12$ | $\chi_2(1) = 8.41$ | $\chi_2(1) = 13.39$ | $\chi_2(1) = 12.23$ |
| | $(p < 0.01)$ | $(p = 0.15)$ | $(p < 0.01)$ | $(p < 0.01)$ | $(p < 0.01)$ |
| $H_0 : \beta(Col.\ 1) = \beta(Col.\ 5)$ | $\chi_2(1) = 11.45$ | | | | |
| | $(p < 0.01)$ | | | | |
| $H_0 : \beta(Col.\ 2) = \beta(Col.\ 5)$ | | $\chi_2(1) = 13.79$ | | | |
| | | $(p < 0.01)$ | | | |

*Notes:* Parameters identified from two-limit Tobit regressions of equations (4) and (6) for monetary discounting and effort discounting, respectively. Parameters recovered via non-linear combinations of regression coefficients. Standard errors clustered at individual level reported in parentheses, recovered via the delta method. Effort regressions control for Job Effects (Task 1 vs. Task 2). Tested null hypotheses are zero present bias, $H_0 : \beta = 1$, and equality of present bias across effort and money, $H_0 : \beta(Col.\ 1) = \beta(Col.\ 5)$ and $H_0 : \beta(Col.\ 2) = \beta(Col.\ 5)$.

## E.4 Estimates For Effort Discounting By Week

We re-estimate parameters by week and test the null hypothesis of equality of discount rates identified from initial allocations and subsequent allocations.

Table A10: Parameter Estimates By Week

| | Effort Discounting | | | |
|---|---|---|---|---|
| | (1) Week 1 Initial Allocations | (2) Week 2 Subsequent Allocations | (3) Week 4 Initial Allocations | (4) Week 5 Subsequent Allocations |
| Weekly Discount Factor: $(\delta)^7$ | 0.998 | 0.898 | 0.939 | 0.892 |
| | (0.029) | (0.025) | (0.019) | (0.024) |
| Cost of Effort Parameter: $\gamma$ | 1.668 | 1.521 | 1.463 | 1.528 |
| | (0.126) | (0.097) | (0.074) | (0.092) |
| # Observations | 800 | 800 | 800 | 800 |
| # Clusters | 80 | 80 | 80 | 80 |
| Job Effects | Yes | Yes | Yes | Yes |
| $H_0 : (\delta)^7(Col.\ 1) = (\delta)^7(Col.\ 2)$ | $\chi_2(1) = 7.02$ | | | |
| | $(p < 0.01)$ | | | |
| $H_0 : (\delta)^7(Col.\ 3) = (\delta)^7(Col.\ 4)$ | | | $\chi_2(1) = 4.10$ | |
| | | | $(p = 0.04)$ | |

*Notes:* Parameters identified from two-limit Tobit regressions of equation (6) assuming $\beta = 1$ for effort discounting. Parameters recovered via non-linear combinations of regression coefficients. Standard errors clustered at individual level reported in parentheses, recovered via the delta method. Effort regressions control for Job Effects (Task 1 vs. Task 2). Tested null hypotheses are equal discounting in Weeks 1 vs. 2 and Weeks 4 and 5, $H_0 : (\delta)^7(Col.\ 1) = (\delta)^7(Col.\ 2)$ and $H_0 : (\delta)^7(Col.\ 3) = (\delta)^7(Col.\ 4)$.

## E.5 Full Effort Data Set Tables Figures

We reconduct all analyses using Block 1 and Block 2 data to identify effort discounting parameters.

Table A11: Parameter Estimates: Full Effort Data Set

| | Monetary Discounting | | Effort Discounting | | |
|---|---|---|---|---|---|
| | (1) All Delay Lengths | (2) Three Week Delay Lengths | (3) Job 1 Greek | (4) Job 2 Tetris | (5) Combined |
| Present Bias Parameter: $\beta$ | 0.974 | 0.988 | 0.927 | 0.927 | 0.927 |
| | (0.009) | (0.009) | (0.022) | (0.021) | (0.020) |
| Weekly Discount Factor: $(\delta)^7$ | 0.988 | 0.980 | 0.978 | 0.979 | 0.977 |
| | (0.003) | (0.003) | (0.022) | (0.022) | (0.021) |
| Monetary Curvature Parameter: $\alpha$ | 0.975 | 0.976 | | | |
| | (0.006) | (0.005) | | | |
| Cost of Effort Parameter: $\gamma$ | | | 1.566 | 1.510 | 1.537 |
| | | | (0.090) | (0.081) | (0.084) |
| # Observations | 1500 | 1125 | 1600 | 1600 | 3200 |
| # Clusters | 75 | 75 | 80 | 80 | 80 |
| Block Effects | | | Yes | Yes | Yes |
| Job Effects | | | | | Yes |
| $H_0 : \beta = 1$ | $\chi_2(1) = 8.77$ | $\chi_2(1) = 1.96$ | $\chi_2(1) = 11.1$ | $\chi_2(1) = 11.9$ | $\chi_2(1) = 13.94$ |
| | $(p < 0.01)$ | $(p = 0.16)$ | $(p < 0.01)$ | $(p < 0.01)$ | $(p < 0.01)$ |
| $H_0 : \beta(Col.\ 1) = \beta(Col.\ 5)$ | $\chi_2(1) = 5.46$ | | | | |
| | $(p = 0.02)$ | | | | |
| $H_0 : \beta(Col.\ 2) = \beta(Col.\ 5)$ | | $\chi_2(1) = 8.61$ | | | |
| | | $(p < 0.01)$ | | | |

*Notes:* Parameters identified from two-limit Tobit regressions of equations (4) and (6) for monetary discounting and effort discounting, respectively. Parameters recovered via non-linear combinations of regression coefficients. Standard errors clustered at individual level reported in parentheses, recovered via the delta method. Effort regressions control for Block Effects (Weeks 1,2,3 vs. 4,5,6) and Job Effects (Task 1 vs. Task 2). Tested null hypotheses are zero present bias, $H_0 : \beta = 1$, and equality of present bias across effort and money, $H_0 : \beta(Col.\ 1) = \beta(Col.\ 5)$ and $H_0 : \beta(Col.\ 2) = \beta(Col.\ 5)$.

Table A12: Monetary and Real Effort Discounting by Commitment: Full Effort Data Set

| | Monetary Discounting | | Effort Discounting | |
|---|---|---|---|---|
| | Commit (=0) | Commit (=1) | Commit (=0) | Commit (=1) |
| | (1) Tobit | (2) Tobit | (3) Tobit | (4) Tobit |
| Present Bias Parameter: $\beta$ | 0.999 (0.010) | 0.981 (0.013) | 0.989 (0.018) | 0.880 (0.031) |
| Weekly Discount Factor: $(\delta)^7$ | 0.978 (0.003) | 0.981 (0.005) | 0.911 (0.030) | 1.032 (0.029) |
| Monetary Curvature Parameter: $\alpha$ | 0.981 (0.009) | 0.973 (0.007) | | |
| Cost of Effort Parameter: $\gamma$ | | | 1.485 (0.123) | 1.579 (0.116) |
| # Observations | | | | |
| # Clusters | 28 | 47 | 33 | 47 |
| Block Effects | | | Yes | Yes |
| Job Effects | | | Yes | Yes |
| $H_0 : \beta = 1$ | $\chi_2(1) = 0.01$ $(p = 0.94)$ | $\chi_2(1) = 2.15$ $(p = 0.14)$ | $\chi_2(1) = 0.34$ $(p = 0.56)$ | $\chi_2(1) = 15.12$ $(p < 0.01)$ |
| $H_0 : \beta(Col.\ 1) = \beta(Col.\ 2)$ | $\chi_2(1) = 1.29$ $(p = 0.26)$ | | | |
| $H_0 : \beta(Col.\ 3) = \beta(Col.\ 4)$ | | | $\chi_2(1) = 9.35$ $(p < 0.01)$ | |

*Notes:* Parameters identified from two-limit Tobit regressions of equations (4) and (6) for monetary discounting and real effort discounting. Parameters recovered via non-linear combinations of regression coefficients. Standard errors clustered at individual level reported in parentheses, recovered via the delta method. Commit (=1) or Commit (=0) separates individuals into those who did (1) or those who did not (0) choose to commit at a commitment price of zero dollars. Effort regressions control for Block Effects (Weeks 1,2,3 vs. 4,5,6) and Job Effects (Job 1 vs. Job 2). Tested null hypotheses are zero present bias, $H_0 : \beta = 1$, and equality of present bias across commitment and no commitment, $H_0 : \beta(Col.\ 1) = \beta(Col.\ 2)$ and $H_0 : \beta(Col.\ 3) = \beta(Col.\ 4)$.

## E.6 Replication Exercise Additional Tables

Table A13: Replication Exercise Parameter Estimates, Restricted Sample

| | Monetary Discounting | Effort Discounting Greek |
|---|---|---|
| | (1) | (2)) |
| Present Bias Parameter: $\beta$ | 0.995 | 0.934 |
| | (0.004) | (0.035) |
| Weekly Discount Factor: $(\delta)^7$ | 0.989 | 1.077 |
| | (0.005) | (0.032) |
| Monetary Curvature Parameter: $\alpha$ | 0.955 | |
| | (0.009) | |
| Cost of Effort Parameter: $\gamma$ | | 1.733 |
| | | (0.169) |
| # Observations | 1746 | 1458 |
| # Clusters | 97 | 81 |
| $H_0 : \beta = 1$ | $\chi^2(1) = 1.13$ | $\chi^2(1) = 3.60$ |
| | $(p = 0.29)$ | $(p = 0.06)$ |
| $H_0 : \beta(Col.\ 1) = \beta(Col.\ 2)$ | $\chi^2(1) = 3.07$ | |
| | $(p = 0.08)$ | |

*Notes:* Parameters identified from two-limit Tobit regressions of equations (4) and (6) for monetary discounting and effort discounting, respectively. Parameters recovered via non-linear combinations of regression coefficients. Standard errors clustered at individual level reported in parentheses, recovered via the delta method. Chi-squared tests used in last two rows. Sample restricted to those individuals with positive variation in experimental response in both weeks of replication exercise. Excluded subjects noted with * in Appendix Tables A7 and A8

Figure A1: Real Effort Discounting Behavior: Full Effort Data Set

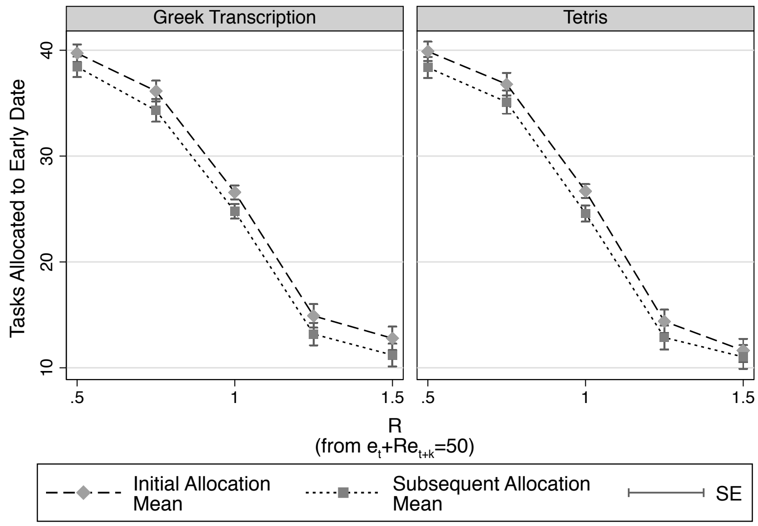



Figure A2: Individual Estimates of Present Bias: Full Effort Data Set

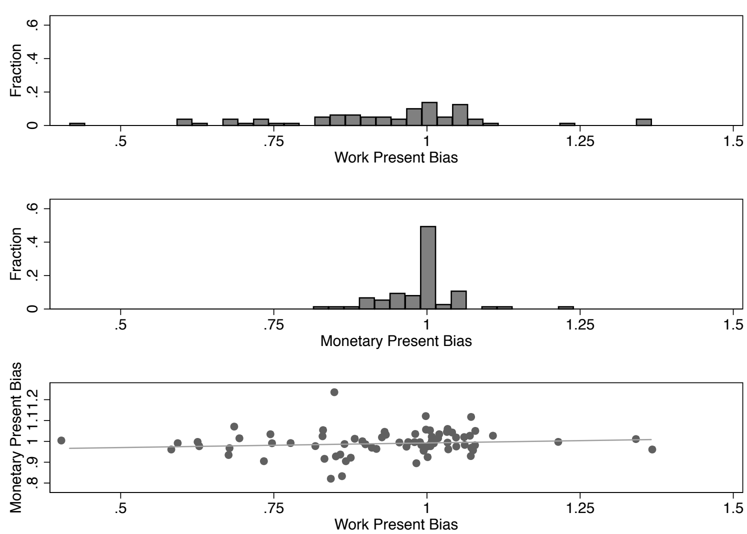
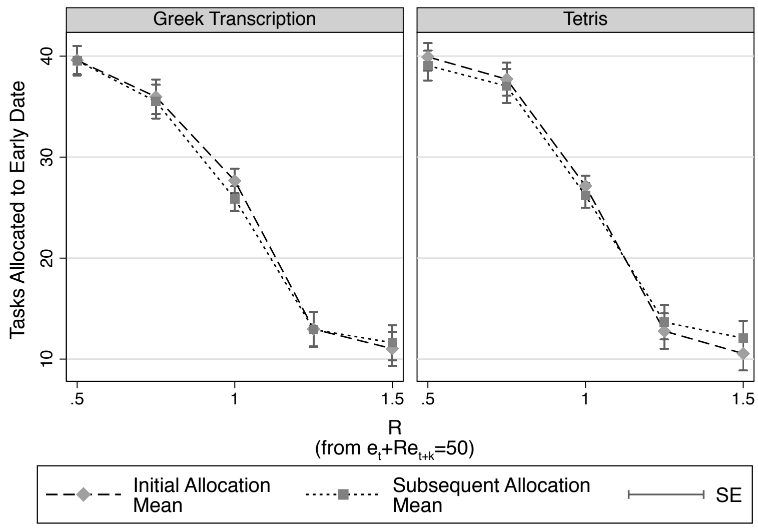
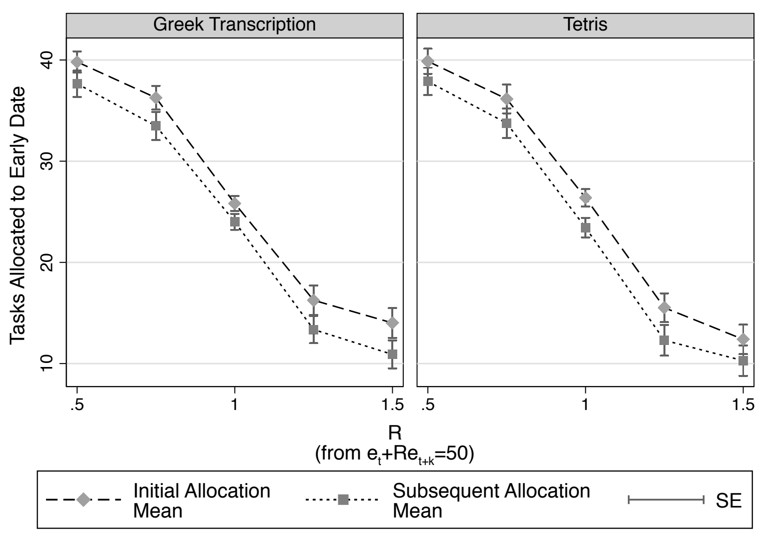


Figure A3: Commitment Demand: Full Effort Data Set

Panel A: Commit (=0)




Panel B: Commit (=1)



# F Instructions

## F.1 Week 1 Effort Instructions

# 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 be willing to participate for six consecutive weeks. Participation will require your presence on six consecutive Thursdays for at least 10 minutes per week for an average of 60 minutes. Weeks 1 (today) and 4 will occur in the xlab. Weeks 2,3,5, and 6 will occur at any computer that has access to the Internet.

You must be willing to receive your payment from this experiment as one single completion payment at the end of the study. Payments will be made one week after the final session, on Thursday, March 22. You will return to the xlab to receive this payment.

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

# Informed Consent

Placed in front of you is an informed consent form to protect your rights as a subject. Please read it. If you would like to choose not to participate in the study you are free to leave at this point. If you have any questions, we can address those now. We will pick up the forms after the main points of the study are discussed.

# Anonymity

Your anonymity in this study is assured. Your name will never be recorded or connected to any decision you make here today. Your email will be collected in order to send reminder emails. After the study, your email information will be destroyed and will not be connected to your responses in the experiment.

## 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. There will be a quiz once we have finished with the instructions. If it is clear that you do not understand the instructions when we review your answers, you will be emailed and removed from the study.

## Your Earnings

If you complete all six weeks of participation, a completion payment of $100 will be provided. You may receive additional earnings during the experiment. If you choose to end your participation before the six weeks are complete, please report this to study administrators, and you will receive a minimum payment of $10.

All payments will be made one week after the final session, on Thursday March 22. You will return to the xlab to receive this payment.

## Jobs

In this study there are two types of jobs, Job 1 and Job 2. These jobs will be completed over time. Some portion of the jobs may be completed sooner, and some portion of the jobs may be completed later depending on your choices and chance. Importantly, some tasks for each job must be completed in each week. That is, as mentioned before, your participation is required in each of the six consecutive weeks of the study.

## Job 1:

In Job 1 you are asked to transcribe letters from a greek text. Greek text will appear in the Transcription Box on your screen. For each letter you will need to find and select the corresponding letter and enter it into the Completion Box on your screen. One task is one row of greek text. For the task to be complete your accuracy must be 80% or better.

## Job 2:

In Job 2 you are asked to play a tetris game. Blocks of different shapes drop from the top of the task screen into a box. Each block is made up of four small squares arranged to make a larger square, an L-shape or a column. As the blocks fall they can be rotated (by pressing the up arrow key), moved horizontally (by pressing the left and right arrow keys), or moved down more quickly (by pressing the down arrow key). Your goal is to fill a entire horizontal line with parts of the blocks. When a horizontal line is filled, that line is "destroyed," moving the rest of the placed pieces down by one square. If a line remains incomplete, another line must be finished above it. The more lines that stand incomplete, the higher the blocks above them stack, reducing the space in which falling shapes can be manipulated. Eventually the blocks reach the top of the screen and the game ends. One task will be 4 lines of blocks completed. If a game ends before a task is complete, the completed lines will be counted in the subsequent game.

**Practice:** We will now spend a few minutes practicing both jobs on the computer. Before we continue, you will be asked to register using your email by clicking "register" once you open the experiment. Make sure that you enter a valid email address.

# The Experiment Timeline

Now that you've tried Job 1 and Job 2, let's consider the timeline of the study. Along the way we will discuss a few important details of how the study works.

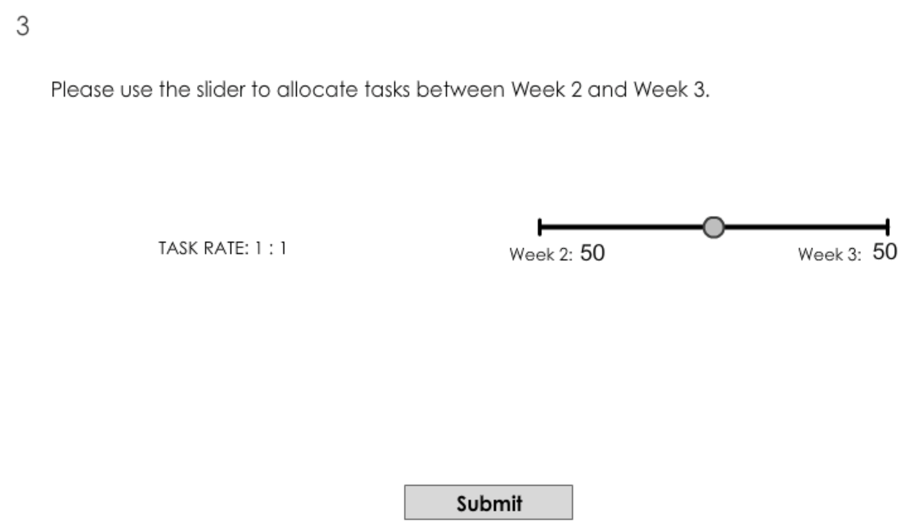
*Note: Minimum Work for each week*

In each week (including today), you are required to complete a minimum number of tasks of both Job 1 and Job 2.

# Today (Week 1):

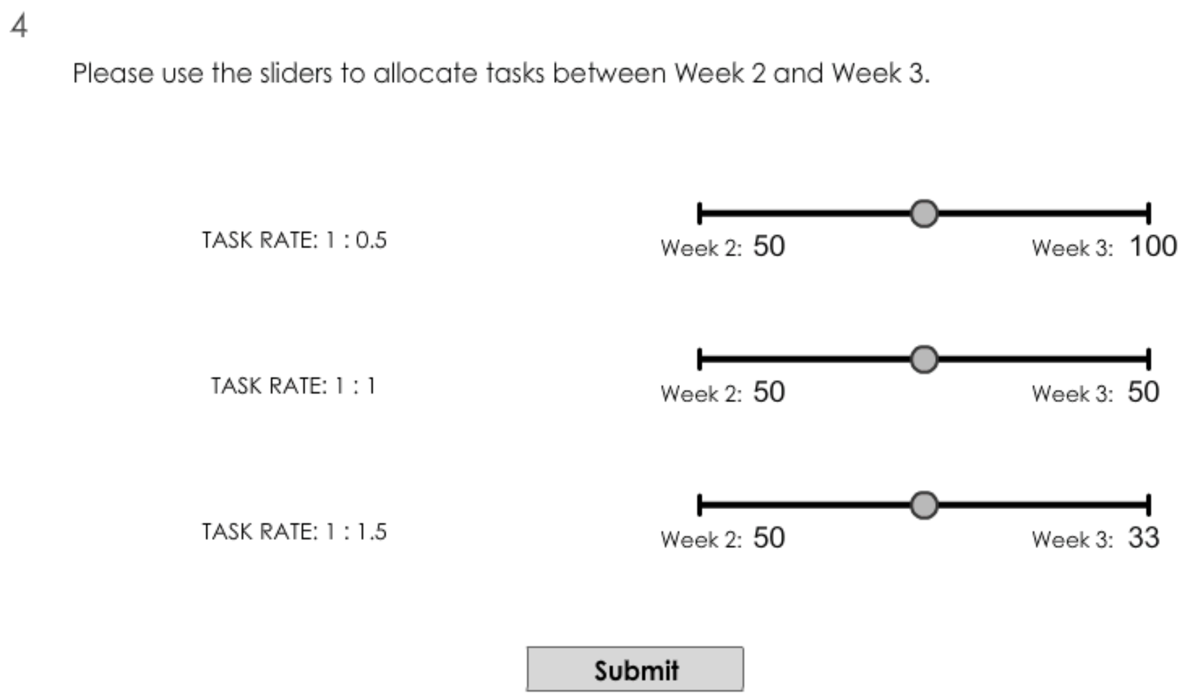
Once your minimum work is complete, you will be asked to make a series of 5 decisions for each job. In these decisions you are asked to allocate tasks between one week from today (Week 2) and two weeks from today (Week 3). You will make 5 decisions for both Job 1 and Job 2.

In each decision you are free to allocate your tasks as you choose. Note that this allocation decision does not include the minimum work for each week, which you must also complete. You will choose by moving a slider to your desired allocation. We will now practice on the computer.




## Task Rates:

In the example decision above every task you allocate to Week 2 reduces the number of tasks allocated to Week 3 by one. This is what we will refer to as a 1:1 task rate. The task rate will vary across your decisions. For example, the task rate may be 1:1.5, such that every task you allocate to Week 2 reduces the number of tasks allocated to Week 3 by 1.5. Or, the task rate may be 1:0.5, such that every task you allocate to Week 2 reduces the number of tasks allocated to Week 3 by 0.5. For simplicity, the task rates will always be represented as 1:X, and you will be fully informed of the value of X when making your decisions. Please practice with the different allocations using the computer.




## Week 2 (One Week From Today):

Week 2, one week from today, will occur online. You will receive an email with instructions on how to access the website with the jobs. You will again complete your minimum work. You will be asked again to make 5 allocation decisions for each job. Exactly one of your 20 total allocation decisions will be implemented. That is, we will implement one decision from Week 1 for Job 1, or one decision from Week 2 for Job 1, or one decision from Week 1 for Job 2, or one decision from Week 2 for Job 2.

We will discuss how this allocation decision is chosen shortly. We refer to this allocation decision as the "**decision-that-counts.**" The tasks you allocated to Week 2 in the decision-that-counts must be completed. If you do not return or do not complete the tasks in Week 2, you cannot complete the study, and you will receive only the minimum payment of $10. In order for your tasks in Week 2 to be counted, they must be submitted by midnight on February 16th, 2012.

## Week 3, Two Weeks From Today:

Week 3, two weeks from today, will occur online. You will receive an email with instructions on how to access the website with the jobs. You will again complete your minimum work. Then, you must complete the tasks you allocated in the decision-that-counts. If you do not return or do not complete the tasks in Week 3, you cannot complete the study, and you will receive only the minimum payment of $10. In order for your tasks in Week 3 to be counted, they must be submitted by midnight on February 23rd, 2012.

## Choosing the Decision-That-Counts:

To summarize: In Week 1 (today), you will make 5 allocation decisions for both Job 1 and Job 2 for different task rates. In Week 2, you will also make 5 allocation decisions for both Job 1 and Job 2 for different task rates.

Therefore, you will make 20 total allocation decisions. As stated above, we will choose only one of these decisions as the decisions-that-counts. That is, we will either implement one decision from Job 1 or one decision from Job 2, but not both.

### There are three stages to determine the decision-that-counts.

1. First, we will choose if the decision-that-counts will come from Week 1 or Week 2. To do this, we will pick a random number from 1 to 10. If the number is 1, then the decision-that-counts will come from your Week 1 allocations. If the number is 2,3,4,5,6,7,8,9 or 10, then the decision-that-counts will come from your Week 2 allocations. Therefore, the decision-that-counts will come from Week 1 with a 10 percent chance and the decision-that-counts will come from Week 2 with a 90 percent chance.

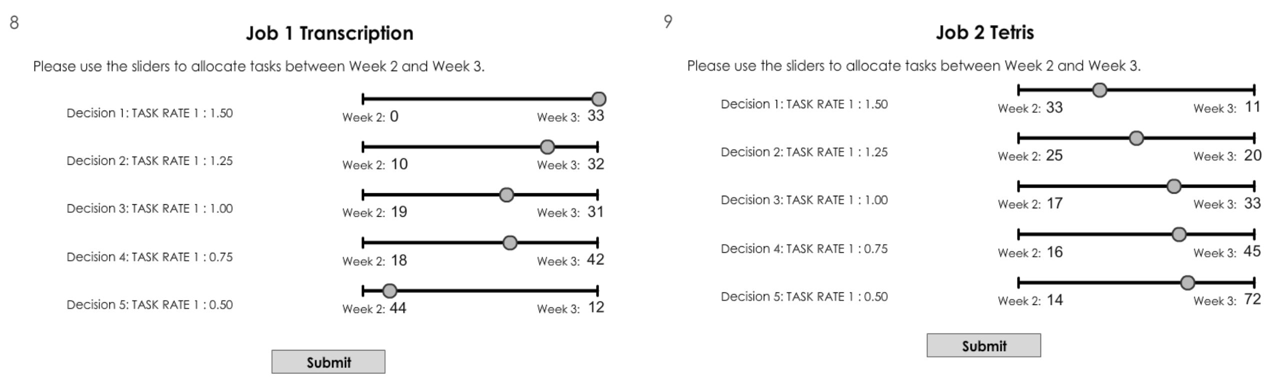
2. Second, we will choose if the decision-that-counts will come from Job 1 or Job 2. To do this we will pick a second random number from 1 to 2. If the number is 1 then the decision-that-counts will come from Job 1. If the number is 2, then the decision-that-counts will come from Job 2. Therefore, the decision-that-counts is equally likely to come

from Job 1 and Job 2.

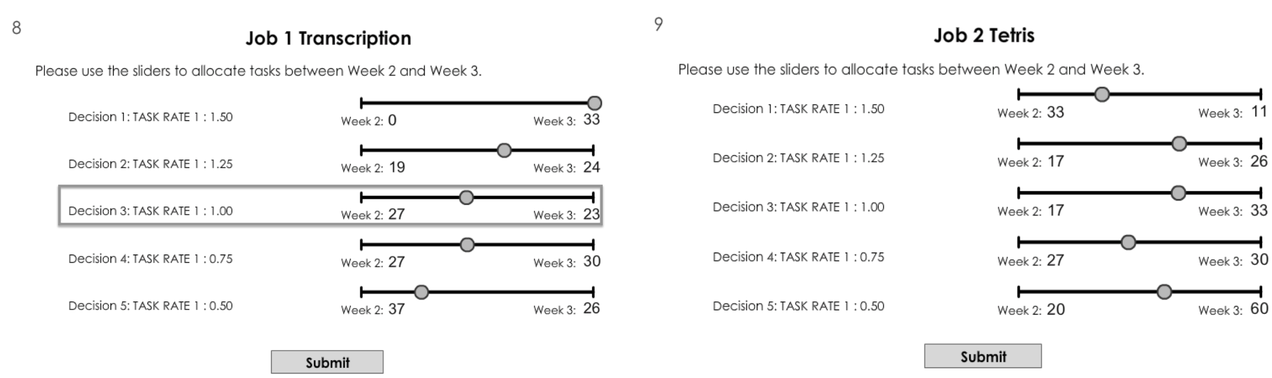
3. Third, we will choose the decision-that-counts from the 5 allocations you made in the chosen week and the chosen job. To do this, we will pick a third random number from 1 to 5. Therefore, within the chosen week and chosen job, every allocation is equally likely to be chosen as the decision-that-counts.

For example, consider the following allocation examples. Imagine that your allocations were shown in the following diagram for Weeks 1 and 2. Now, imagine that we determine the decision-that-counts.

**Week 1 Allocations**




**Week 2 Allocations**




1. Following the first step above, we would first generate a random number from 1 to 10 to determine whether the Week 1 or the Week 2 allocations will be implemented. If the

number is 1, then the decision-that-counts will come from your Week 1 allocations. If the number is 2,3,4,5,6,7,8,9 or 10, then the decision-that-counts will come from your Week 2 allocations. Imagine the number is 7, such that your Week 2 allocations will be implemented.

2. Following the second step above, we would generate a random number from 1 to 2 to determine the job of the decision-that-counts. If the number is 1 then the decision that counts will come from Job 1. If the number is 2, then the decision that counts will come from Job 2. Imagine the number is 1, such that the your Job 1 allocations will be implemented.

3. Following the third step above, we would generate a random number from 1 to 5 to determine the decision-that-counts from your Week 2 allocations for Job 1. Imagine this number is 3 such that **the decision-that-counts would then be third allocation decision from your Week 2 allocations for Job 1**

   **In Week 2, you would be required to complete 27 tasks of Job 1 and in Week 3 you would be required to complete 23 tasks of Job 1.**

   ***Note that these tasks will be in addition to the minimum work that you will be required to complete for both jobs in both weeks.***

**REMEMBER: EACH DECISION COULD BE THE DECISION-THAT-COUNTS SO TREAT EACH DECISION AS IF IT WAS THE ONE DETERMINING YOUR TASKS.**

## Recap:

- You will be participating in a six week study that requires participation one day per week on six consecutive weeks.
- You will receive a completion payment of $100 at the end of the study by check one week after Week 6. You will return to the xlab on March 22, 2012 to receive this payment.
- If you choose to no longer participate, or do not complete the jobs you chose, you will receive only a minimum payment of $10 by check one week after Week 6. You will return to the xlab on March 22, 2012 to receive this payment.
- There are two possible jobs in the study. Job 1 is transcription of greek letters. Job 2 is a tetris game.
- In each week, you will be asked to complete minimum work for each job.
- In Week 1, today, you will be asked to make a series of allocation decisions for both Job 1 and Job 2. You will allocate tasks to Weeks 2 and 3 at various task rates.
- In Week 2, you will again make allocation decisions.
- One of your allocation decisions will be chosen at random as the decision-that-counts and your allocation will determine the tasks that you complete in Weeks 2 and 3.
- One of your Week 1 allocations will be implemented with 10 percent chance while one of your Week 2 allocations will be implemented with 90 percent chance.
- Weeks 4, 5, and 6 will mirror Weeks 1, 2, and 3. In Week 4 you will make allocation decisions. In Week 5, you will again make allocation decisions and one of your allocation decisions will be chosen at random as the decision-that-counts. Your allocation will determine the jobs that you complete in Weeks 5 and 6.

- One week after week 6, you will receive your completion payment of $100. You will return to the xlab on March 22, 2012 to receive this payment.

# 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. Otherwise, please sign the consent form and we will pick these up now.

# Minimum Work

Now you will complete your minimum work for each job for this week. For each job, we ask that you complete 10 tasks.

# Reminder of Timeline

Today you will be asked to make a series of 5 allocation decisions for both Job 1 and Job 2. In these decisions you are asked to allocate tasks between one week from today (Week 2) and two weeks from today (Week 3).

In each decision you are free to allocate your tasks as you choose. The allocations do not include the minimum amount of work for each job. You will choose by moving a slider to your desired allocation.

# Allocations

In the sliders on the screen, you will be asked to make 5 allocations for Job 1. Then, you will be asked to make 5 allocation decisions for Job 2.

Remember each decision could be the decision-that-counts, so please make each decision as if it were the one that determines your tasks.

## F.2 Week 1 Money Instructions

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 over Job 1 and Job 2 and will be paid separately.

You must be willing to receive your payment for this study by cash provided to you in the xlab by Professor Ned Augenblick of the Haas School of Business. You will be required to return to the xlab on the dates indicated to complete the study and so your choice of payments will not require you to arrive any extra times.

# Earning Money

To begin, you will be given a $10 thank-you payment, just for participating in this study! You will receive this thank-you payment in two equally sized payments of $5 each. The two $5 payments will come to you at two different times. These times will be determined in the way described below.

In this portion of the study, you will make 15 choices over how to allocate money between three possible dates:

1) February 9th (today - week 1),

2) March 1st (three weeks from today - week 4)

3) March 22nd (six weeks from today - week 7).

Note that these are all days that you will be in the xlab. In each decision, you will allocate money between two of these dates. In the first set of five decisions, you will allocate money between week 1 (today) and week 4. In the second set, you will allocate money between week 1 (today) and week 7. In the third set, you will allocate money between week 4 and week 7. This means you could be receiving payments as early as today, and as late as the week 7.

Once all 15 decisions have been made, we will randomly select one of the 15 decisions as the decision-that-counts. We will use the decision-that-counts to determine your actual earnings.

Note, since all decisions are equally likely to be chosen, you should make each decision as if it will be the decision-that-counts.

When calculating your earnings from the decision-that-counts, we will add to your earnings the two $5 thank you payments. Thus, you will always get paid at least $5 at the chosen earlier time, and at least $5 at the chosen later time.

**IMPORTANT:** All payments you receive will be paid in cash in the xlab. On the scheduled day of payment, you will come to the xlab for the regular schedule of the study. Hence, you will not be asked to make any special arrangements to receive payment from this portion of the study. You will receive your payment from Professor Ned Augenblick.

On your desk are two envelopes: one for the sooner payment and one for the later payment. Please take the time now to write your participant ID on them.

## How It Works:

In the following three screens you are asked to make 15 decisions involving payments over time. Each row is a decision and is numbered from 1 to 15.

Each row will feature a series of options. Each option consists of a sooner payment AND a later payment. You are asked to pick your favorite option in each row by moving the slider to your desired location. You should pick the combination of sooner payment AND later payment that you prefer the most.

Note that there is a trade-off between the sooner payment and the later payment. As the sooner payment goes down, the later payment goes up. 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.

Once all 15 of your decisions are complete, we will choose one at random to be the decision-that-counts. Your chosen allocation will be implemented.

Consider if the decision-that-counts was the third decision, and in that decision, you allocated \$11 on February 9th and \$10.50 on March 1st. Then, on February 9th, we would place \$11 along with your \$5 minimum payment, making \$16.00, into your first envelope. This envelope will be given to you on February 9th (today) in the xlab. On March 1st, we would place \$10.50 along with your \$5 minimum payment, making \$15.50, into your second envelope. This envelope will be given to you on March 1st when you return to the xlab. Recall that this will not require you to make any special arrangements to receive payment as you will be returning to the laboratory as part of the regular schedule of the study.

Once your payments have been determined, you will write the amounts and dates on the inside of the two envelopes. When you receive your payments you can guarantee there have been no clerical errors by checking against the amounts and dates you wrote.

**Remember that each decision could be the decision-that-counts! It is in your interest to treat each decision as if it could be the one that determines your payment.**

### F.3 Week 1 Quiz

## Quiz

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

Participant #

1. How many weeks are you required to participate?
2. In which weeks are you asked to come to the xlab to participate?
3. In which weeks are you asked to participate online and not come to the xlab?
4. Will you have to complete minimum work for each job in each week?
5. You will make allocation decisions for Weeks 2 and 3 both today and in Week 2. What is the percent chance that one of your Week 2 allocations will be implemented?
6. If you face a 1:2 task rate for allocations between Weeks 2 and 3, every task you allocate to Week 2 decreases by how many the number of tasks you allocate to Week 3?
7. You will make allocations for each job. Apart from your minimum work, will you complete any tetris tasks if a transcription job allocation is chosen as the decision-that-counts.

### F.4 Week 4 Effort Instructions

## Welcome:

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

## Eligibility for this study:

To continue in this study, you need to meet these criteria: You must be willing to participate for three consecutive weeks. Participation will require your presence on three consecutive Fridays for at least 10 minutes per week for an average of 60 minutes. Week 4 (today) will occur in the xlab. Weeks 5 and 6 will occur at any computer that has access to the Internet.

You must be willing to receive your payment from this experiment as one single completion payment at the end of the study. Payments will be made one week after the final session, on Friday, March 23. You will return to the xlab to receive this payment.

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

## Your Earnings

If you complete all six weeks of participation, a completion payment of $100 will be provided. You may receive additional earnings during the experiment. If you choose to end your participation before the six weeks are complete, please report this to study administrators, and you will receive a minimum payment of $10.

All payments will be made one week after the final session, on Friday March 23. You will return to the xlab to receive this payment.

## Jobs

In this study there are two types of jobs, Job 1 and Job 2. These jobs will be completed over time. Some portion of the jobs may be completed sooner, and some portion of the jobs may be completed later depending on your choices and chance. Importantly, some tasks for each job must be completed in each week. That is, as mentioned before, your participation is required in each of the six consecutive weeks of the study.

## Job 1:

In Job 1 you are asked to transcribe letters from a greek text.

## Job 2:

In Job 2 you are asked to play a tetris game.

## The Experiment Timeline

*Note: Minimum Work for each week*

In each week (including today), you are required to complete a minimum number of tasks of both Job 1 and Job 2.

## Today (Week 4):

Once your minimum work is complete, you will be asked to make a series of 5 decisions for each job. In these decisions you are asked to allocate tasks between one week from today (Week 5) and two weeks from today (Week 6). You will make 5 decisions for both Job 1 and Job 2.

In each decision you are free to allocate your tasks as you choose. Note that this allocation decision does not include the minimum work for each week, which you must also complete.

## Task Rates:

For one example task rate, every task you allocate to Week 6 reduces the number of tasks allocated to Week 5 by one. This is what we will refer to as a 1:1 task rate. The task rate will vary across your decisions. For example, the task rate may be 1:1.5, such that every task you allocate to Week 6 reduces the number of tasks allocated to Week 5 by 1.5. Or, the task rate may be 1:0.5, such that every task you allocate to Week 6 reduces the number of tasks allocated to Week 5 by 0.5. For simplicity, the task rates will always be represented as 1:X, and you will be fully informed of the value of X when making your decisions.

## Week 5 (One Week From Today):

Week 5, one week from today, will occur online and follows week 2 of the experiment. You will receive an email with instructions on how to access the website with the jobs. You will again complete your minimum work. You will be asked again to make 5 allocation decisions for each job. Exactly one of your 20 total allocation decisions will be implemented. That is, we will implement one decision from Week 4 for Job 1, or one decision from Week 5 for Job 1, or one decision from Week 4 for Job 2, or one decision from Week 5 for Job 2.

We will discuss how this allocation decision is chosen shortly. We refer to this allocation decision as the "**decision-that-counts.**" The tasks you allocated to Week 5 in the decision-that-counts must be completed. If you do not return or do not complete the tasks in Week 5, you cannot complete the study, and you will receive only the minimum payment of $10. In order for your tasks in Week 5 to be counted, they must be submitted by midnight on March 9th, 2012.

## Week 6, Two Weeks From Today:

Week 6, two weeks from today, will occur online and follows week 3 of the experiment. You will receive an email with instructions on how to access the website with the jobs. You will again complete your minimum work. Then, you must complete the tasks you allocated in the decision-that-counts. If you do not return or do not complete the tasks in Week 6, you cannot complete the study, and you will receive only the minimum payment of $10. In order for your tasks in Week 6 to be counted, they must be submitted by midnight on March 16th, 2012.

## Choosing the Decision-That-Counts:

To summarize: In Week 4 (today), you will make 5 allocation decisions for both Job 1 and Job 2 for different task rates. In Week 5, you will also make 5 allocation decisions for both Job 1 and Job 2 for different task rates.

Therefore, you will make 20 total allocation decisions. As stated above, we will choose only one of these decisions as the decisions-that-counts. That is, we will either implement one decision from Job 1 or one decision from Job 2, but not both.

The decision-that-counts will be chosen using a similar method to the one used in Week 2. **However, this week, you will make a set of new decisions that affect the precise way that the decision-that-counts is chosen.** To understand these new decisions, please recall how the decision-that-counts was chosen in Week 2:

# How the decision-that-counts was chosen in Week 2

We used 3 steps to choose the decision-that-counts in Week 2.

1. First, we chose if the decision-that-counts came from the sooner week (Week 1) or the later week (Week 2) allocations. To do this, we picked a random number from 1 to 10. If the number was 1, then the decision-that-counts came from the allocations from the sooner week (Week 1). If the number is 2,3,4,5,6,7,8,9 or 10, then the decision-that-counts came from the allocations from the later week (Week 2). Therefore, the decision-that-counts came from the sooner week with a 10 percent chance and the decision-that-counts came from the later week with a 90 percent chance. **This is the part of the choosing the decision-that-counts that you will be able to affect in the new set of decisions this week.**

2. Second, we chose if the decision-that-counts came from Job 1 or Job 2. To do this, we picked a second random number from 1 to 2. If the number was 1 then the decision-that-counts came from Job 1. If the number was 2, then the decision-that-counts came from Job 2. Therefore, the decision-that-counts was equally likely to come from Job 1 and Job 2.

3. Third, we chose the decision-that-counts from the 5 allocations you made in the chosen week and the chosen job. To do this, we picked a third random number from 1 to 5. Therefore, within the chosen week and chosen job, every allocation was equally likely to be chosen as the decision-that-counts.

## How the decision-that-counts will be chosen in Week 5

In Week 5, the decision that counts will be chosen in a similar way to Week 2 with one important difference. Today, you will make a set of 15 decisions that can affect the **first step of the process.** In Week 2, there was a 10 percent chance that the decision-that-counts would come from your sooner (Week 1) allocations. In Week 5, based on your decisions, there will either be a 10 percent chance or a 90 percent chance that decision-that-counts will come from your sooner (Week 4) allocations. *That is, your decisions will change the likelihood that one of your Week 4 allocations is chosen as the decision-that-counts.*

For example, in one of the decisions, you will simply be asked to choose which option you prefer:

1) a 10 percent chance that decision-that-counts will come from your Week 4 allocations (and 90 percent chance that it comes from Week 5).

2) a 90 percent chance that decision-that-counts will come from your Week 4 allocations (and 10 percent chance that it comes from Week 5)

This decision measures your preference about which choices will be allocated. For example, if you would prefer that one of your week 5 allocations were chosen rather than a week 4 allocation, you should choose the first option. Please take a second to think about this decision.

The other decisions measure *the strength* of your preference about which choices will be allocated. In these decisions, you will make this same decision but with additional payments added to one of the two options. So, for example, you will be asked to choose which option you prefer:

1) a 10 percent chance that decision-that-counts will come from your Week 4 allocations (and 90 percent chance that it comes from Week 5).

2) a 90 percent chance that decision-that-counts will come from your Week 4 allocations (and 10 percent chance that it comes from Week 5) **plus $3.**

For example, if you would very strongly prefer that one of your Week 5 allocations were chosen rather than a Week 4 allocation, you might still choose the first option, even though you could get an extra $3 for choosing the second option. We will choose one of your 15 percentage decisions to be implemented **at random**. This implemented decision will be used to determine the percentage chance that the decision-that-counts comes from your Week 4 allocations. Furthermore, if your implemented decision includes an additional payment, this additional payment will be added to your final $100 completion check.

**REMEMBER: EACH DECISION COULD BE IMPLEMENTED SO TREAT EACH DECISION AS IF IT WAS GOING TO BE IMPLEMENTED.**

## Recap:

- You will be continuing in a study that requires participation one day per week on three consecutive weeks.
- You will receive a completion payment of $100 at the end of the study by check one week after Week 6. You will return to the xlab on March 23, 2012 to receive this payment.
- If you choose to no longer participate, or do not complete the jobs you chose, you will receive only a minimum payment of $10 by check one week after Week 6. You will return to the xlab on March 23, 2012 to receive this payment.
- There are two possible jobs in the study. Job 1 is transcription of greek letters. Job 2 is a tetris game.
- In each week, you will be asked to complete minimum work for each job.
- In Week 4, today, you will be asked to make a series of allocation decisions for both Job 1 and Job 2. You will allocate tasks to Weeks 5 and 6 at various task rates.
- In Week 5, you will again make allocation decisions.
- One of your allocation decisions will be chosen at random as the decision-that-counts and your allocation will determine the tasks that you complete in Weeks 5 and 6.
- You will be asked to make decisions about the percentage chance that the decision-that-counts will come from your Week 4 allocations. You will make a series of 15 decisions between (10% Week 4) and (90% Week 4) with additional payments potentially added to the options. One of these decisions will be implemented. If the decision that is implemented includes an additional payment, this will be added to your completion payment.
- One week after Week 6, you will receive your completion payment. You will return to the xlab on March 23, 2012 to receive this payment.

## Minimum Work

Now you will complete your minimum work for each job for this week. For each job, we ask that you complete 10 tasks.

## Allocations

Today you will be asked to make a series of 5 allocation decisions for both Job 1 and Job 2. In these decisions you are asked to allocate tasks between one week from today (Week 5) and two weeks from today (Week 6).

In each decision you are free to allocate your tasks as you choose. The allocations do not include the minimum amount of work for each job. You will choose by moving a slider to your desired allocation.

In the sliders on the screen, you will be asked to make 5 allocations for Job 1. Then, you will be asked to make 5 allocation decisions for Job. Remember each decision could be the decision-that-counts, so please make each decision as if it were the one that determines your tasks.

## Determining how the decision-that-counts will be chosen in Week 5

On the screen you will be asked to choose between a 10% or a 90% chance that the decision-that-counts comes from today's allocations (Week 4) rather than the allocations you will make next week (Week 5). In each decision, you are also given an additional payment for choosing one of the two options. Remember each decision could be implemented, so please make the decision as if it was determining the percent chance and your additional payment.

## F.5 Week 4 Money Instructions

Thank you for completing your allocations. On the following screen 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 over Job 1 and Job 2 and will be paid separately.

You must be willing to receive your payment for this study by cash provided to you in the xlab by Professor Ned Augenblick of the Haas School of Business. You will be required to return to the xlab on the dates indicated to complete the study and so your choice of payments will not require you to arrive any extra times.

# Earning Money

To begin, you will be given a $10 thank-you payment, just for participating in this study! You will receive this thank-you payment in two equally sized payments of $5 each. The two $5 payments will come to you at two different times. These times will be determined in the way described below.

In this portion of the study, you will make 5 choices over how to allocate money between two points in time:

1) March 2nd

2) March 23rd

Note that these are days that you will be in the xlab.

In each decision, you will allocate money between these dates. Once all 5 decisions have been made, we will randomly select one of the 5 decisions as the decision-that-counts. We will use the decision-that-counts to determine your actual earnings. Note, since all decisions are equally likely to be chosen, you should make each decision as if it will be the decision-that-counts.

When calculating your earnings from the decision-that-counts, we will add to your earnings the two $5 thank you payments. Thus, you will always get paid at least $5 on March 2st, and at least $5 on March 23nd.

**IMPORTANT:** All payments you receive will be paid in cash in the xlab. On the scheduled day of payment, you will come to the xlab for the regular schedule of the study. Hence, you will not be asked to make any special arrangements to receive payment from this portion of the study. You will receive your payment from Professor Ned Augenblick.

On your desk are two envelopes: one for the sooner payment and one for the later payment. Please take the time now to write your participant ID on them and study time/date on them.

## How It Works:

In the following screen you are asked to make 5 decisions involving payments over time. Each row is a decision and is numbered from 1 to 5.

Each row will feature a series of options. Each option consists of a sooner payment AND a later payment. You are asked to pick your favorite option in each row by moving the slider to your desired location. You should pick the combination of sooner payment AND later payment that you prefer the most.

Note that there is a trade-off between the sooner payment and the later payment. As the sooner payment goes down, the later payment goes up. 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.

Once all 5 of your decisions are complete, we will choose one at random to be the decision-that-counts. Your chosen allocation will be implemented.

Consider for example the first decision. If this was chosen as the decision that counts and your preferred allocation was $11 on March 2st and $10.50 on March 23nd, this would then be implemented. On March 2st, we would place $11 along with your $5 minimum payment, making $16.00, into your first envelope. This envelope will be given to you on March 2st in the xlab. On March 23nd, we would place $10.50 along with your $5 minimum payment, making $15.50, into your second envelope. This envelope will be given to you on March 23nd when you return to the xlab. Recall that this will not require you to make any special arrangements to receive payment as you will be returning to the laboratory as part of the regular schedule of the study.

Once your payments have been determined, you will write the amounts and dates on the inside of the two envelopes. When you receive your payments you can guarantee there have been no clerical errors by checking against the amounts and dates you wrote.

**Remember that each decision could be the decision-that-counts! It is in your interest to treat each decision as if it could be the one that determines your payment.**

# G Replication Study Instructions

## INSTRUCTIONS

## Welcome

Thank you for participating in our study. We will begin shortly.

## Eligibility and Study Requirements

Participation in this study will require activities lasting at least 30 minutes on four consecutive Thursdays, beginning today and ending three weeks from today: Apr-10, Apr-17, Apr-24, May-1.

Your first activity for this study is choosing amounts of money to be received one week from today, Thursday, Apr-17, and two weeks from today Thursday, Apr-24. You will make nine such choices today and you will make nine such choices one week from today on Thursday, Apr-17. The choices you make today will be referred to as your Week 1 choices. The choices you make one week from today on Thursday, Apr-17, will be referred to as your Week 2 choices.

You will make your Week 1 choices today in the laboratory via the study website.

Next week, on Wednesday night, you will receive an email with the study website. This link will be active at 9am on Thursday morning. You can then login and make your Week 2 choices using any computer that has internet access. You must make these decisions by 4pm that day.

Your second activity for this study is collecting your chosen payments. Payments will be collected at a table setup directly outside of the xlab. The Apr-17th payments must be collected within 2 hours of making your decisions. The Apr-24th payments must be collected between 9am and 6pm.

In order to complete this study you must be willing to both choose amounts of money and to collect these amounts on Thursday, Apr-17 and Thursday, Apr-24. If you complete these elements, you will be eligible to receive a completion payment of $30. This can be collected on Thursday, May-1 outside the xlab between the hours of 9 a.m. and 6 p.m. If you do not complete all elements of the study, you will be eligible to receive only a payment of $5. This can also be collected on Thursday, May-1 at the xlab between the hours of 9 a.m. and 6 p.m.

If you do not meet or understand the study requirements, please inform us of this now.

## Your Earnings

All payments will be made by Professor Ned Augenblick and his assistants. All payments will be made in cash. You will receive your payments only in designated locations, at designated times, on designated dates.

## Informed Consent

Placed in front of you is an informed consent form to protect your rights as a subject. Please read it. If you would like to choose not to participate in the study you are free to leave at this point. If you have any questions, we can address those now. We will pick up the forms after the main points of the study are discussed.

## Anonymity

Your anonymity in this study is assured. Your name will never be recorded or connected to any decision you make here today. Your email will be collected in order to communicate with you during the study. After the study, your email information will be destroyed and will not be connected to your responses in the experiment.

## 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.

## Registration

We will now begin the study. Please open the study interface and enter your e-mail address. Make sure that you enter a valid e-mail address as this will be the method by which we contact you throughout the study.

## Study Activities

We will now discuss in detail the study activities. In this study there are two activities. The first activity is choosing payments over time. You will make 9 such choices today, Thursday, Apr-10. The choices you make today will be referred to as your Week 1 choices. You will make 9 such choices one week from today, Thursday, Apr-17. The choices you make one week from today will be referred to as your Week 2 choices. In both your Week 1 and Week 2 choices, you will be choosing an amount of money to be received on Thursday, Apr-17 AND an amount of money to be received on Thursday, Apr-24.

Each choice is a series of options. Each option consists of a sooner payment (to be collected on Thursday, Apr-17) AND a later payment (to be collected on Thursday, Apr-24). You are asked to pick your favorite option in each choice by moving a slider to your desired location. In the example sliders on the website, please explore the potential choices.

Note that there is a trade-off between the sooner payment and the later payment. When the sooner payment goes down, the later payment goes up and vice versa. In each choice, the trade-off will be summarized by an "exchange rate," and will be expressed as a number $1 : X$. This means that if you increase the sooner payment by $1, the later payment will be decreased by $X. In the example, the exchange rate was 1 : 1, meaning that if you increase the sooner payment by $1, the later payment is decreased by $1.

Remember, 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.

The second activity is collecting payments. You will collect the payments from one of your choices. This means you will collect some amount of money on Thursday, Apr-17 and some amount of money on Thursday, Apr-24. The payment on Apr-17 must be collected within 2 hours of making your decision. The payment on Apr-24 can be collected anytime between 9am and 6pm. Payments will be collected at a table setup outside of the xlab.

# The Experiment Timeline

We will now discuss the timeline of the study. Along the way we will discuss a few important details of how the study works.

*Note: Minimum Payments for Each Week.* With the exception of the final completion payment date, on each day of study participation (including today), you will receive a minimum payment of $5. These payments are in addition to your chosen payments. This payment will be paid in cash and be added to your experimental earnings. These payments must be collected for successful completion of the study.

# Week 1(Today: Apr-10)

Today you will make 9 choices. Each choice is a series of options. Each option will consist of a sooner payment (to be collected on Thursday, Apr-17) AND a later payment (to be collected on Thursday, Apr-24). In each choice, the "exchange rate" will be different.

You will be asked to pick your favorite option in each choice by moving a slider to your desired location. You should pick the combination of sooner payment AND later payment that you prefer the most.

Once your 9 choices are complete, you will receive your minimum payment of $5 and depart.

## Week 2 (One Week From Today: Apr-17)

Next week, on Wednesday night, you will receive an email with the study website. This link will be active at 9am on Thursday morning. You must log in to the study website between 9am and 4pm of next Thursday, Apr-17. You will also receive a reminder email on Thursday.

You will again make 9 choices. Each choice is a series of options. Each option will consist of a sooner payment (to be collected on Thursday, Apr-17) AND a later payment (to be collected on Thursday, Apr-24). In each choice, the "exchange rate" will be different.

You will be asked to pick your favorite option in each choice by moving a slider to your desired location. You should pick the combination of sooner payment AND later payment that you prefer the most.

Once your 9 Week 2 choices are complete, you will have made a total of 18 choices: 9 Week 1 choices and 9 Week 2 choices. We will then pick one of your 18 total choices at random to be the **decision-that-counts**. Your earnings will be determined by your decision in the decision-that-counts. You will receive the amounts specified in the decision-that-counts on the designated dates, Thursday, Apr-17 and Thursday, Apr-24. Recall that these earnings are *in addition* to your two $5 minimum payments. Thus, you will always pick up a payment on Thursday, Apr-17 and $5 on Thursday, Apr-24 of at least $5.

**REMEMBER: EACH DECISION COULD BE THE DECISION-THAT-COUNTS SO TREAT EACH CHOICE AS IF IT WAS THE ONE DETERMINING YOUR EARNINGS.**

Consider if in the decision-that-counts your preferred choice was an $11 sooner payment (to be collected on Thursday, Apr-17) AND a $10.50 later payment (to be collected on Thursday, Apr-24). Then, on Thursday, Apr-17 outside the xlab, you would collect $11 along with your $5 minimum payment, making $16.00 in cash. On Thursday, Apr-24 outside the xlab, you would collect $10.50 along with your $5 minimum payment, making $15.50 in cash.

You must collect your earnings on Apr-17 within two hours of making your decisions online. You must collect your earnings on Apr-24 between 9am and 6pm.. If you do not collect your payment on either Thursday, Apr-17 or Thursday, Apr-24, you will be removed from the study and forfeit all future payments including your completion payment of $30. You will be eligible only for the reduced payment of $5 at the end of the study. There will be no exceptions to this rule.

**REMEMBER:YOU MUST PICK UP YOUR PAYMENTS BETWEEN 9AM AND 6PM.**

**YOU MUST PICK UP YOUR PAYMENT NEXT WEEK WITHIN 2 HOURS OF LOGGING INTO THE WEBSITE.**

## Week 3, (Two Weeks From Today: Apr-24)

In Week 3, you will make no decisions. You will receive an e-mail the night before reminding you of the study. You must pick up your payment for Thursday, Apr-24 along with your $5 minimum payment outside the xlab between 9am and 6pm. If you do not pick up your payment, you will be removed from the study and forfeit your completion payment of $30. You will be eligible only for the reduced payment of $5 at the end of the study. There will be no exceptions to this rule.

## Week 4, (Three Weeks From Today: May-1)

In Week 4, you will make no decisions. You will receive an email reminding you to pick up your completion payment outside the xlab between 9am and 6pm on Thursday, May-1. If you have completed all elements of the study you are eligible to receive a $30 completion payment. If you have not completed all elements of the study you are eligible to receive a $5 completion payment.

# Recap:

- You will be participating in a four week study that requires participation for at least 30 minutes on four consecutive Thursdays.
- On Thursday, April-10, Thursday, Apr-17 and Thursday, Apr-24, you will receive minimum payments of $5. These minimum payments are in addition to your chosen payments from the decision-that-counts. These payments must be collected for successful completion of the study.
- In Week 1, today, Thursday, Apr-10, you will be asked to make 9 choices. Each choice is a series of options. Each option will consist of a sooner payment (to be collected on Thursday, Apr-17) AND a later payment (to be collected on Thursday, Apr-24). In each choice, the "exchange rate" will be different.
- In Week 2, one week from today, Thursday, Apr-17, you will again be asked to make 9 choices. These decisions will be made online between 9am and 4pm. Each choice is a series of options. Each option will consist of a sooner payment (to be collected on Thursday, Apr-17) AND a later payment (to be collected on Thursday, Apr-24). In each choice, the "exchange rate" will be different.
- You will be asked to pick your favorite option in each choice by moving a slider to your desired location. You should pick the combination of sooner payment AND later payment that you prefer the most.
- You will make 18 total choices: 9 in Week 1 and 9 in Week 2. We will pick one of your 18 total choices at random to be the **decision-that-counts**.
- Once your Week 2 decisions have been made on Thursday, Apr-17 and the decision-that-counts has been determined, a two hour window will begin. You must collect your earnings for Thursday, Apr-17 from the decision-that-counts outside of the xlab within this two hour window (and between 9 am and 6pm).
- In Week 3, two weeks from today Thursday, Apr-24, you must collect your earnings for Thursday, Apr-24 from the decision-that-counts outside the xlab between 9am and 6pm.
- If you fail to collect your earnings from the decision-that-counts you will be removed from the study and forfeit all future payments. You will be eligible only for the reduced payment of $5 at the end of the study.
- In Week 4, three weeks from today Thursday, May-1, you will pick up your completion payment outside the xlab between the hours of 9 a.m. and 6 p.m. to receive your completion payment. If you have completed all elements of the study you are eligible for a $30 completion payment. If you have not completed all elements of the study you are eligible only for the reduced amount of $5.

## 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. Otherwise, please sign the consent form and we will pick these up now.

## Allocations

In the sliders on the screen, you will be asked to make 9 allocations.

Remember each decision could be the decision-that-counts, so please make each decision as if it were the one that determines your payment.

# INSTRUCTIONS

## Welcome:

Thank you for participating in our study. We will begin shortly.

## Eligibility and Study Requirements

Participation in this study will require activities lasting at least 30 minutes on four consecutive Thursdays, beginning today and ending three weeks from today: Apr-10, Apr-17, Apr-24, May-1.

Your first activity for this study is choosing amounts of work to be completed one week from today, Thursday, Apr-17, and two weeks from today Thursday, Apr-24. You will make nine such choices today and you will make nine such choices one week from today on Thursday, Apr-17. The choices you make today will be referred to as your Week 1 choices. The choices you make one week from today on Thursday, Apr-17, will be referred to as your Week 2 choices.

You will make your Week 1 choices today in the laboratory via the study website.

Next week, on Wednesday night, you will receive an email with the study website. This link will be active at 9am on Thursday morning. You can then login and make your Week 2 choices using any computer that has internet access. You must make these decisions by 4pm that day.

Your second activity for this study is completing your chosen work. The work in this study will be completed via the study website and can be completed on any computer that has internet access. The Apr-17th work must be completed within 2 hours of making your decisions. The Apr-24th work must be completed between 9am and 6pm.

In order to complete this study you must be willing to both choose amounts of tasks and to complete these tasks on Thursday, Apr-17 and Thursday, Apr-24. If you complete these elements, you will be eligible to receive a completion payment of $60. This can be collected on Thursday, May-1 outside the xlab between the hours of 9 a.m. and 6 p.m. If you do not complete all elements of the study, you will be eligible to receive only a payment of $5. This can also be collected on Thursday, May-1 at the xlab between the hours of 9 a.m. and 6 p.m.

If you do not meet or understand the study requirements, please inform us of this now.

## Your Earnings

The completion payment will be made by check by Professor Ned Augenblick and his assistants. You will receive your payment only in designated locations, at designated times, on designated dates.

## Tasks

The tasks in this study are transcriptions of letters from a greek text. Greek text will appear in a Transcription Box on your screen. For each letter, you will need to find and select the corresponding letter and enter it into the Completion Box on your screen. One task is one row of greek text. For a task to be complete, your accuracy must be 80% or better. Each task takes an average student between 40-60 seconds.

## Informed Consent

Placed in front of you is an informed consent form to protect your rights as a subject. Please read it. If you would like to choose not to participate in the study you are free to leave at this point. If you have any questions, we can address those now. We will pick up the forms after the main points of the study are discussed.

## Anonymity

Your anonymity in this study is assured. Your name will never be recorded or connected to any decision you make here today. Your email will be collected in order to communicate with you during the study. After the study, your email information will be destroyed and will not be connected to your responses in the experiment.

## 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.

## Registration

We will now begin the study. Please open the study interface and enter your e-mail address. Make sure that you enter a valid e-mail address as this will be the method by which we contact you throughout the study.

## Study Activities

We will now discuss in detail the study activities. In this study there are two activities. The first activity is choosing amounts of work over time. You will make 9 such choices today, Thursday, Apr-10. The choices you make today will be referred to as your Week 1 choices. You will make 9 such choices one week from today, Thursday, Apr-17. The choices you make one week from today will be referred to as your Week 2 choices. In both your Week 1 and Week 2 choices, you will be choosing an amount of work to be completed on Thursday, Apr-17 AND an amount of work to be completed on Thursday, Apr-24. The amount of work on each date is expressed as a number of tasks.

Each choice is a series of options. Each option consists of a sooner number of tasks (to be completed on Thursday, Apr-17) AND a later number of tasks (to be completed on Thursday, Apr-24). You are asked to pick your favorite option in each choice by moving a slider to your desired location. In the example sliders on the website, please explore the potential choices.

Note that there is a trade-off between the sooner number of tasks and the later number of tasks. When the sooner number of tasks goes down, the later number of tasks goes up and vice versa. In each choice, the trade-off will be summarized by an "exchange rate," and will be expressed as a number $1 : X$. This means that if you increase the sooner number of tasks by 1 task, the later number of tasks will be decreased by X tasks. In the example, the exchange rate was 1 : 1, meaning that if you increase the sooner number of tasks by 1, the later number of tasks is decreased by 1.

Remember, all you have to do for each decision is choose which combination of sooner and later tasks you prefer the most by moving the slider to that location.

The second activity is completing work. This means you will complete some tasks on Thursday, Apr-17 and some tasks on Thursday, Apr-24. The tasks on Apr-17 must be completed within 2 hours of making your decision. The tasks on Apr-24 can be completed anytime between 9am and 6pm. Tasks will be completed online using any computer that has access to the Internet.

## The Experiment Timeline

We will now discuss the timeline of the study. Along the way we will discuss a few important details of how the study works.

*Note: Minimum Work for Each Week.* With the exception of the final completion payment date, on each day of study participation (including today), you are required to complete a minimum number of 10 tasks. These tasks are in addition to your chosen numbers of tasks. These tasks must be completed for successful completion of the study.

## Week 1(Today: Apr-10)

Today you will make 9 choices. Each choice is a series of options. Each option will consist of a sooner number of tasks (to be completed on Thursday, Apr-17) AND a later number of tasks (to be completed on Thursday, Apr-24). In each choice, the "exchange rate" will be different.

You will be asked to pick your favorite option in each choice by moving a slider to your desired location. You should pick the combination of sooner tasks AND later tasks that you prefer the most.

Today you will complete your minimum work of 10 tasks, then make your 9 choices, and depart.

## Week 2 (One Week From Today Apr-17)

Next week, on Wednesday night, you will receive an email with the study website. This link will be active at 9am on Thursday morning. You must log in to the study website between 9am and 4pm of next Thursday, Apr-17. You will also receive a reminder email on Thursday.

You will again complete minimum work of 10 tasks. Then, you will again make your 9 choices. Each choice is a series of options. Each option will consist of a sooner number of tasks (to be completed on Thursday, Apr-17) AND a later number of tasks (to be completed on Thursday, Apr-24). In each choice, the "exchange rate" will be different.

You will be asked to pick your favorite option in each choice by moving a slider to your desired location. You should pick the combination of sooner tasks AND later tasks that you prefer the most.

Once your 9 Week 2 choices are complete, you will have made a total of 18 choices: 9 Week 1 choices and 9 Week 2 choices. We will then pick one of your 18 total choices at random to be the **decision-that-counts**. Your tasks will be determined by your decision in the decision-that-counts. You will complete the tasks specified in the decision-that-counts on the designated dates, Thursday, Apr-17 and Thursday, Apr-24. Recall that these tasks are in addition to your 10 tasks of minimum work. Thus, you will always login into the website and complete at least 10 tasks on Thursday, Apr-17 and 10 tasks on Thursday, Apr-24.

**REMEMBER: EACH CHOICE COULD BE THE DECISION-THAT-COUNTS SO TREAT EACH CHOICE AS IF IT WAS THE ONE DETERMINING YOUR TASKS.**

Consider if in the decision-that-counts your preferred choice was 30 sooner tasks (to be completed on Thursday, Apr-17) AND 25 later tasks (to be completed on Thursday, Apr-24). Then, on the study website, on Thursday, Apr-17, you would complete 30 tasks along with your 10 tasks of minimum work, making 40 tasks. On Thursday, Apr-24, on the study website, you would complete 25 tasks along with your 10 tasks of minimum work, making 35 tasks.

You must complete your tasks on Apr-17 within two hours of making your decisions online. You must complete your tasks on Apr-24 between 9am and 6pm. If you do not complete your tasks on either Thursday, Apr-17 or Thursday, Apr-24, you will be removed from the study and forfeit the completion payment of $60. You will be eligible only for the reduced payment of $5 at the end of the study. There will be no exceptions to this rule.

**REMEMBER:YOU MUST COMPLETE YOUR TASKS BETWEEN 9AM AND 6PM.**
**YOU MUST COMPLETE YOUR TASKS NEXT WEEK WITHIN 2 HOURS OF LOGGING INTO THE WEBSITE.**

## Week 3, (Two Weeks From Today: Apr-24)

In Week 3, you will make no decisions. You will receive an e-mail the night before reminding you of the study. You must login into the website between 9am and 6pm and you must complete your tasks from the decision-that-counts for Thursday, Apr-24 along with your 10 tasks of minimum work on the study website. If you do not complete your tasks by 6pm, you will be removed from the study and forfeit your completion payment of $60. You will be eligible only for the reduced payment of $5 at the end of the study. There will be no exceptions to this rule.

## Week 4, (Three Weeks From Today: May-1)

In Week 4, you will make no decisions. You will receive an email reminding you to pick up your completion payment in the xlab. If you have completed all elements of the study you are eligible to receive a $60 completion payment. If you have not completed all elements of the study you are eligible to receive a $5 completion payment. These payments will be available outside of the xlab on Thursday, May-1 between the hours of 9 a.m and 6 p.m.

# Recap:

- You will be participating in a four week study that requires participation for at least 30 minutes on four consecutive Thursdays.
- On Thursday, April-10, Thursday, Apr-17 and Thursday, Apr-24, you are required to complete minimum work of 10 tasks. These tasks are in addition to your chosen tasks from the decision-that-counts. These tasks must be completed for successful completion of the study.
- In Week 1, today Thursday, Apr-10, you will be asked to make 9 choices. Each choice is a series of options. Each option will consist of a sooner number of tasks (to be completed on Thursday, Apr-17) AND a later number of tasks (to be completed on Thursday, Apr-24). In each choice, the “exchange rate” will be different.
- In Week 2, one week from today Thursday, Apr-17, you will again be asked to make 9 choices. Each choice is a series of options. Each option will consist of a sooner number of tasks (to be completed on Thursday, Apr-17) AND a later number of tasks (to be completed on Thursday, Apr-24). In each choice, the “exchange rate” will be different.
- You will be asked to pick your favorite option in each choice by moving a slider to your desired location. You should pick the combination of sooner tasks AND later tasks that you prefer the most.
- You will make 18 total choices: 9 in Week 1 and 9 in Week 2. We will pick one of your 18 total choices at random to be the **decision-that-counts**.
- Once your Week 2 decisions have been made on Thursday, Apr-17 and the decision-that-counts has been determined, a two hour window will begin. You must complete your tasks for Thursday, Apr-17 from the decision-that-counts on the study website within this two hour window (and between 9 am and 6pm).
- In Week 3, two weeks from today Thursday, Apr-24, you will again login to the website. You must complete your tasks for Thursday, Apr-24 from the decision-that-counts on the study website within two hours of logging in (and between 9am and 6pm).
- If you fail to complete your tasks from the decision-that-counts you will be removed from the study. You will be eligible only for the reduced payment of $5 at the end of the study.
- In Week 4, three weeks from today Thursday, May-1, you will come outside the xlab between the hours of 9 a.m. and 6 p.m. to receive your completion payment. If you have completed all elements of the study you are eligible for a $60 completion payment. If you have not completed all elements of the study you are eligible only for the reduced amount of $5.

## 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. Otherwise, please sign the consent form and we will pick these up now.

## Minimum Work

Recall that, each week, you must complete a mandatory number of 10 tasks. We will not complete those tasks.

## Allocations

In the sliders on the screen, you will be asked to make 9 allocations.

Remember each decision could be the decision-that-counts, so please make each decision as if it were the one that determines your payment.