Applications of the Savage Test to Intertemporal “Anomalies”

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This paper suggests that the tenets of the discounted utility model (DU) don’t appeal to most intelligent adults. When experimental circumstances facilitated direct comparison of discount rates across outcomes differing in valence, magnitude, and delay, respondents did not coordinate responses. Indeed, two of the so-called “anomalies” (the magnitude effect and the sign effect) were more pronounced under these conditions. Respondents who thought more deeply about their pattern of responses diverged further from the dictates of the theory. On the view that normative models draw support from the reflective equilibrium of intelligent individuals, these results undermine the normative validity of DU.

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Symposium Summary
Patience, Attention to Time, and Consumer Cognition
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Session Overview
Many important consumer decisions involve time. Decisions about saving money, maintaining a diet vs. splurging, or making a payment by credit card vs. with cash are just some of the numerous situations in which people must tradeoff between consumption in the present and consumption in the future. Given the importance of intertemporal choice, then, understanding how time and patience factor into the decision-making process is an important goal if we are to properly understand consumer behavior. In line with this goal, the purpose of this symposium is to explore how perceptions of time and individuals’ patience-levels interact to impact consumer decision making. The papers in this session explore the impact of attention to time on consumer cognition as well as some important determinants of people’s discount rates (an economic measure of patience).

The first paper (Krupka) examines the relationship between patience and access to financial resources (i.e., benefits and credit) among welfare recipients and finds that discount rates increase as access to these resources decreases. The second paper (Olivola & Wang) introduces two novel incentive-compatible methods for eliciting discount rates. A comparison of these methods reveals that discount rates vary, depending on whether attention is focused on the temporal or monetary dimension of delayed rewards. The third paper (Day & Bartels) demonstrates that temporal distance impacts perceptions of similarity, with some events seeming more similar when considered in the near future (or past), while others increase in similarity as temporal distance increases. Finally, the fourth paper (Frederick) demonstrates that two intertemporal choice “anomalies” (the magnitude effect and the sign effect) are actually more pronounced when discount rates across conditions are directly compared or when respondents are encouraged to think more deeply about their pattern of responses. This last paper also considers how these results undermine the normative (rather than descriptive) validity of the discounted utility model.

The papers in this session highlight novel and important features of the interaction between patience, attention to time, and decision making. This research demonstrates that normatively irrelevant factors can impact patience and intertemporal choice (i.e., discounting). The discount rate is shown to depend, dynamically, on access to financial resources (Krupka) and varies depending on whether consumers are focused on the monetary or temporal dimension of delayed payoffs (Olivola & Wang). In fact, attempts to reduce these inconsistencies can actually aggravate them (Frederick). Additional interesting and counterintuitive results include the finding that attention to time increases patience (Olivola & Wang) and alters perceptions of similarity (Day & Bartels).

These papers also adopt creative approaches to the study of intertemporal choice, which include the use of field experiments (Krupka) and experimental auctions (Olivola & Wang). Some papers also compare two or more methodological approaches to the elicitation of discount rates, such as between-subjects vs. within-subject designs (Frederick) and hypothetical vs. real-money incentive-compatible procedures (Olivola & Wang).

In summary, the four papers in this symposium provide both original methods for studying intertemporal choice and novel findings concerning the relationship between patience, attention to time, and consumer cognition. Collectively they demonstrate interesting and surprising phenomena, as well as important theoretical constructs to the study of intertemporal choice. This symposium should appeal to a diverse research audience for several reasons. First, research into intertemporal choice has implications for understanding the beneficial behaviors (e.g., saving for retirement), as well as the adverse choices (e.g., accumulation of credit card debt) that seriously impact the well-being of many consumers. It therefore contributes to a growing interest in transformative consumer research. In addition, a number of important areas are considered in these papers, including intertemporal choice, time perception, psychological distance, and consumer welfare.

Extended Abstracts
“Eliciting Subjective Discount Rates: Monthly Patterns of Impatience Among the Very Poor”
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The very poor are important targets for US government policies and financial transfer programs. Broadly speaking, individual time preferences have a fundamental role to play in explaining consumption and financial decision making (e.g., Angeletos et al. 2001), but some have specifically highlighted the relationship between impatience and financial decision making among the very poor (Meier and Sprenger 2007, Shapiro 2005). It has been suggested that an important source of vulnerability for the poor stems from tight financial constraints which may turn small mistakes, like over-spending at the beginning of the month, into big problems (Caskey 1994, Bertrand, Mullinathan and Shafir, 2004, Eckel et al. 2004). Several papers have found evidence for a monthly pattern in consumption and in time preferences (Shapiro 2005, Wilde and Ranney 2000). This later group of papers suggests that there is a link between rising financial desperation and changing time preferences over the course of a benefit month and the former set of papers suggests that financial constraints play a role in determining monthly patterns of behavior.

Using a sample of 975 married male welfare recipients participating in the Seattle Income Maintenance Experiment (SIME), this paper examines the relationship between rates of subjective time preference (ie discount rates elicited using hypothetical scenarios) and the timing of benefits among welfare recipients. The income maintenance experiments, from which the data for my analysis come, were conducted in the 1970’s to examine the effect of negative income tax welfare programs on work behavior. In this paper I use two different and common measures of impatience to explore the relationship between elicited impatience and benefit check receipt.

This paper exploits variation in the interview date of the “Time Horizon and Planning” module, which is orthogonal to the welfare benefit disbursement date, to demonstrate a ‘daily discount rate’ that is increasing over the course of the benefit month while controlling for socio-economic variables and economic behaviors collected as part of the larger study. The correlation between monthly benefit receipt (or the timing of pay checks) and behavior among welfare recipients (and those with low income) has received some empirical support. In economics, Shapiro (2005) analyzes caloric intake of food stamp recipients and finds that intake declines by 10 to 15 percent over the food stamp month. Wilde and Ranney (2000) find similar patterns for food spending and energy intake after food stamp receipt. Using a sample of mostly retired US
workers and a separate sample of UK households, Stephens finds that consumption expenditures are excessively sensitive to monthly receipt of social security checks and paychecks respectively (Stephens 2003, 2006). This literature has focused on the ways in which consumption varies with the timing of welfare benefits and has suggested that the ‘excessive sensitivity’ to monthly payments stems from credit constraints and or poor financial management. In this paper I show a similar sensitivity of subjective discount rates to the timing of benefit payments.

Using the ‘Attitudes to Credit’ module, I can create a subjective perception of credit constraint and examine whether the increase in the daily discount rate I observe can be accounted for by controlling for perceived credit constraints. I find that those who believe themselves to be credit unconstrained have significantly lower discount rates but that the daily discount rate remains significant and increasing over the benefit month.

The design of the Seattle Income Maintenance experiment also allows me to test whether exogenous variation in the size of the monthly transfer affects the daily discount rate. In the Seattle Income Maintenance Experiments, benefit levels (and other sources of non-work related income) were replaced by the experiment at 95%, 120% or 140% of pre-experimental benefit levels for 3 and 5 years (depending on treatment status). Thus, I can examine the effect of higher benefit levels on impatience and on the monthly impatience trend. I find no significant differences between daily discount rates elicited for controls and for those receiving larger benefits, the coefficient on the daily discount rate remains significant, and is, in some cases, larger.

This paper’s final contribution is an empirical one to the growing interest in the study of impatience, and its correlates, among the very poor (Lawrence 1991, Bertrand et al 2004, Eckel et al. 2004). While the data used here are from the 1970’s, my main finding of an increase in the daily discount rate over the benefit month is consistent with estimates of the relationship between subjective impatience over the benefit month using more recent data. The main result of my paper resonates with a policy recommendation for distributing welfare payments in smaller installments so that households may be assisted in smoothing consumption. Further, the results would caution against simply raising benefit levels without changing how they are administered.

References

“Patience Auctions: Novel Mechanisms for Eliciting Discount Rates and the Impact of Time vs. Money Framing”
Christopher Olivola, Princeton University, USA
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How do people trade off consumption in the future with current consumption? Measuring discount rates or discount functions is crucial to answering this question, but such measurements pose many methodological challenges. The majority of current measurement methods, such as matching tasks or hypothetical choice, suffer from important weaknesses (Frederick, Loewenstein, & O’Donoghue, 2002). Either they only provide bounds on the discount parameter rather than a point estimate or they are not carried out with real payoffs, thus giving participants no incentives to provide accurate answers and possibly limiting their external validity. In contrast, auction-based approaches can overcome these limitations by providing incentive-compatible mechanisms to elicit discount rates. For example, in second-price private-value auctions, the dominant strategy is for each bidder to bid his/her true value for the good regardless of what the other bidders do (Vickrey, 1961).

We introduce, test, and compare two novel auction-based experimental methods for eliciting discount rates. In these “patience auctions”, participants could either receive $10 immediately or a payoff sometime in the future, as determined by the bidding process. The two types of single-round sealed-bid “patience auctions” that we used differed with regard to the dimension that participants could bid on: money versus time. We also compare the relative merits of using first-price auctions versus second-price auctions. In each money-bid auction, the length of delay for the future payoff was pre-set and participants simultaneously bid the monetary amount for that payoff. The lowest bidder obtained the bid-determined payoff at the end of the pre-set delay period and all other bidders received $10 at the end of the session. In the first-price money-bid auction, the bid-determined payoff was the lowest bid whereas in the second-price money-bid auction, the bid-determined payoff was the second lowest bid. In each time-bid auction, the monetary amount for the future payoff was pre-set and participants simultaneously bid the length of delay for that payoff. The highest bidder obtained the pre-set payoff at the end of the bid-determined delay period and all other bidders received $10 at the end of the session. In the first-price time-bid auction, the bid-determined length of the delay was the highest bid, whereas in the second-price time-bid auction it was the second highest bid. We discuss the important advantages these auctions have over other incentive-compatible methods of elicitation, including Becker-DeGroot-Marschak (BDM) and alternative auction designs. In particular, we show that patience auctions provide a more efficient method for eliciting discount rates from large numbers of participants than previous procedures, yielding significant savings of time and money.

In each of the four experimental auction sessions, fifteen participants bid in eight money-bid auctions and eight time-bid auctions, with different pre-set parameters for the delayed payoff or
the length of delay, depending on the bid type. All the auctions were
first-price auctions in two of the sessions and second-price auctions
in the other two sessions. Participants were given no feedback about
others’ bids or the outcome of each auction. They were paid based
on the outcome of one of the sixteen auctions, chosen at random,
after all auctions were completed, in order to avoid any incentive
distortions. In addition to the auctions, we administered surveys to
another group of participants. These surveys were designed to be
the hypothetical matching-task equivalents of the auctions: the
parameter values used and their orderings were identical to the ones
used in the auctions. This allows us to compare the discount rates
revealed through the incentive-compatible auctions to those ob-
tained with the commonly used matching task method. Sixty Princeton
undergraduate students participated in the experimental
auction sessions and an additional thirty completed the hypothetical
matching-task surveys.

Beyond their methodological advantages, these auctions al-
low us to examine new and important questions about the deter-
nants of discounting. Using our within-subject bid type manipula-
tion, we can compare how discount rates vary depending on
whether the auction focuses participants’ attention on the temporal
or monetary dimension of delayed rewards. We find that people are
more patient when they bid time than when they bid money—a
difference not obtained with equivalent hypothetical matching
surveys. Specifically, the estimated mean daily discount rate (DDR)
was lower in the time-bid auctions than in the money-bid auctions.
While this result supports a “constructed preferences” account
(Lichtenstein & Slovic, 2006) of intertemporal choice, we also find
a strong within-individual correlation between implied discount
rates obtained under time and money bidding, suggesting that
approximately half the variance is driven by stable underlying
preferences for discounting. Our results are robust to varying
assumptions about the curvature of the utility function (risk-av-
ersion vs. risk neutrality), as well as the form of the discount function
(exponential vs. hyperbolic). Finally, we find that, contrary to
standard auction theory predictions, first-price auctions provide
more coherent estimates of the discount rates than their second-
price equivalents.

We discuss why standard models of discounting fail to account
for the disparity we find in discount rates when people bid money
versus time. We then consider how our results relate to other recent
findings in psychology, regarding the way people value time versus
money. We also discuss the implications of these experimental
results for the design of economic mechanisms that involve
intertemporal tradeoffs. One example is treasury auctions of bills
and bonds that have a pre-specified payoff structure in the future.
We consider the possible outcomes of alternative treasury auction
designs that elicit time bids for pre-determined current prices and
future payoffs rather than the existing money bid method.

References
utility by a single-response sequential method.” Behavioral
Science, 9, 226–236.
Frederick, S., G. Loewenstein, and T. O’Donoghue (2002).
“Time discounting and time preference: A critical review.”
Journal of Economic Literature, 40, 351–401.
Lichtenstein, S., & Slovic, P. (Eds.) (2006). The construction of

“Event Representation, Similarity, and Preference in
Temporal Context”
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Similarity is widely believed to play a major role in determin-
ing how entities, including choice options, are grouped and consid-
ered together, and how the consideration of one entity or event
brings related knowledge to mind (e.g., Shepard, 1987). In three
studies, we considered a novel factor that might affect similarity:
this distance in time in which the comparison is considered.
Previous studies had shown that similarity can vary widely with
factors such as prior knowledge (e.g., Chi, Feltovich & Glaser,
1981) and the comparison context (e.g., Medin, Goldstone &
Gentner, 1993).

It is notable that several theories in intertemporal choice
theorize representational change over time (e.g., that negative
information is discounted at a higher rate, that “affective” informa-
tion is discounted at a higher rate, or that “low-level” information
is less weighty at greater temporal distance), but with few excep-
tions, representational change is never tested. The current studies
offer one such direct test.

Construal Level Theory (CLT; Trope & Liberman, 2003;
Liberman & Trope, 1998) proposes that events in the distant future
are likely to be construed primarily in terms of their abstract,
central, goal-related features. Conversely, representations of events
that are closer to the present are likely to contain more concrete,
contextual information. These are referred to as high-level and low-
level construals, respectively.

The current research draws on this theory, and asks whether
differences in which information is salient may influence how
similar two events are perceived to be. For instance, events that
share more high-level than low-level commonalities should seem
more similar in the distant future, when the abstract goal informa-
tion (which is shared) is highlighted, and contextual information
(which differs between the two) is less available. An example
would be the two events “going to the dentist” and “joining a health
club”, which involve some obvious high-level similarities pertain-
ing to long-term health goals, but are quite different in concrete and
contextual details (the “low-level” features). Conversely, we should
predict the opposite pattern for events that share primarily concrete
features. For example, “going to the dentist” and “getting a tattoo”
are surprisingly similar in terms of specific details (reclining on a
chair, needles, discomfort, etc.), but seem quite dissimilar in terms
of the larger goals that they reflect.

Contrary to the first pair, these sorts of events should seem
more similar in the near than the distant future, since near future
construals should emphasize their concrete commonalities.

In our first experiment, we asked participants to rate the
similarity of event pairs such as these, which could share either
high-level (abstract, goal related) commonalities, or low-level
(concrete, contextual) ones. Additionally, these events were de-
scribed as taking place in the near future (“this week”) or the distant
future (“next year”). As predicted, there was a significant interac-
tion between commonality level (low vs. high) and temporal dis-
tance (near vs. distant). Pairs sharing high level commonalities were
rated as more similar in the distant future, while those sharing low-
level commonalities were rated as more similar in the near future.

The first experiment contained a possible confound: two
events that are near to the present are also necessarily near to each
other, but distant events might not be. To address this issue, we ran
a second experiment that included a “distant-close” condition, in
which events are described as occurring in the same week next year.
We replicated our basic effect: effects appear to be based on
distance from the present (not distance between events). The distant-close condition was virtually identical to the Distant condition, but significantly different from the Close condition.

In our third experiment, we replicated these findings for events described in the near and distant past. Again, we found a significant interaction, with high-level pairs rated more similar in the distant past, and low-level pairs more similar in the recent past.

A great deal of human cognition involves planning for the future, and considering and learning from the past. The current studies suggest that these temporal distances should have a significant impact on perceived similarities, and therefore have an important effect on how knowledge is organized, and which entities and events are grouped together. This, in turn, should have important consequences for people’s judgments and decisions.

Similarity can impact the manner in which choice alternatives are grouped, the adoption of a reference point, and ultimately, the ranking of preferences. We plan to discuss the implications of our findings for context effects. Specifically, Dhar & Glazer (1996) found that context effects were produced by underlying changes in similarity between choice options. We will use temporal distance to induce changes in perceived similarity and make predictions about how to turn substitution effects (between alternatives that are perceived to be similar) into attraction effects (when alternatives are perceived to be less similar).

References

“Applications of the Savage Test to Intertemporal ‘Anomalies’”
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In his classic Foundations of Statistics (1954), Leonard Savage discusses the criteria for judging the normative status of a decision principle. His focus was the Allais paradox, a pair of choices for which the modal responses (including Savage’s) violate the sure-thing principle—an alleged tenet of rational choice. Savage decided that ‘if, after thorough deliberation, anyone maintains a pair of distinct preferences that are in conflict with the sure-thing principle, he must abandon, or modify, the principle.’ In other words, if preferences are robust to deliberative reflection by intelligent individuals—if they pass “the Savage test”—the principle they violate ought to be discarded as a requirement of rational choice. Slovic and Tversky (1974) applied the Savage test to the Allais paradox by exposing individuals to arguments for and against the sure thing principle. After reading arguments from both sides, most continued to make the choices that jointly violate the sure-thing principle: they preferred a 10% chance of 5 million to an 11% chance of 1 million but rejected a 99% chance of 5 million, preferring the sure million. Thus, if one grants that the participants were “intelligent individuals” and that a hearing of the evidence allowed them to achieve reflective equilibrium, the Savage test dictates that the sure thing principle be jettisoned as an axiom of rational choice.

Variants of the Savage test could be applied to many problems in judgment and decision making literature. For example, Tversky and Kahneman (1983) show that the “conjunction fallacy” is diminished when the two critical items that are normally embedded among six unrelated items are placed side by side, the juxtaposition cues the logical rule of set inclusion for some respondents; they recognize that it can’t be more likely for Linda to be a feminist bank teller than for her to be “just” a bank teller. That is, the reflective answers of statistically sophisticated respondents shows a recognition of the validity of that logical principle.

In this paper, we use a ‘minimal’ Savage test to examine the status of the major “anomalies” in intertemporal choice. Following the aforementioned logic, we reasoned that if people are required to make two discounting judgments side by side (or in close succession), then they must consider any differentiation between them as normatively correct—because they would otherwise capitalize on the opportunity to coordinate their responses. If, for instance, people believe they should apply a constant discount rate to all delayed outcomes, regardless of the magnitude, valence, or timing of the delay, then the main intertemporal choice anomalies—the “magnitude effect”, “sign effect”, and “hyperbolic effect” should diminish if discount rates were elicited in a manner that facilitates comparisons (e.g., the magnitude effect should be less pronounced if subjects evaluate “small” and “large” amounts side by side, than if they evaluate them separately). Conversely, if people believe that differences in discount rates are justified, the opportunity to consider multiple judgments side by side will not eliminate the effects, and might even increase them, by drawing attention to a factor that subjects consider to be normatively relevant.

We find that the tenets of the discounted utility model (DU) have little appeal to most intelligent adults. When experimental circumstances facilitate direct comparison of discount rates across outcomes differing in valence, magnitude, and delay, respondents did not coordinate responses. Indeed, two of the so-called “anomalies” (the magnitude effect and the sign effect) were more pronounced under these conditions. Thus, respondents apparently believe that it is legitimate to discount different goods differently. Admittedly, if discrepant discount rates are not reconciled by additional reflection, one could always counter that respondents were not encouraged to think hard enough. However, we show that respondents encouraged to think more deeply about their pattern of responses diverge further from the dictates of the theory. On the view that normative models draw support from the reflective equilibrium of intelligent individuals, these results undermine the normative validity of DU as well as its descriptive validity.

References