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FRAMES OF MIND IN INTERTEMPORAL CHOICE*

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Recent research has demonstrated that choices between gambles are systematically influenced by the way they are expressed. Kahneman and Tversky's Prospect Theory (1979) explains many of these "framing" effects as shifts in the point of reference from which prospects are evaluated. This paper demonstrates the applicability of the reference point concept to intertemporal choice. Three experiments demonstrate that when people choose between immediate and delayed consumption, the reference point used to evaluate alternatives can significantly influence choice. The first study elicited relative preference for immediate and delayed consumption using three methods, each of which differently framed choices between alternatives offering identical end-state consumption. The conventional discounted utility model predicts that the three methods of elicitation should yield similar estimates of time preference, but preferences were found to differ in accordance with a reference point model. The second and third studies extend and replicate the results from the first, the third using real rather than hypothetical choices.
(INTERTEMPORAL CHOICE; FRAMING; DISCOUNTING)

1. Introduction

Since most decisions have delayed consequences, decision makers must frequently make tradeoffs between outcomes occurring at different points in time. To represent how people make such tradeoffs, economists and management scientists have relied almost exclusively on the discounted utility (DU) model. However, an expanding body of evidence challenges the descriptive validity of the conventional discounting formulation (Thaler 1981; Loewenstein 1987; Benzion, Rapoport and Yagil 1987). This empirical work has led to the formulation of alternative behavioral models of intertemporal choice (Thaler and Shefrin 1981; Winston 1980; Loewenstein 1987).

This paper argues that the concept of a reference point, an innovation central to recent models of decision making under uncertainty, can also be applied to intertemporal choice.[1] As used in models of decision making under uncertainty, the reference point reflects a simple insight: people evaluate the outcomes of gambles as gains and losses, or departures from some psychologically relevant point of reference, rather than as final levels of wealth. The reference point plays a similar role in the analysis of intertemporal choice. Rather than integrating delayed consumption with existing consumption plans it appears that people often represent future consumption options as gains or losses or as deviations from some standard, such as a past level of consumption, or the consumption of another person or group.

Borrowed from earlier work on goal setting (Frank 1935, Lewin et al. 1944), the reference point concept was first applied to decision making under uncertainty by Markowitz (1952). He proposed a multiply inflected utility function defined over gains and losses that could account for the tendency of people in all income classes to take

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[1] A number of articles have theorized about the effects of past consumption on current utility and consumption behavior (cf., Bell 1975). For example, Bordley (1986) recently examined the role of satiation in cyclical patterns of consumption. Other work has explored the effects of past consumption on consumer tastes (cf., Pollak 1970; von Weizsäcker 1971; and Stigler and Becker 1977). To my knowledge, however, no one so far has incorporated a psychological reference point into an analysis of intertemporal choice.

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risks with negative expected value while simultaneously purchasing actuarially unfair insurance. Since Markowitz' innovation, a number of other reference point models have been suggested. Fishburn (1977) proposed a model of managerial decision making in which risky projects are evaluated relative to a "target rate of return." In the regret theories of Bell (1982) and Loomes and Sugden (1982), decision makers compare outcomes resulting from chosen alternatives with what they would have obtained had another alternative been selected.

Perhaps the most influential theory of decision making under uncertainty that incorporates a reference point is Kahneman and Tversky's (1979) Prospect Theory. At the heart of Prospect Theory is a "value function" that is defined over departures from a reference point, is concave in the domain of gains and convex in the domain of losses, and is steeper for losses than for gains. The inflection at the reference point produces what Kahneman and Tversky call the "reflection effect": the observation that modal preferences tend to shift from risk averse to risk seeking when gambles involving only gains are reflected into the domain of losses (however, see Hershey and Schoemaker 1980).

In certain cases, the reference point can be affected by the way in which a choice is expressed, a phenomenon known as "framing." Research by Tversky and Kahneman (1981), Payne, Laughhunn and Crum (1980), and others, shows that such reference point manipulations can have a significant and systematic impact on risk preference. For example, a choice between a safe option and a risky option, when framed in terms of money to be saved, may induce risk aversion; but the same choice framed in terms of money to be lost invokes risk seeking. Framing is of consequence for decision theorists because it suggests that subtle changes in decision presentation, whether random or manipulated, can result in significant shifts of choice.

In what follows, the applicability of the reference point to intertemporal choice is demonstrated. The second section introduces a model of intertemporal choice that incorporates a reference point model and contrasts its predictions with those of the conventional discounted utility formulation. §3 presents results from three experiments that test predictions of the two alternative formulations. The final section discusses more generally the role of reference points in intertemporal choice.

2. Modeling Intertemporal Choice

2.1. *Modeling Without a Reference Point*

Most analyses of intertemporal choice by economists and decision theorists have relied on the concept of discounting. Discounting permits an individual to make value comparisons between immediate and delayed consumption. Like the expected utility model, the discounting model was first proposed as a descriptive theory of intertemporal choice (Fisher 1930) and was later derived axiomatically (Koopmans 1960; Lancaster 1963; Fishburn 1979). If $U(\cdot)$ is the individual's "ratio scale" utility function and $\delta(t)$ is his discount function, then the value of a two-period sequence of consumption (c_0, c_1) can be written,

$$V(c_0, c_1) = U(c_0) + \delta(1)U(c_1). \tag{2.1}$$

Utility experienced later is generally assumed to carry less weight than that experienced earlier—i.e., $\delta(t) < \delta(t')$ for $t > t'$. This tendency to downgrade delayed consumption is termed "positive time preference."

2.2. *The Reference Point Model*

In order to demonstrate most forcefully the implications of the reference point, the following model modifies the discounting approach only by substituting a utility func-

tion that incorporates a reference point. The utility function is assumed to be linear and positively sloping for both losses and gains but to be steeper for losses than for gains.

Considerable disagreement concerning the correct shape of the utility function has arisen in earlier formulations of decision making under uncertainty that incorporate a reference point. Markowitz advocated a triply inflected utility function that was convex for small gains, concave for small losses and the reverse for large gains and losses. Prospect Theory's value function is uniformly concave for gains and convex for losses. As in the current model, however, both theories assume that the utility function is more steeply sloped for losses than for equal valued gains. This is also a feature of a conventional concave utility function.

The value of a consumption sequence offering c_0 at time 0 and c_1 at time 1 can thus be expressed as

$$V(c_0, c_1) = v(c_0 - r) + \delta(1)v(c_1 - r) \tag{2.2}$$

where r designates the reference point. As in Prospect Theory it is convenient to assume that $v(0) = 0$.

2.3. *DU versus the Reference Point Model: Contrasting Predictions*

While intertemporal options can be expressed in a neutral manner, as an ordered sequence of consumption over time, there is wide latitude in the manner in which decisions between such sequences can be expressed. For example, there are at least three ways to elicit individuals' relative preferences for immediate versus delayed consumption. First, you can ask people to specify the most they would pay to obtain an object immediately (the immediate consumption price) and then ask how much they would pay to get the object following a time delay (the delayed consumption price). The difference between these measures is one measure of relative preference for immediate consumption. Alternatively, you can ask how much they would pay to obtain the object immediately, instruct them to imagine that they have made the purchase, and then ask for the smallest amount they would accept in order to delay consuming. This "delay premium" is a second measure of relative preference for immediate consumption. Finally, you can ask how much they would pay to obtain the object following a time delay, instruct them to imagine that they have paid that amount, and then ask for the most they would be willing to pay to speed up consumption so as to eliminate the delay. This final amount, the "speed-up cost," is a third measure of relative preference.

The two models, the conventional discounting model and the reference point model, make different predictions concerning the relative values that would be obtained from each of these three methods of elicitation. The standard discounting formulation implies that immediate and delayed consumption each has a fixed value, and that both the positive value of speeding up consumption and the negative value of delaying consumption should be equal to the difference between these values. Indeed this is true of a wider class of models of which DU is a special case—namely models in which utility is assumed to depend on objective levels of consumption rather than consumption relative to some standard.

To see why this is the case, we can define a triple (w, b_0, b_1) which represents the person's status with respect to some consumption item at two points in time, 0 and 1. Here, w designates the individual's wealth at time 0 (at the point when a choice is made), b_0 is a binary variable representing the condition of possessing or not possessing the consumption item at time 0, and b_1 represents possession or nonpossession of the object at time 1. In what follows, "$\sim$" designates indifference. In addition to the central assumption that utility depends only on objective levels of consumption, the following derivation assumes only that the operation "$\sim$" is transitive. In what follows ν_0 represents the immediate consumption price, ν_1 the delayed consumption price, $\nu_{0\to1}$ the delay premium and $\nu_{1\to0}$ the speed-up cost.

By the definition of a reservation price,

$$(w, 0, 0) \sim (w - \nu_0, 1, 0) \sim (w - \nu_1, 0, 1), \tag{2.3}$$

current position	paying for and obtaining object now	paying for the object now and obtaining it later.

For an individual who has bought the immediate object at a price ν_0, the delay premium, $\nu_{0\to1}$, is such that:

$$(w - \nu_0, 1, 0) \sim (w - \nu_0 + \nu_{0\to1}, 1 - 1, 1), \tag{2.4}$$

buying item now	receiving delay premium	giving up object now and getting it later.

By the assumption that people are concerned only with final levels of consumption, $1 - 1 = 0$. Hence,

$$(w - \nu_0 + \nu_{0\to1}, 1 - 1, 1) \sim (w - \nu_0 + \nu_{0\to1}, 0, 1). \tag{2.5}$$

By transitivity, combining (2.5) with (2.4) and (2.3), and applying the same logic to the speed-up cost ($\nu_{1\to0}$), we obtain 3 testable predictions of the conventional discounting model:

(a) *The delay premium = the difference between the immediate and delayed consumption prices* ($\nu_{0\to1} = \nu_0 - \nu_1$).

(b) *The speed-up cost = the difference between the immediate and delayed consumption prices* ($\nu_{1\to0} = \nu_0 - \nu_1$).

Hence,

(c) *The delay premium = speed-up cost* ($\nu_{0\to1} = \nu_{1\to0}$).

The predictions of the reference point model differ from those of the conventional discounting model because the reference point implicit in the three question formats differs. Asking someone who does not currently possess an object (designated as "x") how much she would pay to obtain it immediately causes her to compare her current position of not having the object to the situation of having it, which would be viewed as a gain. Since the person does not initially anticipate possessing the object at either point in time, the relevant reference point is $r = 0$. The immediate consumption price thus corresponds to $v(x - 0) + \delta(1)v(0 - 0) = v(x)$. Similarly, the value of receiving the object at time 1 for someone who does not currently possess the object will be $v(0 - 0) + \delta(1)v(x - 0) = \delta(1)v(x)$. The difference between these values is equal to $[1 - \delta(1)]v(x)$.

In the delay situation an individual who has purchased the object and anticipates imminent delivery is asked how much he or she would need to be paid in order to delay. This person will have completely adjusted to ownership of the object, meaning that the reference point reflects possession of the object ($r = x$).[2] The difference in value between delaying and not delaying is therefore:

$$-[1 - \delta(1)]v(-x) = [v(x - x) + \delta(1)v(0 - x)] - [v(0 - x) + \delta(1)v(x - x)], \tag{2.6}$$

benefit of not delaying = value of not delaying − value of delaying.

[2] It is not necessary for the implications of the model that the individual has completely adjusted ($r = x$) to possession of the object in the delay condition, only that the adjustment in the delay condition is greater than in the speed-up condition. In other words, $r_{\text{delay}} > r_{\text{speed-up}}$.

Hence, the individual would need to be compensated for a loss of $[1 - \delta(t)]v(-x)$ in order to accept deferral of x.

Implicit in the above is the assumption that a person views failure to delay delivery to time 1 as a loss in that period. This does not mean that when time 1 actually arrives, the individual will actually experience privation; only that when evaluating the choice between consuming at time 0 or time 1, consumption in whichever period ends up without the object is viewed as a loss. This assumption—that people have a single reference point at any moment used to evaluate consumption at different points in time—is analogous to the assumption in Prospect Theory that people have a single reference point used to evaluate the different possible payoffs from a gamble. In Prospect Theory, once an outcome occurs people will tend to update their reference point. Similarly, in the current reference point model, as time passes the individual may update her reference point.

The speed-up situation, in which the individual anticipates future possession and contemplates speeding it up, is somewhat more complex than the delay situation. Although the individual does not initially possess the object, it seems inappropriate to assign a reference point of zero. Waiting for anticipated consumption to take place is not the same as simply passing time with no anticipation of consumption (Loewenstein 1987). Rather, it appears that anticipation of desired consumption typically results in some shift of one's point of reference, causing one to feel deprived in the present (Gurr 1970; Tomarken and Kirschenbaum 1984). The assumption made here is that the reference point reflects a balancing of future possession and immediate lack of possession.[3] If r' is the reference point in the speed-up condition then $0 < r' < x$. Generally, it seems plausible that r' would be a negative function of time delay. Given a reference point r' the value of speed-up will be:

$$[1 - \delta(1)][v(x - r') - v(-r')] = v(x - r') + \delta(1)v(-r') - [v(-r') + \delta(1)v(x - r')], \quad (2.7)$$

benefit from speed-up = speeding up delivery − not speeding delivery.

By the assumptions made regarding the value function, it follows that[4]:

[3] If x was a money amount, an obvious assumption would be to set $r = \delta(t)x$—i.e. to the net present value of x. This is analogous to the assumption in disappointment theory (Bell 1985) that the expected value of a gamble serves as a reference point against which outcomes are compared.

[4] Proof that:

$$[1 - \delta(t)][v(x - r') - v(-r')] > [1 - \delta(t)]v(x). \quad (1)$$

By the assumption that the value function is steeper for losses than for gains

$$v(x - r') - v(-r') > v(x - r') + v(r'). \quad (2)$$

By the assumption that the value function has constant slope and $v(0) = 0$:

$$v(x - r') = v(x) - v(r'), \quad (3)$$

combining (2) and (3):

$$v(x - r') - v(-r') > v(x - r') + v(r') = v(x) - v(r') + v(r') = v(x), \quad \text{or} \quad v(x - r') - v(-r') > v(x). \quad (4)$$

Multiplying both sides of (4) by $[1 - \delta(t)]$, yields (1).

Proof that:

$$-[1 - \delta(t)]v(-x) > [1 - \delta(t)][v(x - r') - v(-r')]. \quad (5)$$

By the assumption that the value function is steeper for losses than for gains:

$$v(x - r') - v(-r') < -v(r' - x) - v(-r'). \quad (6)$$

By the assumption of constant slopes and $v(0) = 0$,

$$-v(r' - x) - v(-r') = -v(-x) + v(-r') - v(-r') = -v(-x) \quad \text{or} \quad v(x - r') - v(-r') < -v(-x). \quad (7)$$

Multiplying both sides of (7) by $[1 - \delta(t)]$, we obtain (5).

$$-[1-\delta(t)]v(-x) > [1-\delta(t)][v(x-r')-v(-r')] > [1-\delta(t)]v(x), \tag{2.8}$$

delay premium > speed-up cost > difference between immediate and delayed consumption price.

Stated as alternative hypotheses:

(a') *the delay premium > the difference between the immediate and delayed consumption prices.* $v_{0\to 1} > v_0 - v_1$.

(b') *the speed-up cost > the difference between the immediate and delayed consumption prices.* $v_{1\to 0} > v_0 - v_1$.

(c') *the delay premium > speed-up cost* $v_{0\to 1} > v_{1\to 0}$.

Figures 1–3 illustrate the way in which consumption is framed at time 0 under each of the three methods of elicitation. Figure 1 illustrates the first method of elicitation in which the individual does not initially anticipate consumption ($r = 0$). Figure 2 depicts the delay condition in which the individual initially anticipates consuming immediately ($r = x$). Figure 3 presents the speed-up condition in which the individual has partially accommodated to anticipated consumption ($0 < r < x$).

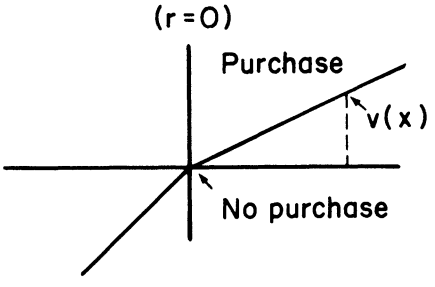

FIGURE 1. Period 0 Framing of Purchase ($r = 0$).

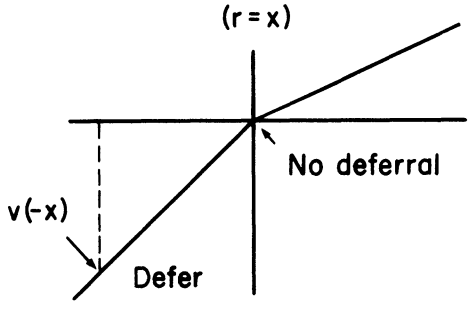

FIGURE 2. Period 0 Framing of Deferral ($r = x$).

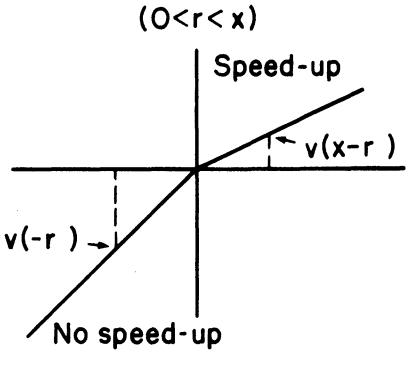

FIGURE 3. Period 0 Framing of Speed-Up ($0 < r < x$).

3. Experiments on Intertemporal Choice

3.1. *Experiment* 1

In the first experiment, subjects' relative preferences for an immediate and delayed consumption item—a video cassette recorder (VCR)—were elicited by the three

methods specified above.[5] Sixty-six undergraduates at the University of Illinois attending an introductory economics class volunteered to participate in the study. Each was paid $3.00 for participating.

Two different questionnaires were handed out, one per student. Each questionnaire consisted of three questions concerning hypothetical transactions involving a VCR, and several additional questions unrelated to the current study. The first questionnaire first elicited the immediate consumption price, then the delay premium. At the end of the questionnaire, a third question asked subjects to state a delayed consumption price. The second questionnaire first asked for the delayed consumption price for the VCR, then the speed-up cost. At the end of the questionnaire, subjects were asked to state an immediate consumption price. In both questionnaires, the three questions were placed at the beginning and end of the questionnaire so as to mask awareness of potential inconsistencies (e.g., of $v_0 + v_{0\to1} = v_1$). A sample of the three questions from the first questionnaire is presented below. The first two questions were placed at the beginning of the questionnaire.

1. What is the most you would pay today for a Sony VCR with remote control (list price $300)? If you pay this amount you will receive the VCR later today. You should be willing to pay the amount you specify but not a penny more.

Amount you would pay $ v_0

2. Suppose you had bought the above VCR for the amount you specified on the line above. What is the smallest payment you would be willing to accept today to delay receiving the VCR for one year. You should be willing to delay receiving the VCR for the amount you specify but not for one penny less.

Amount you require to delay receiving VCR $ $v_{0\to1}$

The third question, placed at the end of the same questionnaire, asked:

What is the most you would pay today to obtain a Sony VCR with remote control in one year (list price $300)? If you pay this amount you will receive the VCR on this date in one year. You should be willing to pay the amount you specify but not a penny more.

Amount you would pay $ v_1

3.21. *Results*

Table 1 presents mean values of v_0, v_1, and $v_{0\to1}$ for those subjects who received the questionnaire that elicited $v_{0\to1}$. Standard errors are in parentheses.

As predicted by the reference point model, subjects required considerably greater compensation to postpone receiving the VCR than the difference between their prices for an immediate and delayed VCR. The mean within-subject difference between $v_{0\to1}$ and $v_0 - v_1$ is 80.6 which is highly significant ($t = 4.57$, d.f. = 33, $p < 0.001$). Proposition (a) can therefore be rejected, while (a′) is supported.

[5] The reference point model can easily be generalized to handle durable goods, such as the VCR, that provide consumption services over multiple periods. For example the speed-up cost for a VCR that provided a consumption level of x for three periods would be equal to:

$$[v(x - r') + \delta(1)v(x - r') + \delta(2)v(x - r') + \delta(3)v(-r')]$$
$$- [v(-r') + \delta(1)v(x - r') + \delta(2)v(x - r') + \delta(3)v(x - r')],$$

which is equal to:

$$[1 - \delta(3)][v(x - r') - v(-r')].$$

The three predictions, (a), (b), and (c), of the conventional discounting model and the counter-hypotheses of the reference point model are unaffected by the duration of services provided by the consumption good.

TABLE 1

Mean Immediate and Delayed VCR Reservation Prices and Required Reimbursement for Postponing ($n = 34$)

Immediate Consumption Price (v_0)	Delayed Consumption Price (v_1)	Difference: Immediate-Delayed ($v_0 - v_1$)	Delay Premium ($v_{0\to1}$)
\$272	\$226	\$46	\$126
(13.9)	(13.5)	(14.3)	(16.0)

A similar picture emerges in Table 2, which presents a within-subject comparison of the speed-up cost of the VCR compared with the difference between the subjects' valuation of the delayed and immediate VCR. For these subjects, the difference between $v_{1\to0}$ and $v_0 - v_1$ was 31.2 ($t = 2.81$, d.f. = 31, $p < 0.01$). Again the discounting prediction (b) is contradicted while the prediction of the reference-point model, (b′), is supported. Both the immediate consumption price and the delayed consumption price in Table 2 are lower than those in Table 1, but neither difference is significant ($p > 0.1$).

Another way to evaluate the predictions of the two models is to look at the behavior of individual subjects. An analysis of the number of subjects whose delay premium or speed up cost was greater than, equal to, or less than the difference between their immediate and delayed consumption prices is as follows:

DELAYING DELIVERY

	$v_{0\to1} > v_0 - v_1$	$v_{0\to1} = v_0 - v_1$	$v_{0\to1} < v_0 - v_1$
number of subjects:	16 (50%)	15 (47%)	1 (3%)

SPEEDING DELIVERY

	$v_{1\to0} > v_0 - v_1$	$v_{1\to0} = v_0 - v_1$	$v_{1\to0} < v_0 - v_1$
number of subjects:	22 (65%)	6 (18%)	5 (17%)

For some subjects the delay premium or speed-up cost exactly equals the immediate consumption price minus the delayed consumption price. It seems likely that many of these subjects noted the connection between the items and matched their answers to show consistency. Among those who did not exactly satisfy prediction (a), 16/17 violated it in the direction predicted by the reference point model (a′). In the speed-up condition, 22/27 of those who violated (b) did so in the direction predicted by the reference point model.

A final comparison concerns $v_{0\to1}$ and $v_{1\to0}$. The conventional discounting model predicts that these should be equal (c), while the reference point model predicts that $v_{0\to1}$ should exceed $v_{1\to0}$ (c′). Based on a between-subject comparison (no subject was asked both questions), the mean values of $v_{0\to1}$ and $v_{1\to0}$ were 126 and 54, respectively ($t = 3.54$, d.f. = 64, $p < 0.001$). This discrepancy remains significant ($p < 0.01$) after adjusting for individual differences in time preference by subtracting $v_0 - v_1$ from $v_{0\to1}$ and from $v_{1\to0}$. Hence, as predicted by the reference point model, the delay premium is greater than the speed-up cost.

TABLE 2

Immediate and Delayed VCR Reservation Prices and Value of Accelerated Delivery (n = 32)

Immediate Consumption Price (ν_0)	Delayed Consumption Price (ν_1)	Difference: Immediate-Delayed ($\nu_0 - \nu_1$)	Speed-up Cost ($\nu_{1\to 0}$)
$242	$219	$23	$54
(15.4)	(16.1)	(6.9)	(12.3)

3.3. *Experiment* 2

One problem with the first study concerns the consumption item that was used. The VCR is not an ideal item for several reasons. First, model changes occur fairly rapidly so it is possible that subjects think that when they delay consumption they will be receiving "last year's model." Second, the VCR is not a "consumable," but a durable which gives a stream of services over time. It may be unrealistic, therefore, to model consumption of the VCR as occurring in a single period. Finally, if the useful life of the VCR is unknown, then the effect of time delay may be complicated by considerations of uncertainty. To avoid these problems the second experiment substituted for the VCR a $100 gift certificate to the restaurant of your choice. In addition, the time delay was reduced from one year to 6 months.

One hundred and sixteen Wharton MBA students from three introductory level classes participated in this study. Students were randomly divided into two groups. One group was first asked to specify the most they would pay for a $100 gift certificate that was valid immediately (the immediate consumption price) and then was asked to state the most they would need to be paid not to use the certificate for 6 months (the delay premium). The other group was first asked how much they would pay for a certificate they could not use for six months (the delayed consumption price) and then was asked to specify the most they would pay to be able to use the certificate immediately (the speed-up cost).

Surprisingly, the group asked about the delayed dinner, on average, valued it more highly ($86) than did the group asked to evaluate the immediate dinner ($78), although the difference is not statistically significant. This result again testifies to the unimportant role played by time delay when subjects are simply asked how much they would pay to consume at different points in time. The delay premium and speed-up costs, on the other hand, were significantly greater than zero and differed significantly from one another. The mean value for the delay premium was $23.85, while the mean value for the speed-up premium was $10.17 ($t = 3.6$, $p < 0.001$). Hence, alternative hypothesis (c′) is again supported. Since the delay premium and speed-up costs are both significantly greater than the difference between the immediate and delayed consumption prices, hypotheses (a′) and (b′) are also confirmed.

The results from the second experiment thus replicate those obtained in the first. Substitution of the restaurant gift certificate for the VCR indicates that the speed-up delay asymmetry obtained in the first study applies to "consumable" items as well as durables. Furthermore, the between-subject design ensures that the result does not depend on response mode effects engendered by question order.

However, two problems limit the generalizability of results obtained from the first two studies. First, both involved hypothetical rather than real choices, raising doubts about whether similar effects would be obtained if the decisions had real consequences for the subjects. This shortcoming was eliminated in the third experiment which gave subjects choices between real immediate and delayed rewards.

Second, it is possible that the observed asymmetry between speed-up cost and delay premium is simply due to the different ways in which the two quantities were elicited —the former in terms of willingness to pay, the latter in terms of minimum acceptable compensation. Previous research (cf., Knetsch and Sinden 1984) has shown that an individual's minimum selling price for an item tends to exceed his/her maximum purchase price for the same item. To rule out such an interpretation of the delay versus speed-up asymmetry, the third study used an identical procedure for eliciting the delay premium and speed-up cost; both were assessed by giving subjects a series of pairwise choices. The third experiment is limited to a test of the delay versus speed-up asymmetry—hypotheses c and c′.

It should also be noted that the willingness to pay/willingness to accept discrepancy has no implication for the relative magnitudes of the speed-up cost and the difference between the immediate and delayed consumption prices (predictions b and b′) since both were elicited using willingness to pay. Yet in the first two studies, the former was found to systematically exceed the latter as predicted by the reference point model.

3.4. *Experiment* 3

One hundred and five high school sophomores and juniors in 5 classes participated in this study. In each class, subjects formed pairs; one subject in each pair flipped a coin, and the other called the flip. In this manner each class was split into two groups. All subjects received a $7 gift certificate for a local record shop; however winners of the coin toss were scheduled to receive the certificate at an earlier time than losers. In half the classes winners of the toss anticipated obtaining the certificate in one week, losers in 4 weeks; in the other half, winners anticipated obtaining the certificate in four weeks, losers in 8 weeks. Hence, following the coin flips, there were subjects who anticipated receiving the certificates following 1, 4, and 8 week delays. All students were then given a series of binary choices between keeping their certificates at the originally appointed times or trading them in for smaller certificates earlier or larger certificates later. Subjects in the 1-week condition chose between keeping their certificates or exchanging them for smaller ones immediately or larger ones in 4 or 8 weeks. Subjects in the 4-week condition chose between keeping the 4-week certificate or trading it in for smaller certificates immediately or in 1 week, or larger certificates in 8 weeks. Finally, subjects with 8-week certificates were given choices between retaining the 8-week certificates or exchanging them for larger certificates immediately, in 1 week or in 4 weeks. Appendix 1 contains a sample choice form for subjects in the 4-week condition.

After they had circled their preferred choice from each pair, a bingo ball was drawn from a bag containing balls numbered from 1 to 75. If a number corresponding to one of the binary choices was drawn, subjects were told they would get their choice on that item. If any other number was drawn, they retained the $7 certificate at the originally appointed time.

This design made it possible to compare, for example, the amount that 8 week subjects were willing to give up in order to speed-up their certificate to 1 week against the amount that 1 week subjects required in order to delay receiving the certificate until 8 weeks. The results are summarized in Table 3.

In each of the above comparisons, the mean delay premium is from 2 to 4 times greater than the mean speed-up cost. All three differences are significant at the 0.01 level. The asymmetry between speed-up and delay, therefore, remains highly significant with real choices between consumption at different points in time. The experiment also demonstrates that subjects' resistance to delay applies not only to delaying from the present but also to delaying of already deferred consumption. Apparently, people accommodate to consuming at a particular point in time and become averse to further delay, and at the same time are relatively uninterested in speed-up.

TABLE 3
Mean Amounts to Speed-up and Delay Consumption
($7 Record Store Gift Certificate)

Time Interval	Delay	Speed-up
1 week versus 4 weeks	$1.09	$.25
4 weeks versus 8 weeks	$.84	$.37
1 week versus 8 weeks	$1.76	$.52

3.5. *Summary*

These results indicate the applicability of the reference point concept to intertemporal choice. In the first study, each of the three predictions of the reference point model, a′, b′, and c′ were confirmed, while the corresponding predictions of the conventional discounting model were rejected. The second study replicated the first using a consumable good rather than a durable. The third study demonstrates the asymmetry between preference for delay and speed-up with real rather than hypothetical choices, shows that the difference persists even when both are elicited in the same manner, and that the asymmetry occurs even when both points in time are in the future.

4. Discussion

4.1. *Other Evidence of Reference Point Effects in Intertemporal Choice*

Many earlier results from research on intertemporal choice can be understood in terms of reference point shifts. For example, Mischel and Ebbesen (1970) found that children who had to wait in order to receive the superior of two rewards were less able to do so when they were in the presence of either object. One can hypothesize that being in the presence of the rewards has an effect not unlike that of purchasing, yet having to wait for, a VCR. The child may accommodate to the idea of possession, which becomes a reference point, and waiting may subsequently become intolerable.

Similar results have also been found for adults. Ruderman (1985) found that when dieters ("restrained eaters") expected to eat a highly caloric meal in the future, their resolve collapsed and they began to eat immediately. Tomarken and Kirschenbaum (1984) reported an equivalent finding for both dieters and nondieters. It seems possible that the anticipated consumption caused subjects to shift their reference point, causing immediate deprivation which encouraged immediately impulsive behavior.

Likewise, the certainty that one will *not* consume something in the future can *reduce* one's feeling of deprivation. As Schelling notes,

> Addicts suffer noticeably less withdrawal discomfort when in an establishment that has a reputation for absolute incorruptibility, unbribable guards and staff, and no underground market anywhere, compared with a hospital in which it is expected, rightly or wrongly, that appropriate effort and willingness to pay will produce relief (Schelling 1984, p. 3).

Apparently, the possibility of obtaining the drug is sufficient to induce a reference point shift with physiological ramifications.

The idea that increases in anticipated consumption can cause current deprivation is also supported by work in political science. Many observers have noted that revolutions often occur not when conditions are deteriorating, but rather, just as they seem ready to improve. de Tocqueville, perhaps the first to make this observation, wrote:

> Nations that have endured patiently and almost consciously the most overwhelming oppression often burst into rebellion against the yoke the moment it begins to grow lighter. The regime

> which is destroyed by revolution is almost always an improvement over its immediate predecessor . . . Evils which are patiently endured when they seem inevitable become intolerable once the idea of escape from them is suggested (1856, p. 214).

Gurr, in his classic *Why Men Rebel* (1970, p. 14), includes "the promise of new opportunities" among the antecedents of discontent and rebellion. Apparently, anticipation of future progress can cause a shift of reference that increases discontentment with the current position, leading people to take drastic measures in order to speed-up that progress.

4.2. *Estimation of Discount Rates*

That framing effects can interfere with the elicitation of preferences is well documented in decision making under uncertainty (See, e.g., Lindman 1971; Lichtenstein and Slovic 1971; Grether and Plott 1979; Hershey, Kunreuther and Schoemaker 1982). The current paper extends this work by examining the effect of choice-framing on the elicitation of intertemporal preferences. In the first study discussed above, each of the three different methods of assessment yielded different estimates of subjects' relative preference for immediate and delayed possession of the VCR. In fact, if we assume risk neutrality, the mean annual discount rates that result from the three elicitation methods ranged from 0.24 for the conventional method, to 0.31 for the speed-up condition, to 0.96 for the delay condition. If the reference point theory is valid, then the problem is not that discount rates vary according to type of consumption and delay versus speed-up, but that a second factor influences time preference—the reference point used to evaluate immediate and delayed consumption. Accurate estimation of discount rates thus requires parsing out the relative impact of discounting per se and of reference point effects.

4.3. *Time Inconsistency*

The reference point concept may also shed new light on the phenomenon of time inconsistency. Time inconsistency occurs when a decision maker makes plans for the future but systematically departs from those plans. Time inconsistency is commonly associated with impulsive or short-sighted behavior such as smoking, drinking, or overeating, in which the individual vacillates between consuming the harmful substance and wanting to stop.

Since Strotz (1956) demonstrated that any discount function except one that is logarithmic will exhibit time inconsistency, most accounts of the phenomenon have been cast in terms of discounting. The most recent and influential of these contributions was Ainslie's (1975) work on impulsivity, which explained time inconsistency using nonlogarithmic "reward effectiveness" schedules that designate the effectiveness of a reward as a function of the duration of its deferral.[6]

But explanations of time inconsistency that rely on discount functions or reward effectiveness schedules confront a serious shortcoming: they cannot account for why

[6] Not all work on time inconsistency has adhered to a discounting perspective. A number of theorists have recently developed "egonomic" models that view intertemporal choice as a conflict between different egos or selves within the individual. Schelling (1984), who coined the term egonomics, views intertemporal choice as a conflict between two selves, one typically myopic (e.g., the one who wants a cigarette), the other farsighted (the one who wants to quit). Thaler and Shefrin's (1981) model includes a series of temporally isolated id-like "doers" and an atemporal "planner" whose job is to allocate consumption between the doers. Elster (1985) conceives of intertemporal choice as a collective action problem in which consumption at one point in time imposes various *externalities* on the consumer at other points in time, and in which a breakdown of will at one point in time, like a violation of the golden rule in social choice, produces a domino-like deterioration of behavior. In Winston's (1980) formulation, people alternate between two sets of preferences, one that encourages myopic behavior, the other that promotes greater concern for the future.

certain types of consumption objects commonly produce time inconsistent behavior, while others fail to do so. Smoking, drinking, and eating recur in accounts of time inconsistency while other forms of consumption, such as clothing purchases, are rarely cited as examples. Moreover most individuals are impulsive towards some forms of consumption and not toward others. In order to account for such *intra-individual* variations in a strict discounting framework, we must postulate that different types of consumption have different discount curves, a development that would collapse the concept of discounting to a tautology. An alternative explanation is that some other mechanism is operating in addition to time preference.

If we look more closely at what types of consumption objects evoke impulsivity, an interesting pattern emerges. In most cases consumption has the characteristic that failure to consume does not simply involve a forestalling of potential satisfaction, but actually imposes pain or deprivation on the individual. Most forms of appetitive consumption such as food, liquids, and perhaps sex not only give pleasure when experienced, but can cause pain if they are not satisfied. This is also true of addictive substances such as alcohol and cigarettes. These appetites and needs are in effect biological reference points which shift as a function of time.

4.4. *Implications for Consumer Choice*

Perhaps the most important issue for everyday intertemporal decision making concerns how people typically frame the intertemporal decisions they face. For example, are people most likely to frame a purchase decision as a one-stage decision to purchase an item at a particular point in time or as a two-stage decision—an initial decision to purchase followed by a deliberation concerning *when* to purchase?

The reference point model suggests that consumers will be less willing to delay if the decision is divided into two stages. For example, a consumer may be quite uncertain whether he needs a new car. But, after making the decision to purchase, his reference point may adjust to accommodate to anticipated ownership. If he is now told that the model he planned to purchase is momentarily unavailable, he will be in a position analogous to the speed-up condition in the experiments in which people exhibited a marked unwillingness to delay consumption. As a result, he may end up renouncing his initially planned purchase in favor of a less-than-perfect car that he can drive home from the dealer.

Choice may also be deliberately framed to produce impulsive or far-sighted behavior. The negotiating technique of appearing to be on the verge of agreeing to a settlement and then suddenly backing off (Bell 1985) can be understood in these terms. The victim of this ploy accommodates to the imminent settlement and, when it subsequently fails to materialize, is placed in a position of deprivation which can only be eliminated by reaching a settlement. Such deprivation, or, impatience, increases his willingness to accept an immediate but unfavorable settlement.

4.5. *Conclusion*

This paper demonstrated the applicability of the reference point concept to intertemporal choice. Experimental evidence was presented which examined the effect of reference point manipulations on intertemporal choice. Specifically, it was demonstrated that when a temporal shift of consumption is framed as a delay it has greater significance than when framed in terms of speed-up. The significance of the delay is minimized when the consumer is simply asked to state the present value of consumption at the two points in time. Further research could productively examine the effect on intertemporal choice of other types of reference points, such as interpersonal com-

parisons and prior consumption. More generally, the influence of framing and context effects on intertemporal choice merits further attention.[7]

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Appendix 1

What follows is a series of numbered pairs. Each offers a choice between keeping the $7 in 4 weeks, or exchanging it for a different prize at a different point in time. For *every* pair, please circle the choice you prefer. When everyone has completed and handed in their form, one ball numbered 1 to 60 will be picked at random from a bingo cage. You will then get your choice on that item. For example, suppose on line 4 you circled $6.50 now rather than $7 in 4 weeks. If a bingo ball numbered 4 was subsequently picked you would get your choice: $6.50 now. You will notice that, instead of pairs of choices, some numbers are followed by "keep the $7 in 4 weeks." If one of these numbers is drawn then you will receive the $7 in 4 weeks as originally determined.

1. $7 in 4 weeks or $7.10 in 8 weeks
2. $7 in 4 weeks or $7.25 in 8 weeks
3. $7 in 4 weeks or $7.50 in 8 weeks
4. $7 in 4 weeks or $7.75 in 8 weeks
5. $7 in 4 weeks or $8.00 in 8 weeks
6. $7 in 4 weeks or $8.25 in 8 weeks
7. $7 in 4 weeks or $8.50 in 8 weeks
8. $7 in 4 weeks or $8.75 in 8 weeks
9. $7 in 4 weeks or $9.00 in 8 weeks
10. $7 in 4 weeks or $10.00 in 8 weeks
11. $7 in 4 weeks or $6.90 immediately
12. $7 in 4 weeks or $6.75 immediately
13. $7 in 4 weeks or $6.50 immediately
14. $7 in 4 weeks or $6.25 immediately
15. $7 in 4 weeks or $6.00 immediately
16. $7 in 4 weeks or $5.75 immediately
17. $7 in 4 weeks or $5.50 immediately
18. $7 in 4 weeks or $5.25 immediately
19. $7 in 4 weeks or $5.00 immediately
20. $7 in 4 weeks or $6.90 in 1 week
21. $7 in 4 weeks or $6.75 in 1 week
22. $7 in 4 weeks or $6.50 in 1 week
23. $7 in 4 weeks or $6.25 in 1 week
24. $7 in 4 weeks or $6.00 in 1 week
25. $7 in 4 weeks or $5.75 in 1 week
26. $7 in 4 weeks or $5.50 in 1 week
27. $7 in 4 weeks or $5.25 in 1 week
28. $7 in 4 weeks or $5.00 in 1 week

29–60. keep the $7 in 8 weeks

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