Journal of Experimental Psychology: General
2005, Vol. 134, No. 1, 23–37

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0096-3445/05/$12.00 DOI: 10.1037/0096-3445.134.1.23

Resource Slack and Propensity to Discount Delayed Investments of Time Versus Money

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The authors demonstrate that people discount delayed outcomes as a result of perceived changes over time in supplies of *slack*. Slack is the perceived surplus of a given resource available to complete a focal task. The present research shows that, in general, people expect slack for time to be greater in the future than in the present. Typically, this expectation of growth of slack in the future is more pronounced for time than for money. In 7 experiments, the authors demonstrate that systematic temporal shifts of perceived slack determine the extent and the pattern of delay discounting, including hyperbolic discounting. They use this framework to explain differential propensity to delay investments and receipts of time and money.

Many of us have accepted invitations weeks or months in advance to do a review for a journal outside of our field, to serve on some departmental or university committee, or to travel to another university to give a talk, only to regret our decision when the time arrived to make the time investments promised. Viewed from a distance, the benefits seemed clearly to outweigh the costs. But when the time arrived, the costs seemed much more painful than we had anticipated. "Yes" was often followed eventually by "Damn!" If the same invitations had required more immediate action, we would have said, "No, I'm too busy." But when asked in advance, we imagine that we will be less busy in the future. Why do we fall prey to the same mistakes again and again? Are we equally prone to make the same mistakes in decisions that involve investments of resources other than our own time—investments of money, for example?

This article attempts to answer these questions by presenting a general framework for why different resources lead individuals to exhibit different propensities for *delay discounting*—that is, different degrees of preference to receive a lower reward now rather than a higher reward later or to incur a large cost later rather than a small cost now. The central construct in our formulation is the notion of perceived changes over time in *resource slack*. Resource slack is defined as the perceived surplus of a given resource available to complete a focal task without causing failure to achieve goals associated with competing uses of the same resource. Because resources differ in their patterns of gain or loss in slack over time, there are different propensities to discount delayed investments for different resources. We test this framework with a series of experiments comparing preferences to discount delayed investments or receipts of two resources, time and money.

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Portions of this work were completed while John G. Lynch, Jr., was Leverhulme Trust Visiting Professor at the London Business School. We thank Selin Malkoc for assistance in conducting Experiment 7. For comments on previous versions of this work, we thank Peter Ayton, Jim Bettman, Kristin Diehl, Sandra Jones, Laura Kornish, Rick Larrick, George Loewenstein, and Daniel Read. We also thank participants at the Workshop on the Psychology of Intertemporal Discounting at the Sixth Invitational Choice Symposium and seminar participants at Tilburg University, INSEAD, the University College of London, Duke University, the University of North Carolina, and Columbia University.

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Theoretical Background

The last 2 decades have seen the growth of a large body of research on how individuals evaluate and choose options with costs and benefits that are distributed over time. Much research has used the economic discounted utility model as a baseline (Samuelson, 1937), wherein utility at time t for a stream of outcomes from time t to some end time T, $U^t(c_t, \ldots c_T)$, is simply the weighted sum of instantaneous utility, $u(c_{t+k})$, at each period $t + k$ over that range:

$$U^t(c_t,\ldots,c_T) = \sum_{k=0}^{T-t} D(k)u(c_{t+k}) \text{ where } D(k) = \left(\frac{1}{1+\rho}\right)^k. \qquad (1)$$

$D(k)$, the weight attached to utility in time $t + k$, is 1 when $k = 0$ (delay = 0). If the discount factor ρ is positive, utility in later periods will receive progressively less weight. Researchers have cataloged various anomalies that demonstrate the descriptive inadequacy of the model (for a review, see Frederick, Loewenstein, & O'Donoghue, 2002). The model implies two regularities pertinent to the current article: that delay discounting is temporally independent, and that it is resource independent. There is abundant evidence that delay discounting is not temporally independent and ambiguous evidence with respect to resource independence, as discussed below.

Temporal Independence?

Normative theory dictates that if people prefer to invest two units of a resource tomorrow rather than one unit today, they should also prefer to invest two units a month and a day from now

rather than one unit in a month. Numerous studies show that this assumption fails. People prefer the larger, later investment rather than the smaller one today but have the opposite preference when all investments are pushed back by a month (Thaler, 1981). This temporal inconsistency has been modeled through the use of *hyperbolic discounting*, wherein a time-dependent discount factor increases as the time of investment approaches (Ainslie, 1975; Ainslie & Haslam, 1992; Kirby, 1997). Recent work has introduced present-biased or quasi-hyperbolic models (Laibson, 1997; O'Donoghue & Rabin, 1999; Zauberman, 2003) that assume that greater weight is given to utility of outcomes in the first period than to subsequent periods and that this disproportionate weight is greater the closer that first period is to the time of the decision.

In both hyperbolic and quasi-hyperbolic classes of models, time-inconsistent preferences have been attributed to the effects of delay through the discounting function, $D(k)$, rather than through outcome utility, $u(c_{t+k})$. That is, these models assume differences in preference to receive utility now versus utility later rather than differences in the expected utility of consequences as a function of temporal proximity (e.g., Loewenstein & Prelec, 1992, p. 579). We show that a similar pattern of time-inconsistent preferences can occur because of time-dependent changes in utility; people perceive high opportunity costs of investments in the immediate, rather than the more distant, future. We return to this issue in Experiments 5 and 6 of the current article and show that temporal inconsistency, or bias toward the present, is greater for investments of time than of money, as predicted by our slack account.

Resource Independence?

Should we expect to observe similar strength of preference for earlier versus later reward for investment of different resources, such as time, money, food, entertainment, or health? The literature offers mixed support at best for this premise. Some work suggests that delay discounting is a stable individual-differences factor that cuts across decision domains involving different resources. In the delay of gratification paradigm introduced by Mischel and colleagues (e.g., Mischel, Shoda, & Peake, 1988), preschool children might be given a choice between one cookie that can be consumed immediately and two cookies if they wait for the adult experimenter's return. Length of time spent waiting and delay of gratification reliably predicted academic and social competence in adolescence (Mischel et al., 1988). Other research also ties discount factors to stable individual differences. For example, addicts have higher discount rates for money than do nonaddicts (e.g., Kirby, Petry, & Bickel, 1999; cf. Holt, Green, & Myerson, 2003).

Favoring the view that the same individual might discount two resources differentially, Chapman (1996) estimated two individual-respondent discount rates: one from problems involving outcomes in money, and another from problems involving health outcomes. On average, these did not differ; but Chapman found little correlation between individual money and health discount rates in the absence of practice making health–money trade-offs (cf. Chapman, 2002).

An influential theory implying systematically different discount rates for different resources is Loewenstein's (1996) work on visceral factors. Some rewards may be discounted steeply because they become overpoweringly attractive as they draw nearer (in temporal or physical distance) when one is in a state of deprivation, causing drivelike affective reactions. For example, hunger, thirst, sexual arousal, and sleep deprivation have the potential to overwhelm other motives that the decision maker might deem more important when viewed from a distance before or after a decision. Visceral factors are contrasted with other, more utilitarian resources that engender lower levels of impatience and less pronounced interaction of stimulus proximity and deprivation state. For similar points, see Shiv and Fedorikhin (1999) and Metcalfe and Mischel (1999). Also relevant to our research question is work showing higher discount rates for addictive substances than for money (Baker, Johnson, & Bickel, 2003; Kirby et al., 1999).

The research we report provides evidence that propensity to discount delayed expenditures is greater for time than for money. We appeal to a situational theory of resource slack rather than to the operation of stable individual-differences factors or to distinctions of visceral and utilitarian resources. Our research cannot explain the special properties of addictive or visceral resources, nor can we explain the discounting behavior of nonhumans (Ainslie, 1975). Other research has characterized hyperbolic discounting as the hallmark of emotional reactions to visceral factors (Loewenstein, 1996); we show a purely cognitive mechanism by which hyperbolic discounting arises for utilitarian resources.

Resource Slack and Propensity to Delay

A persistent problem in human life is the existence of multiple goals that compete for the use of a single, limited resource pool (G. A. Miller, Galanter, & Pribram, 1960; Shah, Friedman, & Kruglanski, 2002). We propose that people discount delayed outcomes—that is, prefer greater future investments of a certain resource to smaller immediate ones—under the following two conditions: (a) Immediate investment would block them from obtaining other, proximate activated goals that require the same resource, and (b) in the future, they would have more slack and thus less sacrifice of other highly valued goals. Put differently, discounting and desire to delay investment are driven by perceptions of *slack gain* (or loss) for a given resource over time.

This perspective implies that two resources may be discounted at different rates if people perceive slack to be more likely to grow over time for one than for the other. We predict that hyperbolic discounting will arise when resource slack at time t is less than that at $t + n$ and that the difference is greater when t is very near than when it is more temporally distant. Reverse delay discounting—preference for more immediate investment—will arise whenever slack in the future is perceived to be lower than that in the present.

Time Versus Money

We test our general slack concept of delay discounting by contrasting delay decisions for two resources, time and money. Prior research shows that time and money are treated differently in decision making (e.g., Leclerc, Schmitt, & Dube, 1995). We chose these two resources because both are utilitarian, are not visceral in nature, and are ubiquitous in people's day-to-day decisions.

Soman (1998) found that retail promotions that offered a money gain but that required time/effort expenditure to redeem became more attractive if money gain and time expenditure were both delayed rather than immediate. When a rebate was immediate,

both the size of the rebate and the distance to be traveled had significant effects on choice of the promoted versus unpromoted option. When rebate redemption was delayed, the effect of the size of the rebate did not diminish, but the effect of the travel distance to redeem the rebate became vanishingly small. Soman interpreted his results as showing that time/effort is discounted more than money.

Alternatively, his results can be explained by temporal construal theory (Liberman & Trope, 1998; Trope & Liberman, 2003), which holds that, in the more distant future, people represent events by *high-level construals* that focus on the benefits and desirability of outcomes. In the more immediate future, they represent the same events by *low-level construals* that focus on constraints and the feasibility of attaining outcomes. Put in these terms, Soman (1998) found that, with delay, the relative weight of feasibility (travel time costs) decreased relative to desirability (monetary reward). Temporal construal theory would not predict differences in discounting between time and money when both are rewards or both are costs. In contrast, our account posits that time investments are, in general, more steeply discounted than are money investments. In our studies, we unconfound the time versus money comparison from the contrast of benefits versus costs by presenting both time and money as costs. In Experiment 4, we also consider the case in which both are benefits.

Resource Slack Theory and Delay Discounting of Time and Money

We suggest that, for time, people perceive less slack now than in the future. On average, an individual will be just as busy 2 weeks or a month from now as he or she is today. But that is not how it appears to be in everyday life. People often make commitments long in advance that they would never make if the same commitments required immediate action. That is, they discount future time investments relatively steeply.

Why don't people realize that they will not truly have more time slack in the future than they have today? Research on the planning fallacy shows that people underestimate task completion times for tasks stretching out into the future. Buehler, Griffin, and Ross (1994) attributed this to base-rate neglect for the focal task. For example, if the focal task is writing a paper, people ignore how long it has taken them to write papers in the past. We suggest that a second reason why people underestimate task completion times for a focal task in the future may be that they are bad at imagining future competition for their time.

For money, we postulate that most people expect that slack now and in the future are more nearly equal. Barring some change in employment or family status, supply and demand of money are relatively constant over time, and people are aware of that. Compared with demands on one's time, money needs a few weeks or months in the future are relatively predictable from money needs today. In addition, compared with time, money is fungible (Leclerc et al., 1995; Okada & Hoch, 2004). Fungibility is the degree to which a unit is exchangeable or substitutable—in our case, across time periods. People often can borrow when there is an unexpected immediate demand on money resources. Thus, we expect perceived slack at times t and $t + n$ to be less similar for time than for money, especially as t draws near. Because people perceive relatively more slack gain for time than for money, we expect that they will exhibit steeper discounting and more present-biased preferences for future investments of time than of money.

These predictions hold in the modal case. Under circumstances in which people expect equivalent slack gain for time and for money, we expect no differences in the propensity to discount delayed outcomes—that is, equivalent strength of preference to delay investments of time versus money. The main thesis of this article is that the relative rate of delay discounting for two resources, A and B, depends on the relative rates at which people expect to gain or lose slack for those resources.

We test these conjectures in seven experiments. Experiment 1 shows that people expect more growth in slack in the future for time than for money. Experiment 2 demonstrates that people exhibit steeper delay discounting when required investments are framed in terms of minutes of effort rather than numerically equivalent dollars. Experiment 3 shows that this result is not due to the lower utility of minutes compared with dollars, and Experiment 4 shows that the result holds for both gains and losses of time and money. Experiment 5 demonstrates that hyperbolic discounting is more pronounced for time (minutes) than for numerically equivalent units of money (dollars). Experiment 6 shows that people perceive time slack (but not money slack) to be especially scarce in the very near term compared with any point in the intermediate term. Experiment 7 demonstrates that measures of expected gains in slack for time and for money account for time versus money differences in revealed preference to delay investments.

Experiment 1: Future Slack Gain for Time Versus Money

Experiment 1 tests the hypothesis that for time, people expect to have more available slack in the future than they do today. We predict that this expectation of growth in slack will be greater for time than for money—that is, that expected time slack gain will be greater than expected money slack gain for an equivalent time period.

Method

Participants. Ninety-five University of North Carolina undergraduates were recruited on campus and asked to complete a one-page, double-sided questionnaire in exchange for a candy bar. Seventy-six completed both sides, and only these respondents' data are reported below.

Procedure. Respondents received a double-sided questionnaire with questions measuring time slack gain and money slack gain. Order of the two pages was counterbalanced and had no effect, $F(1, 74) = 0.01$, $p = .92$. One side of the page, labeled "Thinking about your schedules," asked, "Think about your activities today and your available spare time. Now consider your likely activities and available spare time for the same day of the week a month from now. On which day do you expect to have more spare time?"

The other side of the page, labeled "Thinking about your budget," asked, "Think about your expenses today and your available spare money. Now consider your likely expenses and available spare money for the same day of the week a month from now. On which day do you expect to have more financial reserves?"

For each of the two items, participants responded on a 10-point scale ranging from 1 = *much more time [money] available today* to 10 = *much more time [money] available next month*.

Results and Discussion

For both time ($M = 8.2$, $SD = 2.9$) and money ($M = 7.0$, $SD = 2.9$), respondents believed that the resource would be more available in a month than today. Both means differed from the scale midpoint of 5.5: For time, $t(75) = 10.10$, $p < .001$, $\omega^2 = 0.571$; for money, $t(75) = 4.80$, $p < .001$, $\omega^2 = 0.225$.[1] More important, this belief that slack would be greater in the future was stronger for time than for money, $t(75) = 2.54$, $p = .013$, $\omega^2 = 0.067$.[2]

The results also indicated that there was no significant correlation between the measure of slack gain for time and for money, $r(74) = -.11$, $p = .366$. This suggests that perception of expanding future slack is not a general trait (e.g., optimism) that cuts across domains.

We predict that the stronger the sense is that slack will be more available in the future compared with now, the stronger should be observed delay discounting. Thus, we expect that discounting should be greater for investments that involve time than for those that involve money. Experiment 2 tests this prediction.

Experiment 2: Discounting of Future Time Versus Money

In Experiment 2, respondents were presented with two Internet shopping services. One had a high one-time set-up cost and a low per-period usage cost to search for and purchase products; the other had a low set-up cost and a high per-period usage cost. We measured delay discounting by the number of uses respondents required to be indifferent between the two options. The higher that number was, the more weight respondents gave to immediate set-up costs in comparison with minimizing future per-use costs. We manipulated whether these costs were expressed in terms of minutes or numerically identical dollars. Because in Experiment 1 we had found that people perceive more future slack gain for time than they do for money, we expected to find in Experiment 2 that people required more uses to equate the value of high and low set-up cost options when costs were expressed in terms of time rather than money.

Method

Participants and design. Respondents were 68 University of North Carolina undergraduates who participated in partial fulfillment of a research requirement in an introductory marketing course. They were randomly assigned to one of two conditions in which immediate and future investments were both described in terms of either time or money.

Procedure. Respondents completed a questionnaire labeled "Internet Shopping Study." They were asked to put themselves in the position of a consumer considering two alternative Internet information service providers. In the time condition, the alternatives were as follows:

> Information Provider A. To use this information service provider requires a one-time initial set-up, and an ongoing evaluation process. This provider requires a 2-minute set-up stage in order to initialize the service and a 15-minute per use process for evaluating options and finalizing their use.
>
> Information Provider B. To use this information service provider requires a one-time initial set-up, and an ongoing evaluation process. This provider requires a 25-minute set-up stage in order to initialize the service and an 8-minute per use process for evaluating options and finalizing their use.

In the money condition, the problems were identical, except that references to time were changed to money. Information Provider A was described as requiring a $2 set-up fee and a $15 per-use fee. Provider B was described as requiring a $25 set-up fee and an $8 per-use fee.

Participants were asked, "How many uses would you need over the next year before you would be just indifferent between selecting provider A and provider B? ____ times over the year."

Results and Discussion

If respondents did not discount future costs at all, the high set-up cost option would be more attractive in Period 4 and beyond. The results show that in the time condition, respondents required more periods to match the attractiveness of the high and low set-up cost options ($M = 9.6$, $SD = 11.0$) than was true when the same problems were expressed in terms of money ($M = 4.1$, $SD = 2.4$), $t(66) = 2.96$, $p = .004$, $\omega^2 = 0.102$. Because the variances were unequal in the two conditions, we also computed a Mann–Whitney nonparametric test, which yielded the same results ($U = 325.5$, $p = .002$). Medians were 6 and 3 for time and money, respectively.

Consistent with our slack argument, Experiment 2 suggests that people have a higher discount rate for time than for money. In this study we nominally equated the dollar value and minutes associated with money and time investments. Of course, units of time and money are arbitrary, and there is no reason to assume that the nominally equal units of time versus money are equal in utility. Prior research has shown a magnitude effect, where small outcomes are discounted more than large (Shelley, 1993; Thaler, 1981). If our time units (minutes) are worth less than money units (dollars), might the apparent greater discounting of time than money be a reflection of a (confounded) magnitude effect? To eliminate this alternative explanation we conducted a follow-up experiment.

Experiment 3: Resource Differences in Discounting of Time and Money or a Magnitude Effect?

The current experiment was designed to test whether the time versus money differences in delay discounting are due to the magnitude effect. Experiment 3 used the same basic procedure as Experiment 2 but manipulated the cost structure. In Replicate 1, the cost structure was very similar to that used in Experiment 2, equating the nominal values of minutes and dollars. In Replicate 2, we doubled all the time costs and halved all the money costs compared with their counterparts in Replicate 1. The $1/4 min ratio in Replicate 2 corresponds to an exchange rate of $15/hr, compared with the $60/hr in Replicate 1. If time was discounted more than money in Experiment 2 because $1 is more valuable than 1 min, Replicate 2 should make time and money more similar in value than in Replicate 1. Therefore, Replicate 2 should reduce, eliminate, or reverse the time versus money difference in discounting found in Replicate 1 and Experiment 2. If the results of

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[1] All ω^2 values cited in this article are partial ω^2 (Keren & Lewis, 1979), excluding variance due to analysis of variance (ANOVA) terms unrelated to the tested effect. Partial $\omega^2 = \sigma^2_{\text{effect}} / (\sigma^2_{\text{effect}} + \sigma^2_{\text{error}})$.

[2] The between-subjects analysis using the first trial for all 95 respondents yields the same results (time, $M = 8.7$, $SD = 2.3$, $n = 48$; money, $M = 7.3$, $SD = 2.7$, $n = 47$), $t(93) = 2.62$, $p = .01$.

Experiment 2 are truly due to the difference of time and money, Replicates 1 and 2 should not differ.

Method

Participants and design. Participants were 241 Duke University masters of business administration (MBA) students who volunteered to participate in exchange for a piece of chocolate. They were randomly assigned to one of the four conditions in a 2 (time vs. money) × 2 (Cost Structure Replicate 1 vs. 2) between-subjects design.[3]

Procedure. Experiment 3 used the same procedure as Experiment 2, but with an important modification—the manipulation of the cost structure. In Replicate 1, the cost structure equated dollars and minutes, as in Experiment 2. Provider A required a 2-unit set-up fee and a 16-unit per-use cost, as opposed to Provider B, which required a 28-unit set-up cost and an 8-unit per-use cost; these costs were expressed in terms of either minutes or the same number of dollars. Replicate 2 doubled the time costs: Provider A required a 4-min set-up and 32 min per use, and Provider B required a 56-min set-up and 16 min per use. Replicate 2 also halved the money costs compared with Replicate 1: Provider A required a $1 set-up and $8 per-use fee, and Provider B required a $14 set-up and $4 per-use fee. Respondents reported how many uses would make Providers A and B equally attractive.

Results and Discussion

If respondents did not discount future costs at all, the high set-up cost option would be more attractive in Period 4 and beyond. A two-way ANOVA revealed a main effect for resource, $F(1, 236) = 5.79$, $p = .017$, $\omega^2 = 0.020$, but no main effect for cost structure, $F(1, 236) = 0.40$, $p = .53$, and no interaction, $F(1, 236) = 0.18$, $p = .67$. Results are shown in Figure 1. In the time condition, respondents required more periods to match the attractiveness of the high and low set-up cost options ($M = 7.3$, $SD = 8.0$) than was true when the same problems were expressed in terms of money ($M = 5.2$, $SD = 5.7$). A Mann–Whitney nonparametric test yielded the same results ($U = 5{,}629.0$, $p < .005$). Medians were 5 for time and 4 for money in both replicates.

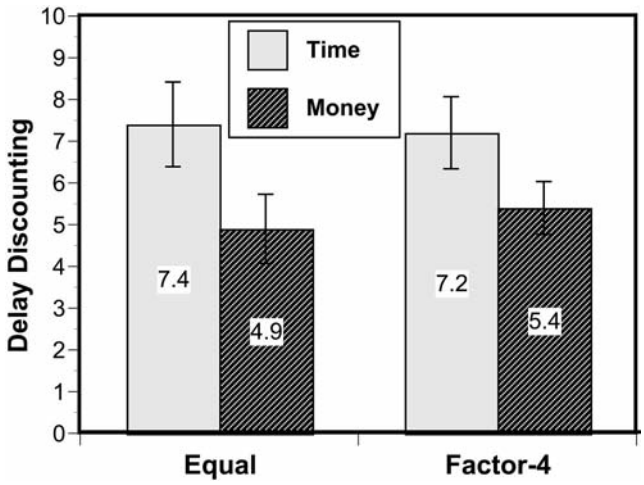

Figure 1. Experiment 3: Preference to delay as a function of time versus money resource and the cost structure of time and money (minutes = dollars vs. minutes = 4 × Dollars). Preference to delay is measured as the number of uses of an option with high set-up cost and low per-use cost to equate its value to the value of an option with low set-up cost and high per-use cost. Error bars represent standard errors of the mean.

The absence of any Resource × Cost Structure interaction increases our confidence that our results in Experiment 2 were due to time versus money differences in implicit levels of delay discounting, rather than to a magnitude effect (i.e., to more valuable money costs than time costs). We return to this issue in Experiment 5.

Experiment 4: Delay Discounting of Future Gains Versus Losses of Time and Money

Experiments 2 and 3 studied the discounting of investments (or losses) of time and money. Most research on intertemporal choice concerns trade-offs of rewards at two different points in time. Moreover, Experiments 2 and 3 asked respondents to judge the number of periods of use that would equate the value of an option that was better in the long run to one that was better in the short run. In contrast, the standard intertemporal choice task asks respondents to match the value of a later Outcome B to create indifference to a fixed, earlier Outcome A (e.g., Thaler, 1981).

In Experiment 4, we demonstrate that our findings in Experiments 2 and 3 are not due to the use of losses rather than gains or to task differences from the prior literature. Experiment 4 manipulated whether outcomes were gains or losses. As in most prior work, delay discounting was measured in this experiment by describing a specified smaller reward or cost at time t and asking respondents to set the amount of that resource at $t + n$ that would match the subjective value of the smaller, sooner amount. The higher the number a participant assigned to the later amount, the greater was the delay discounting. We manipulated whether these rewards or costs were expressed in terms of hours or dollars (where 1 hr was equivalent to $10). Our main prediction was that the greater discounting of time than of money would generalize from losses (investments) to gains (receipts). We expected to find that people required more of the future resource to equate the value of the near and distant options when the resource was time rather than money.

This design is also relevant to testing whether the discounting behavior we have reported thus far should be interpreted in terms of temporal construal theory (Eyal, Liberman, Trope, & Walther, 2004; Liberman & Trope, 1998; Trope & Liberman, 2003), which predicts that low-level future costs fade in importance with temporal distance but high-level future gains grow in importance. Temporal construal theory can predict that an alternative with a monetary gain and a time loss would become more attractive with greater temporal distance.[4] It is silent on why one should find time versus money differences when both are costs, but one could envision modifying the theory to take account of differences among resources in how amenable they are to concrete versus abstract representation in memory. If such a modified theory could

[3] One extreme outlier from the time condition was dropped from the analysis. This respondent's matching response of 300 was 42 standard deviations above the mean of his or her cell without that response.

[4] This work and that of Soman (1998) conflict with prior work showing a sign effect—that is, gains discounted more than equivalent losses (e.g., Shelley, 1993; Thaler, 1981). To date, the conflict has not been recognized or resolved.

account for our results so far, we should find in Experiment 4 that both time and money are discounted more when they are investments/costs rather than rewards/gains.

Method

Participants and design. Respondents were 61 Duke University MBA students who volunteered to participate and received a piece of chocolate in exchange for completing the task. They were randomly assigned to one of four conditions in which immediate and future outcomes were described in terms of either time or money and as gains or losses.

Procedure. Respondents completed a questionnaire labeled "Practicum Class Requirement."[5] They were asked to imagine themselves in the position of a student enrolled in a small practicum class that meets once a week. Respondents were told that students take turns organizing and leading discussion and paying for food for the class. In gain conditions, respondents had been responsible for 2 days in the course 6 weeks apart; because a student had added the course, they could now gain time (money) by dropping either the sooner or the later of the assigned days. In loss conditions, respondents had been responsible for 1 day of the class; because two students had dropped the course, they could lose time (money) by covering an additional day initially assigned to one of the two students who had dropped. In the time conditions, the resources involved expending time preparing to lead discussion; in the money conditions, they involved paying for snacks and drinks for the session.

In all cases, participants had to consider two alternative assignments and complete a matching task specifying the amount needed in the future for them to be indifferent between the later and earlier options. The dependent variable wording for the four conditions was as follows: (a) for the time/gain condition, "What amount of time savings in the last week of March would make you just indifferent between saving 4 hours of preparation this week and saving more than 4 hours in the last week of March?" (b) for the money/gain condition, "What amount of money savings in the last week of March would make you just indifferent between saving $40 this week and saving more in the last week of March?" (c) for the time/loss condition, "What amount of time spent in the last week of March would make you just indifferent between spending 4 hours of preparation this week and spending more than 4 hours in the last week of March?" and (d) for the money/loss condition, "What amount of money spent in the last week of March would make you just indifferent between paying $40 this week and paying more in the last week of March?"

The dependent variable was the ratio of the participant's larger, later matching response to the smaller, sooner amount stated in the problem. A ratio of 1 implies no discounting.

Results and Discussion

The point of this study was to test whether the time versus money differences in discounting would be replicated with gains as well as losses. Matching ratios were analyzed in a 2 × 2 (resource: time vs. money × domain: gain vs. loss) between-subjects ANOVA. As predicted, there was a significant main effect of resource, $F(1, 57) = 22.87$, $p < .001$, $\omega^2 = 0.234$. On average, people discounted time ($M = 1.40$, $SD = 0.42$) more than money ($M = 0.98$, $SD = 0.25$). There was no main effect of domain, $F(1, 57) = 0.09$, $p = .76$, or Resource × Domain interaction, $F(1, 57) = 2.65$, $p = .11$. Results are shown in Figure 2.

Our prior findings were replicated. Respondents required more uses to match the attractiveness of the near and distant options when outcomes were expressed in terms of time rather than money. This difference held both for gains (time, $M = 1.46$, $SD = 0.52$; money, $M = 0.89$, $SD = 0.31$), $t(30) = 3.70$, $p < .001$, $\omega^2 = 0.284$, and losses (time, $M = 1.34$, $SD = 0.26$; money, $M = 1.06$, $SD = 0.14$), $t(27) = 3.65$, $p < .001$, $\omega^2 = 0.299$, with no trend toward weaker effects for gains than for losses. Because the variances were unequal across conditions, we computed a Mann–Whitney nonparametric test, which yielded the same results for both gains ($U = 41.0$, $p < .002$) and losses ($U = 35.5$, $p < .005$).

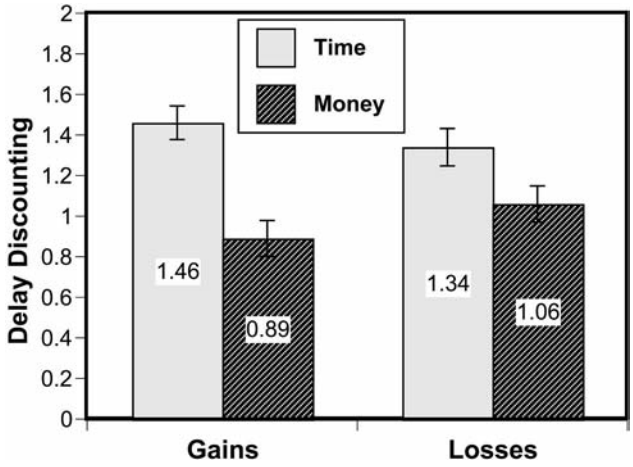

Figure 2. Experiment 4: Ratio of larger, later investment required to match value of stated smaller, sooner investment as a function of time versus money resource and the resource domain (gain vs. loss). Error bars represent standard errors of the mean.

Experiments 2, 3, and 4 demonstrate that people discount future time more than future money, consistent with our slack account. Experiment 4 further shows that the time versus money difference in discounting holds for gains as well as losses. This result distinguishes our account both from temporal construal theory, which predicts greater discounting of losses than of gains, and from a sign effect, which predicts the opposite.

To further explore differences in delay discounting of time and money and to examine more directly the implication of changes in slack gain on the pattern of discounting, the next experiment tests the relative temporal consistency of discounting future time versus money.

Experiment 5: Present-Biased Preferences for Time Versus Money

One of the most well-established findings in the discounting literature is that discounting is hyperbolic or present biased. As discussed earlier, research in intertemporal choice indicates that people place greater weight on the short-term cost advantage of options when a decision is closer in time (Ainslie & Haslam, 1992; O'Donoghue & Rabin, 1999; Zauberman, 2003). That is, people may prefer a large cost in 2 days to a small cost today but not prefer the same large cost in 32 days over the small cost in 30 days.

The classic account attributes present-biased preferences to the effect of temporal distance on the weight, $D(k)$, attached to earlier versus later utility rather than on temporal changes in outcome

[5] In this MBA program, a practicum class is a small, self-organized class that works on a project for a business client under the supervision of a professor.

utility itself, $u(c_{t+k})$ (Loewenstein & Prelec, 1992). We argue that one can observe a phenotypically similar result because the (dis)utility of time invested in a task changes with temporal distance, not just because of how the weight of time-invariant utility changes with temporal distance. We assume that slack gain for time is driven by people's misperception that they are much busier in the near future than they will be at any point in the more distant future. That is, time slack gain from t to $t + n$ should be greater when t is imminent than when t is distant. Any such asymmetry should be weaker for money, as suggested by Experiment 1. People have little expectation of slack gain for money for short and intermediate time frames such as those compared in this article (weeks and months rather than years). Consequently, we should expect to see greater temporal inconsistency and more present-biased preferences for decisions involving time rather than money.

In Experiment 5, we endowed all subjects with a low set-up cost, high ongoing-cost Internet information service provider and asked them whether they would switch to a high set-up cost, low ongoing-cost alternative that was clearly better in the long run. The more people discount future (ongoing) investments, the more prone they should be to stay with their current provider. The task we used was similar to Experiments 2 and 3, where we varied whether the investments required were framed in terms of dollars or an equivalent number of minutes. Unlike those experiments, we also varied whether the decision to stay or switch was to be taken today or in 1 month. We hypothesized that, for time decisions, people are less prone to switch today than when the decision is to take effect a month from now. We expected this tendency to be weaker for money than for time.

Method

Participants. Two hundred sixty-four University of North Carolina undergraduate students were assigned randomly to one of four conditions; they were each paid $2 for their participation.

Procedure. Participants were faced with a hypothetical selection of Internet information service providers. The scenario described a consumer who is using the online information service an average of once a month. It stated that this consumer previously used the low set-up and high usage cost option. Participants were asked to put themselves in the position of that consumer and to choose whether to stay with the low set-up cost provider or switch to the high set-up cost provider. Both providers were said to be equal in all other aspects, including offerings, prices, and trustworthiness. Participants had to choose whether to switch providers or to stay and then indicate how likely they were to do so on an 11-point scale.

Design and stimuli. The experiment followed a 2 (temporal distance) × 2 (resource) between-subjects design. The time of the next purchase was either today (low temporal distance) or next month (high temporal distance). The resource required for investment was either time or money. The set-up costs and usage costs of the two options were either time in minutes or money in dollars. The low set-up and high usage cost option consisted of a 2-min ($2) initial set-up and a 15-min ($15) ongoing usage cost. The high set-up and low usage cost option consisted of a 25-min ($25) initial set-up and an 8-min ($8) ongoing usage cost. Participants were endowed with the low set-up option; they were told that they had used that provider in the past and thus would not need to incur a set-up cost.

Results

Proportions of respondents choosing to switch are shown in Figure 3. Switching is better in the long run but not in the short run, so greater switching indicates lower levels of discounting of future investments. Using a logistic regression, we found a significant interaction—a time versus money difference in the association of stay/switch with today/1 month, $\chi^2(1, N = 264) = 3.93$, $p = .047$, $\varphi^2 = 0.015$.[6] For the money condition, there was no reliable difference in percentage switching today (69.7%) versus in 1 month (62.1%), $\chi^2(1, N = 132) = 0.84$, $p = .34$. In contrast, for the time condition, significantly fewer participants switched when the decision was today (39.4%) than when the decision was next month (56.1%), $\chi^2(1, N = 132) = 3.67$, $p = .055$, $\varphi^2 = 0.014$.

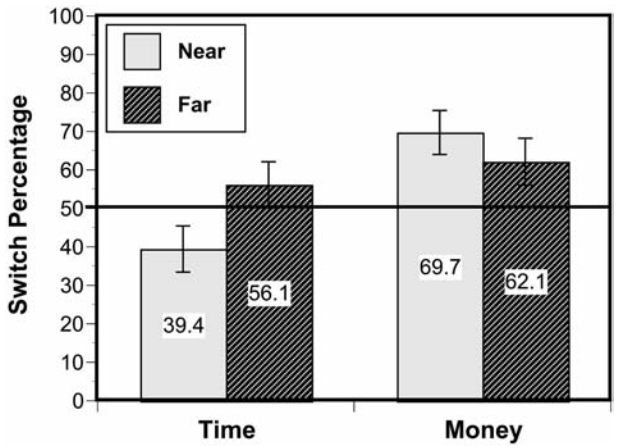

Figure 3. Experiment 5: Percentage switching from a low set-up–cost provider as a function of resource (time vs. money) and timing of decision (far: ratings today vs. near: ratings in 1 month). Error bars represent standard errors of the proportion.

Discussion

Replicating our previous findings, the main effect of resource type reflects a significantly stronger preference to switch for money than for time, indicating greater discounting for time than money. Experiment 5 adds to Experiment 3 in showing again that the time versus money differences in discounting cannot be explained by a magnitude effect (i.e., time values have lower utility than corresponding money values and thus are discounted at a higher rate). Experiment 5's results show that 1 month into the future, participants' switching rates are virtually identical for time and for money, $\chi^2(1, N = 132) = 0.50$, $p = .48$. However, when those same investments were required today, there was a time versus money asymmetry, $\chi^2(1, N = 132) = 12.22$, $p < .001$, $\varphi^2 = 0.046$. If one argues that time was discounted more than money today because of a magnitude effect (i.e., time units were less valuable than money units), one would have to explain why we did not observe a parallel time–money difference when investments did not begin for a month.

The key point of Experiment 5, though, is that participants show more pronounced present-biased preferences for time than for money. Our explanation for this finding is in terms of patterns of

[6] We also found a main effect for resource, $\chi^2(1, N = 264) = 8.79$, $p = .003$, and no main effect for temporal distance, $\chi^2(1, N = 264) = 0.43$, $p = .51$. Strength of preference ratings showed identical effects.

growth in slack over the time periods being compared in a decision. By our account, people think that they are unusually busy in the immediate future but will become less busy shortly, so that any two points in the midterm future look similar in degree of slack. For money, people do not think that they will be unusually cash constrained in the immediate future or that their money slack will change dramatically in the future. Experiment 6 tests this hypothesis.

Experiment 6: Hyperbolic Slack Gain for Time Versus Money and Slack Predictability

Method

Participants. Respondents were 48 University of South Carolina undergraduate students (33 women and 15 men) who participated in both waves of a two-wave study, with the two sessions separated by 3 weeks. Seventy participants completed the first part, 19 of those participants did not complete the second part, and 3 respondents who completed the first part completed only a portion of the second part and were excluded.

Design. The design was a 2 (temporal distance) × 2 (resource) completely within-subject design. Temporal distance was either far (ratings on March 16) or near (ratings on April 6). Resource was either time or money.

Procedure. This experiment included two sessions. The first session was on March 16, and the second session was on April 6. Each session included elicitation of the slack measures and was very similar to Experiment 1. Respondents received a two-page questionnaire measuring time slack gain and money slack gain. One side of the page was labeled "Thinking about Schedules," and the other side of the page was labeled "Thinking about Budgets." Order of the two pages was counterbalanced and again had no effect, $F(1, 44) = 0.54$, $p = .47$ for first test period, and $F(1, 44) = 0.001$, $p = .98$ for second test period.

On the first session, March 16, we asked for the time condition, "Think about your specific activities **today** (Tuesday, March 16th) and your available spare time. Now consider your likely specific activities and available spare time for two days, **three weeks from now**: Tuesday, April 6th and Thursday, April 8th." The other page, labeled "Thinking about Budgets," asked, "Think about your specific expenses **today** (Tuesday, March 16th) and your available spare money. Now consider your likely specific expenses and available spare money for two days, **three weeks from now**: Tuesday, April 6th and Thursday, April 8th."

The second session took place on April 6. On the first page, we asked, "Think about your specific activities **today** (Tuesday, April 6th) and your available spare time. Now consider your likely specific activities and available spare time for Thursday, April 8th, **two days from now**." The other page, labeled "Thinking about Budgets," asked, "Think about your specific expenses **today** (Tuesday, April 6th) and your available spare money. Now consider your likely specific expenses and available spare money for Thursday, April 8th, **two days from now**."

For each of the two time periods, participants rated time and money slack. For time, participants were asked, "On the following scale, please circle a number that reflects how much available spare time you have." They responded on a scale anchored by −5 (*very little available time*) and 5 (*lots of available time*). For money, participants were asked, "On the following scale, please circle a number that reflects how much available spare money you have" and responded on a scale anchored by −5 (*very little available money*) and 5 (*lots of available money*).

The key dependent variable was the *slack gain* score. For each participant, we computed time slack on April 8 minus time slack on April 6 and money slack on April 8 minus money slack on April 6. These slack gain measures can range from 10 (*much more slack available on April 8th than on April 6th*) to −10 (*much less slack available on April 8th than on April 6th*).

Results and Discussion

Present-biased slack gain. Hyperbolic or present-biased slack gain would be evident if people perceived that the gain in a resource on day $t + 2$ compared with day t increases as t draws nearer. We expected that, when viewed from a distance of 3 weeks, people would perceive little gain in slack moving from April 6 to April 8. But when slack was rated on April 6, we expected people to rate themselves as having less slack on April 6 than on April 8. We expected that this pattern would be stronger for time than for money.

That is what we found, as shown in Figure 4. The repeated measures ANOVA revealed a marginally significant Resource × Temporal Distance interaction, $F(1, 47) = 3.62$, $p = .063$, $\omega^2 = 0.052$,[7] in addition to a significant main effect of resource, $F(1, 47) = 7.49$, $p = .009$, $\omega^2 = 0.119$, and a marginally significant main effect of temporal distance, $F(1, 47) = 3.42$, $p = .070$, $\omega^2 = 0.048$. People expected more slack gain from April 6 to April 8 when viewed from a near than from a far temporal distance, but this simple effect was significant only for time, $F(1, 47) = 5.11$, $p = .028$, $\omega^2 = 0.079$, and not for money, $F(1, 47) = 0.01$, $p = .92$. For money, slack gain from April 6 to April 8 did not differ significantly from zero when rated either on March 16 ($M = -0.21$, $SD = 1.24$), $t(47) = 1.17$, $p = .249$, or on April 6 ($M = -0.23$, $SD = 2.05$), $t(47) = 0.77$, $p = .444$. For time, slack gain from April 6 to April 8 did not differ from zero when rated on March 16 ($M = 0.19$, $SD = 1.04$), $t(47) = 1.24$, $p = .220$, but when rated on April 6, people expected to have significantly more time available on April 8 than on April 6 ($M = 1.00$, $SD = 2.65$), $t(47) = 2.61$, $p = .012$, $\omega^2 = 0.108$.

Predictability of slack for time and for money. We argue that these patterns of hyperbolic slack gain explain why, in Experiment 5, we found hyperbolic discounting for time but not for money. People understand that they are no more cash constrained today than they will be in the near future. However, they maintain the illusion that today is especially busy.

A reader might wonder why people do not learn that if they are busy today, they will be equally busy in 2 days. One may also ask why, in contrast, people seem to understand that money demands will be similar in 2 days to what they are today. One reason is that slack gain for time is often less predictable than slack gain for money. For money, people think that their slack for one day is similar to slack for any other day; this is not the case for time. We posit that these differences in predictability are caused by the greater irregularity across periods in how time is spent in comparison with how money is spent and the greater fungibility of money compared with time. Therefore, we expected to see that gains (or losses) in slack between April 6 and April 8 as perceived on April 6 are more predictable from estimates of the same quantities on March 16 for money than for time.

For each respondent, we calculated the absolute difference between the slack gain (April 8 − April 6) as rated at two points in time: March 16 and April 6. Results showed that this absolute

[7] Including respondent gender as a factor in the analysis slightly strengthens the Resource × Temporal Distance result, $F(1, 46) = 4.53$, $p = .039$. Gender had no main or interactive effects (all Fs < 1.00), so we report the simpler analysis.

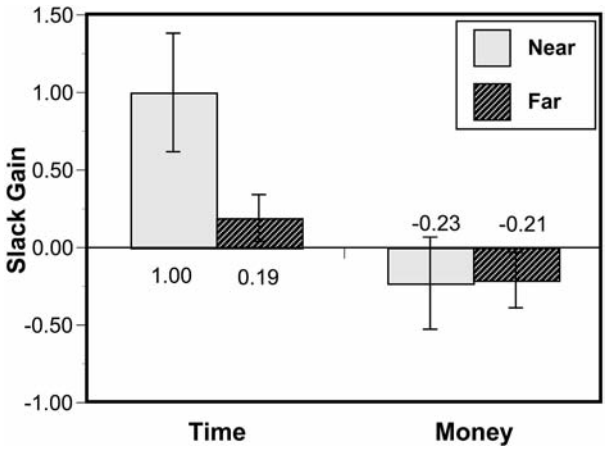

Figure 4. Experiment 6: Reported slack gain for 2 days (April 6 to April 8) as a function of time versus money resource and temporal distance (far: ratings on March 16 vs. near: ratings on April 6). The dependent measure was Slack Gain = Slack April 8 − Slack April 6. Error bars represent standard errors of the mean.

difference was significantly greater for time ($M = 1.85$, $SD = 1.83$) than for money ($M = 1.10$, $SD = 1.24$), $F(1, 47) = 6.38$, $p = .015$, $\omega^2 = 0.101$.

This finding implies that, on April 6, the difference in time slack between that day and 2 days later is a surprise to participants—in the sense of having been unpredictable 3 weeks earlier. The difference in money slack between that day and 2 days later is comparatively less surprising on April 6. This interpretation is consistent with our argument that people are consistently surprised to be so busy today, which leads them to perceive that time slack will become more abundant in the near future. People are less able to anticipate changes in competition for their time than they are to anticipate changes in competition for their money. Lacking knowledge of what specific tasks will compete for their time in the future, they act as if new demands will not inevitably arise that are as pressing as those faced today.

Up to this point, we have shown evidence of greater delay discounting for time than for money (Experiments 2, 3, and 4) and greater evidence of hyperbolic discounting for time than for money (Experiment 5). Further, we have shown that expectations about gains in slack are fully consistent with our slack account of delay discounting (Experiments 1 and 6). However, we have not yet shown that relative future slack for time and for money predicts time versus money differences in delay discounting. Experiment 7 investigates this directly.

Experiment 7: Propensity to Delay as a Function of Future Slack Gain for Time and Money

In Experiment 7, we tested whether measured time slack gain and money slack gain can account for time versus money differences in observed preference to delay investments. We measured slack for time and for money on 2 days: tomorrow and 2 weeks from now. We then computed two measures for each participant: time slack gain (time slack in 2 weeks − time slack tomorrow) and money slack gain (money slack in 2 weeks − money slack tomorrow). After an unrelated task, participants were asked about their willingness to contribute to each of two similar, real local charities. The descriptions of the charities differed in whether the help was required tomorrow or 2 weeks from today. We measured preference to delay as the difference in rated intention to help in 2 weeks versus tomorrow. The key manipulated variable was whether the help being solicited was a donation of time or money.

We expected the analysis of time slack gain and money slack gain measures to replicate Experiment 1—that is, greater time slack in 2 weeks than tomorrow, with this tendency being reduced for money. We also wanted to assess the replicability of our finding from Experiment 6 that time slack is less predictable than money slack. We expected to see that money slack in 2 weeks was correlated with money slack tomorrow but that time slack in 2 weeks was not highly correlated with time slack tomorrow. The most critical aims of Experiment 7, though, were twofold: (a) to examine whether time or money charitable appeals elicit more preference to delay helping, and (b) to test whether time versus money differences in preference to delay are explainable by the relative magnitudes of anticipated slack gains for time and for money.

We hypothesized that people would, on average, anticipate more slack gain for time than for money but that they would demonstrate greater discounting of time versus money if and only if this condition holds. When people expect equivalent slack gain for time and for money, they should show equivalent preference to delay time versus money investments. And when people expect greater slack gain for money than for time, they should show greater preference to delay investment for money than for time.

Method

Participants. One hundred thirty University of North Carolina undergraduate students (88 women, 41 men, and 1 who did not note gender) participated in partial fulfillment of a class requirement.

Procedure. Respondents reported in groups of 8 to 12 for 1-hr sessions that involved several tasks. The tasks were presented as unrelated projects by different investigators. The first task was another researcher's unrelated study. Second, respondents received a packet of questionnaires to be completed at their own pace. Included in this packet were our measures of slack. Respondents were asked to rate their available time and money slack tomorrow and in 2 weeks, which allowed us to compute time slack gain and money slack gain for each respondent. Third, respondents completed a set of unrelated tasks for 20 min. Fourth, respondents were asked to rate their likelihood of assisting each of two local children's charities, the Boys and Girls Club of Durham and Big Brothers and Big Sisters of Durham and Orange Counties. One of these charities requested help tomorrow, and the other needed help in 2 weeks. We measured preference to delay as the difference in intent to help in 2 weeks versus tomorrow. We counterbalanced which charity made the delayed appeal. We also manipulated between subjects whether both charities were asking for help in the form of volunteered time or donated money. Last, in postexperimental debriefing, participants were asked whether they saw any connection between the studies. None connected our tasks occurring in the second and fourth phases of the session.

Measurement of time slack gain and money slack gain. In the second phase of the overall procedure, we measured time slack and money slack for two dates: tomorrow and 2 weeks from today. From these measures, we computed time slack gain as the difference between time availability in 2 weeks minus availability tomorrow. We computed money slack gain in the same way. Both measures range from −10 to 10, with positive numbers indicating more time (or money) in 2 weeks than tomorrow.

The focal analyses to be reported use the *difference* between time slack gain and money slack gain to account for time–money differences in discounting. The measured independent variable (time slack gain − money slack gain) ranges from −20 to 20.

Stimulus materials for charity study measuring preference to delay. Stimulus materials describing the Boys and Girls Club of Durham and Big Brothers and Big Sisters of Durham and Orange Counties were edited versions of similar stories taken from newspaper stories and Web sites. These materials were identical for all respondents. At the bottom of the page for each charity was a section entitled "How can you help?" The nature of the help requested was manipulated between subjects. Appeals for the money resource condition were as follows: (a) for the Boys and Girls Club, "A fund drive is being spearheaded at UNC two weeks from today, asking for students to make a $20 donation to the Boys and Girls Club of Durham at the Kenan-Flagler Business School," and (b) for Big Brothers and Big Sisters, "The current need of the Durham and Orange County Big Brothers and Sisters is for financial support for its major annual fundraising event, Bowl for Kids' Sake. We are requesting that students at UNC make a $15 donation, to be collected at the Kenan-Flagler Business School, tomorrow."

In the time condition, the "How can you help?" section at the bottom of the page made requests for time donations rather than money: (a) for the Boys and Girls Club, "Students from UNC are asked to help by volunteering at the Boys and Girls Club in Durham for two hours, in the afternoon or evening two weeks from today. (Rides can be provided from the Kenan-Flagler Business School.)," and (b) for Big Brothers and Big Sisters, "The current need of the Durham and Orange County Big Brothers and Sisters is for financial support for the Bowl for Kids' Sake fundraiser. We are requesting that students at UNC sign up to staff a fund-raising table at a Chapel Hill shopping mall for a one and one-half hour time block tomorrow. Transportation will be provided from the Kenan-Flagler Business School."

After each request, respondents were asked to rate how likely they were to help in the specified way on the specified day on a scale from 1 (*very unlikely*) to 7 (*very likely*). They were told that their responses were private and nonbinding. Subsequently, participants were asked in a forced choice which of the two charities they would help if they could assist only one. The latter dependent variable showed no reliable effects and is not discussed in this article.

Design. The key dependent variable was preference to delay, computed as the difference in rated likelihood of helping the charity needing assistance in 2 weeks minus likelihood of helping the charity needing assistance tomorrow. Because each element of this difference could range from 1 to 7, this difference score ranged from −6 to 6. More positive numbers indicate a stronger preference to help in 2 weeks versus tomorrow.

There were three independent variables, two manipulated and one measured. We counterbalanced whether the delayed charity was the Boys and Girls Club or Big Brothers and Big Sisters. This between-subjects factor had no effects in any of the analyses we conducted—largest $F(1, 128) = 0.37$, smallest $p = .50$—so we have dropped it from the analyses reported. Resource (time vs. money) was manipulated between subjects. The final independent variable was the measured difference between expected future gains in slack of time versus money. This difference (time slack gain − money slack gain) ranges from −20 to 20. It is positive when time slack is growing faster than money slack and negative when the opposite is true.

Results

We first report analyses of the slack measures, which tested whether participants expected time slack to grow faster than money slack. Following this, we present analyses showing how preferences to delay investment differ for donations of time versus money as a function of the degree to which time slack gain in the future exceeds money slack gain. We predicted that we would find greater delaying for time than for money only for individuals who expected time slack to grow faster than money slack.

Analyses of measures of perceived slack. Perceived slack gain measures were analyzed as a 2 × 2 ANOVA in which resource was a repeated factor and order of questions (time–money or money–time) was a between-subjects counterbalancing factor that had no effects, largest $F(1, 128) = 0.66$, smallest $p = .419$. When we averaged across time and money, the mean gain score was significantly positive, $F(1, 128) = 12.73$, $p = .0005$, $\omega^2 = 0.083$; on average, people perceived more slack in 2 weeks than tomorrow.

Critical to our slack gain account was a resource effect on slack gain scores. Slack gain from tomorrow to 2 weeks was more positive for time ($M = 1.2$, $SD = 4.0$) than for money ($M = 0.3$, $SD = 2.6$), $F(1, 128) = 4.82$, $p = .03$, $\omega^2 = 0.029$, replicating Experiment 1. For money, slack gain did not differ from zero, $F(1, 128) = 1.41$, $p = .24$; for time, slack gain from tomorrow to 2 weeks was significantly positive, $F(1, 128) = 11.74$, $p = .0008$, $\omega^2 = 0.076$.

As in Experiment 6, we reasoned that people expect time slack to grow more in the future compared with money slack, in part because time slack is perceived to be less stable than money slack; people do not generalize from their present busyness to the future. To test this hypothesis, we correlated the measures of time and money slack for tomorrow and for 2 weeks. As expected, for money slack, the correlation between slack tomorrow and in 2 weeks was reliable, $r(128) = .45$, $p < .0001$. For time slack, there was no correlation of slack tomorrow and in 2 weeks, $r(128) = .03$, $p = .72$.

Analyses of preference to delay. Our resource slack hypothesis implies that people will discount future time investments more than future money investments only when time slack is expected to grow at a faster rate than is money slack. Our theory implies that when time slack gain equals money slack gain, there should be no difference in preference to delay. Moreover, when time slack gain is less than money slack gain, we should observe stronger preference to delay for money than for time, a reverse of the pattern of Experiments 2, 3, 4, and 5 that discounting is greater for time than for money.

Preference to delay is a difference score computed as the rated intention to help in 2 weeks minus intention to help tomorrow. Because each element of this difference could range from 1 to 7, this difference score ranged from −6 to 6. More positive numbers indicate a stronger preference to help in 2 weeks versus tomorrow.

Relative slack gain is the difference score (time slack gain – money slack gain), ranging from −20 to 20. It is positive when time slack is growing faster (or shrinking more slowly) than money slack and negative when the opposite is true. This measure was positive on average ($M = 0.9$), but there was considerable heterogeneity ($SD = 4.9$), allowing us to test how the simple effect of time versus money (resource) depended on whether time slack gain minus money slack gain was positive, zero, or negative.

The key analysis regressed preference to delay on a dummy variable for resource (time vs. money donations requested), the continuous measure of time slack gain minus money slack gain, and the interaction of Resource × (Time Slack Gain − Money Slack Gain). The interaction was significant, $F(1, 126) = 9.16$, $p = .003$, $\omega^2 = 0.059$. The pattern of the interaction can be seen

in Figure 5, which shows the forecast of the ordinary least squares regression model:

$$\text{Preference to delay} = b0 + b1 \times \text{resource dummy} + b2 \times (\text{time slack gain} - \text{money slack gain}) + b3 \times \text{resource dummy} \times (\text{time slack gain} - \text{money slack gain}). \quad (2)$$

Figure 5 shows how preference to delay differs for time versus money investments when time slack is growing more, equally, or less quickly than money slack. We followed up this interaction with tests of the simple effect of time versus money resource when time slack gain minus money slack gain is positive, zero, and negative. We used the methods described by Aiken and West (1991) and Irwin and McClelland (2001) for testing simple effects of a categorical variable at different levels of a continuous variable.

When time slack gain minus money slack gain was 1.5 standard deviations above zero, predicted preference for delay was 1.4 scale points higher for time than for money, $t(126) = 2.92$, $p = .004$, $\omega^2 = 0.055$. However, when time slack gain minus money slack gain equaled zero—that is, when expectations about future growth in time slack were matched by expectations of future growth in money slack—there was no significant time versus money difference in predicted preference to delay, $t(126) = -0.24$, $p = .81$. Finally, when time slack gain minus money slack gain was 1.5 standard deviations below zero—that is, when people expected slack to grow more in the future for money than for time—predicted preference for delay was 1.3 scale points greater for money than for time, $t(126) = 2.19$, $p = .03$, $\omega^2 = 0.028$. These findings support our resource slack theory of time versus money differences in delay discounting.[8]

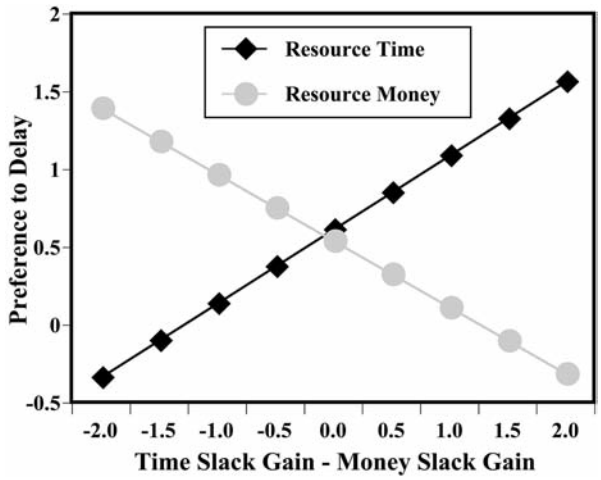

Figure 5. Experiment 7: Ordinary least square–estimated preference to delay as a function of time versus money resource and the difference between time slack gain and money slack gain. Preference to delay is the difference score (intention to help in 2 weeks − intention to help tomorrow). Positive numbers imply preference to delay. Time slack gain is (time slack in 2 weeks − time slack tomorrow), and money slack gain is (money slack in 2 weeks − money slack tomorrow). When (time slack gain − money slack gain) > 0, people expect more future growth in time slack than in money slack. When (time slack gain − money slack gain) < 0, people expect more future growth in money slack than in time slack. Adjacent symbols on each resource curve are 0.5 standard deviations apart from each other on the variable (time slack gain − money slack gain).

Discussion

Rates of slack gain or loss explain time versus money differences in delay discounting. The results from Experiment 7 replicate the findings from Experiments 1 and 6 that, on average, people expect to have more time slack in the future than they have in the present (i.e., they expect slack gain in the future). We had proposed that similar beliefs underpinned our findings in Experiments 2, 3, 4, and 5 that people discount time investments more on average than money investments. The findings from Experiment 7 directly support this interpretation.

We showed in Experiment 7 that, for people who have typical expectations that time slack will grow more in the future than will money slack, time is discounted more than money. When people have the opposite expectation, that money slack will be growing more than time slack, future money investments are discounted more than future time investments are. Finally, if there is no difference in expected growth in slack over time, there is no simple effect of time versus money on discounting as measured by preference to delay investment. This is important because it demonstrates that the resource dependency we observed in Experiments 2, 3, 4, and 5 is explainable by changes in slack.

One might argue that our findings are driven entirely by the effect of time slack tomorrow. Put simply, this critique says that our results merely show that people do not want to make time commitments on short notice. If one has a full schedule tomorrow, one may be unable to reschedule events to allow volunteering for a charity tomorrow. The same activity might be accommodated into a full schedule 2 weeks from now because there is time to reschedule conflicting activities. In contrast, having little money on hand is not a barrier to making a donation, because one can always borrow or use credit to cover the expense.

However, our results cannot be explained by mere knowledge of time slack today. Analyses detailed in the Appendix show that it is not just time slack tomorrow that is driving the interaction in Figure 5. If we substitute time slack tomorrow for the difference (time slack gain − money slack gain) in our moderated regression model, model fit declines significantly. Holding constant time slack tomorrow, it is the gain or loss in slack in 2 weeks that dictates whether one prefers to delay time investments. Moreover, the relative preference to delay for money (vs. time) is also

[8] Identical conclusions emerge if we replace our continuous measure of time slack gain − money slack gain with a trichotomy (positive, zero, negative) and treat this as a between-subjects factor crossed with resource in an ANOVA. Preference to delay exhibited a significant Resource × Slack Gain Block interaction, $F(2, 124) = 5.53$, $p = .005$, $\omega^2 = 0.065$. All follow-up planned comparisons replicate the regression results. Details are available on request.

affected by the degree of slack gain for money compared with slack gain for time.

Is it an illusion to expect to have more time slack in the future? Is it really an error to think that one will be less busy in the future than in the present? The reader might argue that, given lead time, one can rearrange one's schedule to allow any new commitment to be undertaken without pain of failing to attain competing goals requiring one's time. With short notice, it is not possible to reschedule, and thus one really does always have less slack in the short run than in the long run.

To test this possibility more directly, we analyzed a simple natural experiment in which 178 students in a class were asked about their interest in an optional session on ethnographic and observational methods in market research 1 week before the actual event. Because of room constraints, the session was made by invitation only. Teams of students were randomly assigned to receive one of two invitations. A specifically forewarned group ($n = 97$) was told the exact time and date of the session, and a generally forewarned group ($n = 81$) was told that the session would be one evening the next week, with details to follow. We subsequently were able to acquire a room to accommodate both groups. The night before the session, an invitation was sent to both groups with details of the time and place.

Results showed that specifically and generally forewarned groups did not differ in likelihood of replying to the first E-mail invitation (52% vs. 44%), expressing interest in their replies (44% vs. 41%), or actually attending (19% vs. 18%), $\chi^2(1, N = 178) = 1.00$, 0.19, and 0.03, respectively. Also, expressions of interest were just as predictive of attendance among those specifically as those generally forewarned; a logistic regression of attendance on forewarning condition, expression of interest, and their interaction showed only a significant effect of expression of interest, $\chi^2(1, N = 178) = 5.60$, $p = .018$, and no interaction, $\chi^2(1, N = 178) = 0.68$, $p = .41$.

The 32 students who attended were asked to rate the difficulty or ease (−5 to 5) of fitting the session into their schedule, given other competing activities. The session was rated as equally easy to fit in for the specifically forewarned group ($M = 1.5$, $SD = 2.7$, $n = 17$) as for the generally forewarned group ($M = 0.9$, $SD = 2.7$, $n = 15$), $t(30) = -0.57$, $p = .57$.

Thus, it did not appear from any of the results that students "planned for pain." That is, they did not appear to do anything different when given specific notice about the time parameters of an activity in the future, nor did they really experience less pain than those who undertook the activity on very short notice.

Any time an experiment supports the null hypothesis, one can always explain the results by low power. Also, one might question how the pain ratings by those who attended might have compared with ratings by those who did not. That said, our tentative findings do not support the view that people in Experiments 1–7 were right to assume that they would find it easier to fit in some time-consuming activity in the future than in the present.

At the beginning of this article, we noted that people often commit to decisions in advance that they later regret when it comes time to fulfill the commitment. Similarly, Soman (1998) found that people were more likely to choose an alternative with a rebate that required effort to redeem when it could not be redeemed immediately; however, when the time came to redeem, many did not follow through. In our natural experiment, over half of those expressing an intention to attend did not follow through a week later; this implies that they would have felt regret at their decision had their expression of intent to attend been binding.

General Discussion

The seven experiments presented here demonstrate that time and money produce different propensities to discount delayed outcomes as well as differential stability in intertemporal choice. Experiments 2, 3, 4, and 5 show that delayed time is typically discounted faster than money. Experiment 5 also shows more temporal inconsistency and bias toward the present for time than for money—that is, greater preference to delay when temporally separated investments are imminent rather than distant. We explain these phenomena by respondents' expectations that time slack will be more abundant in the future than it is now but that money slack will not, as demonstrated in Experiments 1, 6, and 7.

Experiment 7 directly connects expected slack gain to delay discounting. We observed greater delay discounting of time than of money under conditions when participants expected time slack to grow faster in the future than money slack. But our general slack gain theory of delay discounting implies that we should be able to find reversals of the modal pattern. In Experiment 7, when time and money slack gains were equivalent, propensity to delay was equivalent. When time slack gain was less than money slack gain, people delayed money investments more than time investments. Such reversals might occur in the real world if people expected more time slack in the present than the future or if they are highly cash constrained in the present but not in the future (e.g., 2nd-year MBA students headed for lucrative jobs).

Why do people continue to labor under the illusion that they will have more time in the future than they do today? If one commits to a delayed time investment that feels too painful to make today, one will experience more pain than expected later. And why does this irrational exuberance about growth in time slack not translate to a parallel illusion that money will be more plentiful in the future than it is today? Others have argued that time is less fungible than money (e.g., Leclerc et al., 1995). We infer that this fungibility of money smoothes out unusual imbalances between supply and demand of money slack, making future slack more predictable for money than for time. We have presented evidence in Experiments 6 and 7 that money slack is more predictable than time slack. Below we discuss the roles of predictability and fungibility more fully. We follow with conjecture about the (as yet unstudied) role of goals in discounting and perceptions of slack.

Predictability

Time demands are generally less predictable than money demands. In Experiment 7, we found that perceived slack for money tomorrow was correlated with money slack in 2 weeks but that perceived slack for time tomorrow was unrelated to perceived slack in 2 weeks. Also, time slack gain was less predictable than money slack gain between 2 days. In Experiment 6, participants responding in March were more accurate at anticipating the difference in money slack between 2 days in April than the difference in time slack between the same 2 days.

It is difficult to learn from feedback that time will not be more abundant in the future because of the irregular ways people spend

their time. Although many people may perceive themselves to be quite busy almost every day of their lives, the specific activities vary from day to day. Consequently, they do not learn from feedback that, in aggregate, total demands are similar. This reasoning resembles the account of the planning fallacy that people underestimate task completion times because they ignore base rates (Buehler et al., 1994). People perceive that past longer completion times were due to unique (ungeneralizable) situational constraints. By extension, we suggest that people are bad at learning that future time slack is no greater than present slack because they perceive that activities that compete for their time today are irrelevant to those that will compete in the future.

Resource Fungibility

Money is, by its nature, fungible, at least for those with ability and willingness to save and to access credit. Money is also more fungible than time (e.g., Leclerc et al., 1995), and we infer that this contributes to its greater predictability. If one has a spike in demand for money today, one can borrow from the future (e.g., by using a credit card). If one anticipates an unusual demand on money in 2 months, one can save to meet the demand or borrow when the spike arises. The effect of fungibility is to make slack pools smoother, more equal, and, hence, more predictable over time. We believe that this smoothing plays a role in our finding that people expect relatively similar levels of money slack now as in the future. If so, people without access to credit may show higher levels of discounting of future money.

Unlike money, time is perhaps fungible in the future but not in the present. If one is offered a prospect requiring time investment in the distant future, it is possible to move around appointments, do work in advance that would have conflicted, and create a situation in which accepting the prospect does not (seem to) offer much pain. It is for this reason that it is so easy to persuade us to give talks at other schools, write tenure letters, serve on committees, comment on each others' papers, and so forth when requests are made far in advance. But in the immediate future, time is much less fungible. That is, it is harder to accept a prospect requiring investment now than in the future without experiencing pain from inability to complete other planned tasks. This is true for purely logistical reasons; it is intriguing that it may also be true because people have active goals for their immediate activities that make it feel painful today to deny themselves the pleasure of completing these salient tasks. We elaborate on this possible role of goals below.

Goal Setting for Time and Money

If goals for competing uses of a resource are both more likely and more proximate in the immediate future than in the more distant future, this would produce perceptions of lower slack in the immediate future and consequent higher rates of delay discounting for that resource. Heath, Larrick, and Wu (1999) explained how many of the standard results on goal setting can be explained in terms of self-set goals becoming reference points, as in prospect theory (Kahneman & Tversky, 1979). In the prospect theory value function, falling short of a goal by X is more painful than exceeding a goal by X is pleasurable. Moreover, the steepest part of the value function is just below the reference point created by the goal. Thus, goals as reference points can explain standard findings such as that a goal to sell 120 units in a year leads to lower performance than a goal to sell 10 units per month. Motivation is strongest when one is just short of a goal (N. E. Miller, 1944).

By this account, slack is about whether accepting an offer requiring investment today might cause one to fail to attain proximate goals on other tasks and to experience pain from that shortfall. It is this pain—and not the sheer amount of resource demand now versus in the future—that produces preference to delay investment.

Now add to the argument above the premise that people have articulated goals for time (spend 4 hr to accomplish *B* today) but not for money (spend $40 on *B* today) and that they are more likely to have such goals for the very near than for the more distant future. If so, one might predict more delay discounting of time than of money, as we observed here. One might also predict that we should observe reversals of our default finding for people who are careful money budgeters in the current period but not prone to setting goals for how to spend their time.

A Cognitive Account of Impulsiveness in Utilitarian Domains

Hyperbolic discounting has been interpreted as evidence of low-level processes in both humans and animals (Ainslie & Haslam, 1992). In humans, hyperbolic discounting has been found to characterize impulsive individuals (e.g., Baker et al., 2003) and low-road responses to visceral and hedonic stimuli (Loewenstein, 1996; Shiv & Fedorikhin, 1999). Our results from Experiments 5 and 6 show that this present-biased behavior can also occur for very utilitarian motives rooted in cognitive perceptions of slack.

Obviously, the cognitive constructs in our slack theory cannot account for all instances of hyperbolic discounting, such as discounting by animals or discounting of addictive or visceral stimuli. But neither can our results be anticipated by the accounts presented to date in the literature. Delay discounting seems to be like other multiply determined behavioral decision phenomena in that evidence for cognitive underpinnings coexists with evidence showing similar behavior by lower animals (e.g., compare Simonson, 1989, with Shafir, Waite, & Smith, 2002).

Our results on slack and hyperbolic discounting are important for several reasons. First, we are able to show hyperbolic discounting driven by purely cognitive perceptions of slack. Rubenstein (2003) argued that hyperbolic discounting can be explained by lesser similarity between two events the closer they are in time, without specifying the dimension of similarity. We show in Experiments 5 and 6 that it is similarity in slack that changes over time and leads to behavior that can be interpreted as hyperbolic discounting.

Second, we show that one need not invoke changes in pure time preferences to explain intertemporal preferences of the sort associated with hyperbolic discounting. Previous authors have attributed hyperbolic discounting to the weighting of future utility as a function of its temporal distance rather than to changes in the expected utility of consequences as a function of temporal distance (e.g., Ainslie, 1975; Loewenstein & Prelec, 1992). We are able to show that we get phenotypically similar discounting as a result of changes in the utility of future events, owing to perceptions of greater opportunity costs now than in the future. Similarly, one

need not appeal to hyperbolic pure time preferences to explain the need for self-control devices that prevent one from choosing a smaller, sooner reward over a larger, later one when the sooner one draws close in time (Ainslie, 1975; Wertenbroch, 1998).

Our findings in Experiments 5 and 6 leave open a tantalizing question. The usual self-control problem is that people must bind themselves to preferences that they have at a temporal distance; otherwise, they cannot resist the temptation from a proximal stimulus to choose against their long-run interests. In our work, people exhibit temporal inconsistency in their preferences for expenditures of time. One might speculate that, for investments of time, people have a self-control problem when they are too far from events rather than too close. Is the problem that they have the self-control to say no in the present but not when an alternative results in costs only in the future (cf. Soman, 1998)?

The anecdotes that we used to introduce this article assumed implicitly that people are making a mistake when they agree too readily to activities in the future because they underestimate the future competition for their time. One might argue, though, that decisions taken at a temporal distance are wiser because they are more driven by one's higher goals rather than by local costs (Trope & Liberman, 2003). Gilovich and Medvec (1995) reported that, in the long run, people regret inactions more than actions. In temporal construal terms, people regret that they allowed short-term constraints to keep them from taking life-altering actions that would have been better for them in the long run. This perspective might lead one to conclude that we are wise to say yes to all of those requests made long in advance to review candidates for tenure, serve on committees, or give talks.

Our intuition, though, is that we really are making a mistake to agree to so many activities far in advance that we would decline if temporally close. We may be glad in the long run that we agreed to coach our children's sports teams, but most instances when we say yes are not life-enhancing opportunities that afford utility from remembrance. We may curse ourselves in the long run for saying yes to many small professional services that provide momentary approval from those who ask us to undertake some task but provide no particular satisfaction in long-term retrospect. This is a fascinating issue for future research on self-control.

Conclusion

The resource slack account of intertemporal choice that we have presented implies that one of our central findings—that future time investments are discounted more steeply than future money investments—is not completely general. This was the point of Experiment 7. Extending the argument, we note that time may not be discounted more than money by people who have jobs with irregular wages (e.g., salespeople on commission, street performers) or by those with very regular time demands in their job with little day-to-day variation in the specific tasks required (e.g., railroad engineers, toll booth attendants, assembly line workers). However, all of these contingencies are consistent with the general conceptual framework put forth in this article. Resource differences in delay discounting and degree of present bias or temporal inconsistency can be explained by resource differences in perceived growth or contraction of slack.

We plan in future research to investigate directly the roles of predictability, fungibility, and goals on perceptions of whether slack will be more abundant in the future, with consequent effects on revealed delay discounting. We also plan to investigate whether time-inconsistent preference for how people spend their time is functional or dysfunctional. When "yes" is followed by "damn," does further temporal distance in remembrance make one's decisions seem wiser or more foolish?

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Appendix

Model Comparisons Evaluating Alternatives to Slack Gain Account of Time Versus Money Differences in Discount Rates in Experiment 7

This appendix reports model comparisons to evaluate an alternative account of our findings in Figure 5 in Experiment 7—specifically, that greater discounting of time than of money is driven entirely by the effect of time slack tomorrow. The following analysis compares the unique contribution of present versus future slack of time and money. We test the competing accounts by nested model comparisons. Our base model in Figure 5 comes from estimating the regression equation A1:

$$\text{Preference to delay} = b0 + b1 \times \text{resource dummy} + b2 \times (\text{time slack gain} - \text{money slack gain}) + b3 \times \text{resource dummy} \times (\text{time slack gain} - \text{money slack gain}). \quad \text{(A1)}$$

This model constrains the weights of time slack gain and money slack gain to be equal in absolute value but opposite in sign. It also constrains the weights of the resource × time slack gain and resource × money slack gain to be equal in absolute value but opposite in sign. Substituting (time slack 2 weeks − time slack tomorrow) for (time slack gain), substituting (money slack 2 weeks − money slack tomorrow) for (money slack gain), distributing coefficients *b*2 and *b*3, and rearranging terms yields the alternative form:

$$\begin{aligned}\text{Preference to delay} = {} & b0 + b1 \times \text{time slack dummy} \\ & + b2 \times (\text{time slack 2 weeks} - \text{money slack 2 weeks}) \\ & - b2 \times (\text{time slack tomorrow} - \text{money slack tomorrow}) \\ & + b3 \times \text{resource dummy} \times (\text{time slack 2 weeks} \\ & - \text{money slack 2 weeks}) - b3 \times \text{resource dummy} \\ & \times (\text{time slack tomorrow} - \text{money slack tomorrow}). \quad \text{(A2)}\end{aligned}$$

The alternative theory implies that the crucial interaction reflected in the coefficient *b*3 is completely driven by time slack tomorrow. If so, one should be able to fit the data better by relaxing the constraint that the weight of slack tomorrow and slack in 2 weeks be equal and opposite in sign:

$$\begin{aligned}\text{Preference to delay} = {} & b0 + b1 \times \text{time slack dummy} \\ & + b2 \times (\text{time slack 2 weeks} - \text{money slack 2 weeks}) \\ & + b3 \times (\text{time slack tomorrow} - \text{money slack tomorrow}) \\ & + b4 \times \text{resource dummy} \times (\text{time slack 2 weeks} \\ & - \text{money slack 2 weeks}) + b5 \times \text{resource dummy} \\ & \times (\text{time slack tomorrow} - \text{money slack tomorrow}). \quad \text{(A3)}\end{aligned}$$

A model comparison test showed that Equation A3 fit no better than Equation A1, despite two more parameters, $F(2, 124) = 0.08$, $p = .92$. Moreover, the coefficients in *b*4 and *b*5 when we estimated Equation A3 were significant and opposite in sign. Put differently, it is both the time versus money difference in slack tomorrow and the time versus money slack difference in 2 weeks that determine time versus money differences in preference to delay. It is not simply a matter of whether one has constraints tomorrow that seem to be binding given a short window of opportunity to reschedule.

Received September 4, 2003
Revision received September 20, 2004
Accepted October 6, 2004 ■