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# Trade-ins, Mental Accounting, and Product Replacement Decisions

ERICA MINA OKADA\*

When a consumer who already owns a durable-type product in a category faces the opportunity to upgrade to a new, higher-quality product, the replacement purchase decision is driven by both normative economic factors and psychological factors. As a normative decision maker, s/he considers the purchase price of the new alternative, but s/he additionally considers the mental cost of retiring the old product before s/he has gotten his/her money's worth out of it. During ownership of a product, a consumer mentally depreciates the initial purchase price, thus creating a "mental book value" for the product. The write-off of this mental book value is felt as the mental cost of a replacement purchase. Based on the principles of mental accounting and mental depreciation, I provide a theoretical explanation for this mental cost and why an individual's replacement purchase decision may be more sensitive to the mental cost than the marginal cost. When applied appropriately, mental accounting can serve a useful purpose to the utility-maximizing consumer in the long run, but when misapplied, it results in a misallocation of resources that does not add any value from the perspective of utility maximization. Through three experiments, I measure the negative effect of the write-off on a replacement purchase decision and demonstrate ways in which it can be mitigated. Trade-ins are examined as one way in which a consumer can be guided to make replacement purchase decisions that are more aligned with normative choice.

Adopting the framework of mental accounting and prospect theory, this article explains how both normative and psychological mechanisms drive replacement purchase decisions. Consumers making a replacement decision face essentially two types of costs: (1) the purchase price of the new model itself and (2) the mental cost of retiring the old model before they have gotten their full money's worth out of it. The first type of cost is studied extensively as a normative determinant in various disciplines, including economics, finance, and marketing. However, there has not been very much research on the mental cost. The purpose of this study is twofold. First, I study the mental cost of retiring the old product. Based on the principles of mental accounting (Thaler 1985) and mental depreciation (Heath and Fenema 1996), I provide a theoretical explanation as to why

a replacement purchase decision is more sensitive to the mental cost than the purchase price of the new model itself. Second, I demonstrate how pricing tools such as trade-ins, gift-giving opportunities, and rental rates can affect the consumer's mental accounting for this psychological cost.

## AN EXAMPLE OF THE TRADE-IN AT WORK

I started out with the intuition that consumers would be more responsive to a decrease in the mental cost than to an equivalent decrease in the purchase price of a new durable, and I conducted a preliminary study with undergraduates. Subjects were told that they owned a very basic camera that they purchased a few years ago. Now there is a new camera available that takes higher-quality photos, comes with advanced features, and also is smaller in size and lighter in weight. Half the subjects were presented with the new camera regularly priced at \$200 on sale for \$120. The other half was offered an \$80 trade-in for their old camera when they purchased the new \$200 camera. The cash values are equivalent, but normative theories of choice would predict that they would be at least as likely to purchase the new camera at a sale price as with a trade-in, as the end state of the trade-in offer is strictly dominated by the end state of the straight sale offer. They get to keep the old camera with the straight sale, but not with the trade-in. However, this ex-

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periment demonstrated that the likelihood of purchase overall was actually 12.5 percent higher when a trade-in was offered (56 percent) as compared to a straight sale (44 percent). Furthermore, when a trade-in was offered for the old camera, subjects who had bad experiences with their cameras were significantly more likely to upgrade (69 percent) than those who had good experiences (44 percent). This seems intuitive, as the ones who had bad experiences would have more to gain from the upgrade. However, when the higher-quality camera was priced as a straight sale without a trade-in, the ones who had good experiences, who seemingly had less to gain from the upgrade, were just as likely to upgrade (46 percent) as the ones who had bad experiences (41 percent). These results not only supported the original intuition but also suggested that (1) the mental cost may be driven by past usage experience and (2) trade-ins are more effective when individuals feel that they have not yet gotten their money's worth out of the old camera, and the mental cost is higher.

An alternative explanation for this observation is that trade-ins are in general preferred to cash equivalent price discounts. This is a simpler explanation that does not rely on the mental cost construct. However, people's general preference for trade-ins does not adequately explain the difference in the effectiveness of trade-ins across different usage experiences. One straightforward test to distinguish between the two explanations is to see what happens when there is no money involved in the acquisition of the previous camera, and the mental cost is presumably zero. I conducted a similar study with one exception: the subjects were told that they won the very basic camera a few years ago when they entered a free lottery. In this case, there was no difference between when a trade-in was offered (60 percent) and a straight sale (59 percent). The trade-in seems to work by mitigating the mental cost.

## THEORETICAL FOUNDATION

This study applies mental accounting and prospect theory to product replacement decisions. The concept of replacement is relevant to durable-type products that I refer to as "reusables." Reusables have the following characteristics: (1) the cost of purchase is incurred up front, but they are used over and over, and the benefits from consumption are spread out over future periods, and (2) the utility does not diminish significantly in successive usage occasions. I have considered a variety of reusables in my studies, such as cameras, bicycles, sports club memberships, time-shares at beach houses, laptop computers, and personal stereos. This study focuses on replacement purchases, where a consumer who owns a reusable that is still functional faces the opportunity to upgrade to a new higher-quality reusable.

My product replacement model has two unique aspects. First, replacement purchase decisions involve two criteria: one based on marginal cost-benefit analysis and another based on mental accounting. Each criterion is coded as a gain or loss according to a simplified value function (Kahneman and Tversky 1979), and the net gain associated with

a replacement purchase is the sum of the gain or loss of the two criteria. The second unique aspect is the concept of a product's mental book value. During ownership of a reusable, a consumer mentally depreciates the initial purchase price, thus creating a mental book value for the reusable. When the replacement purchase is made, the buyer incurs a mental cost equal to the write-off of this remaining book value. What I present, rather than a model of psychological process, is a paramorphic model that describes a consumer's replacement purchase decision.

## Marginal Criterion: Marginal Cost-Benefit Analysis of the New Reusable

When consumers who currently own an old reusable  $R_0$ , consider upgrading to a new reusable  $R_1$  (subscripts 0 and 1 refer to the old and new, respectively), one criterion that they use is the marginal cost-benefit analysis of the new reusable over a planning horizon  $H$ . If  $E_0$  and  $E_1$  are the expected total future enjoyment of the old and new reusables, respectively, over  $H$ , the consumer can expect an incremental benefit of  $(E_1 - E_0)$  by upgrading to the new reusable. The marginal cost is the purchase price of the new reusable, or  $P_1$ . The marginal decision criterion is therefore to replace if  $(E_1 - E_0 - P_1) > 0$ . A consumer's probability of purchasing a new reusable to replace the current reusable decreases with the expected total future enjoyment of the current reusable ( $E_0$ ) over the planning horizon. A consumer who expects his current reusable to be useful into the future expects to gain less from an upgrade than one who expects his current reusable to be of little use.

Future estimates generally are based on past experiences, so the expected total future enjoyment of the old reusable should be a function of the consumer's past usage experience with the old reusable. I operationalize usage experience on two dimensions: frequency and quality. Usage frequency refers to how many times an individual has consumed the old reusable over a given time period. Quality refers to how much enjoyment the individual has derived from the old reusable on each usage occasion. If past usage experience has been frequent and positive (infrequent and negative), a consumer will expect her future usage pattern to continue to be frequent and positive (infrequent and negative) over the planning horizon.<sup>1</sup>

This study assumes that an individual's usage experience affects the expected total future enjoyment of the old reusable only, and the expected total future enjoyment of the new reusable is assumed to be independent of past usage experience. The validity of this assumption is tested in the experiments as well.

<sup>1</sup>When there is significant wear and tear on a product with successive usage, this may not necessarily hold. For example, with candles or batteries, the expected total future enjoyment would actually be lower if past usage has been frequent. However, with reusables, future utility does not diminish significantly over a reasonable planning horizon.

### Mental Accounting Criterion: Write-off of the Mental Book Value of the Current Reusable

Once an individual has paid  $P_0$  for the old reusable, normative models suggest that the individual should use the old reusable as if it were free. After all,  $P_0$  is a sunk cost. However, individuals who practice mental accounting will not conform to the normative model. Money is fungible, but consumers do not always recognize this fungibility and, instead, engage in mental accounting. Consumers mentally track the costs and benefits of a transaction (Thaler 1980, 1985). When a consumer purchases the old reusable, he opens a mental account and posts the purchase price  $P_0$  as a negative entry in the account, but he feels no pain at the time of payment. A consumer psychologically links the costs and benefits of a transaction (Hirst, Joyce, and Scadewald 1994; Kahneman and Tversky 1984; Prelec and Loewenstein 1998). As the consumer uses the old reusable, the benefits from consumption are posted in the same account as positive entries, and the cumulative enjoyment in the account increases. The "mental book value," or  $BV$ , at a point in time refers to the positive difference between the initial purchase price and the cumulative enjoyment up to that point. When the cumulative enjoyment from consumption increases to a point where it equals the purchase price, the net entries in the account become zero. This is the breakeven, or the point at which the consumer feels that he has gotten his money's worth from the old reusable.

Purchasing the new reusable triggers the closing of the old reusable account, because the consumer presumably would no longer use the old one once she has the new one. If the replacement purchase is made at a time  $t$  before breakeven, the old reusable still has a positive mental book value  $BV_0(t)$ . When the account is closed the remaining mental book value must be written off, and she feels the pain associated with recognizing this loss. A consumer's probability of purchasing a new reusable to replace the current reusable decreases with the remaining mental book value of the current reusable.

The sunk cost effect (Arkes and Blumer 1985; Dick and Lord 1998; Garland 1990; Garland and Newport 1991; Heath 1995) is motivated by the idea that once a purchase has been made, the only way not to waste this money is to stick with the original plan and continue to use the purchased item. The sunk cost effect can be explained as a consumer's effort to avoid the write-off of the remaining mental book value by continuing to use the product, thereby keeping the account open. In this study, I start out with a simple case in which the old reusable cannot be sold or given away, so when a replacement purchase is made, the entire amount of the mental book value must be written off without any offsetting residual value. In a later study, I relax this condition and consider situations where there is residual value and the old reusable may be sold or given away as a gift.

The mental book value is the positive difference between the initial purchase price and cumulative enjoyment, which in turn is also a function of the consumer's past usage experience. The remaining mental book value of a previously

purchased reusable is expected to be lower for an individual with a frequent usage experience than for an individual with an infrequent usage experience. Remaining book value is also expected to be lower for an individual with a positive usage experience than for an individual with a negative usage experience.

This is an elaboration of the work by Heath and Fennema (1996) that showed that individuals mentally depreciated durables linearly over time. Gourville and Soman (1998) demonstrated that over time people adapted to payments that they previously made, as well. This study varies frequency and quality of usage experience across individuals over a given time interval. I posit that mental depreciation is not only a function of time but also the frequency and quality of past usage experience.

An individual's past usage experience exerts two opposing effects on each of the two criteria. A good (bad) usage experience results in low (high) mental book value, which decreases (increases) the mental cost, but at the same time it increases (decreases) the expected total future enjoyment of the old reusable, which decreases (increases) the marginal net benefit of the new reusable. The expected total future enjoyment and mental book value are two different valuations of the same old reusable, similar to the way in which firms have different valuations of its assets. A financial accountant's valuation of a firm's asset is its book value, or the acquisition price minus accumulated depreciation. This book value is a retrospective valuation that is analogous to a consumer's mental book value. However, a managerial accountant would value an asset based on the future cash flow that it is expected to generate. This is a prospective valuation analogous to a consumer's expected future enjoyment.

Mental accounting can serve a useful purpose to the utility-maximizing consumer. It is painful to write off the mental book value of a reusable that she never uses, but if the memory of this pain prevents her from making purchase mistakes in the future, mental accounting can serve as a control mechanism and encourage prospective thinking in the initial purchase decision stage. The misapplication of mental accounting occurs when pain avoidance becomes the primary motivation for the consumer's behavior. Analogously, a profit-maximizing firm calculates its assets' book value in order to get a better understanding of its business as a going concern. The misapplication of financial accounting occurs when avoidance of book losses drives investment decisions. Book losses often influence firms' investment decisions (Francis, Hanna, and Vincent 1996; Phillips 1995; Pourciau 1993), similar to the way in which the write-off of the remaining mental book value of an old reusable influences the replacement purchase decision of an individual consumer.

### Two Decision Criteria Coded Separately as Gains/Losses

According to existing theory, consumers keep track of benefits and costs for different product categories (Heath and Soll 1996; Henderson and Peterson 1992; Thaler 1985).

Returning to the camera example, purchasing a new camera is painful to the consumer if the current camera still has a positive mental book value. But if the marginal net benefit of the new camera is sufficiently high, the consumer should purchase the new camera anyway. Existing theory does not explain a consumer's preference for trade-ins over price discounts. If benefits and costs are aggregated at the product category level, the sums of the entries in the camera account are equal whether the new camera is sold on sale for \$120, or sold for \$200 with an \$80 trade-in for the old camera. However, in experiments that I conducted, people are more likely to purchase a replacement product when a trade-in is offered than when the replacement product is sold at a discount.

I propose, alternatively, that in the context of product replacement decisions, gains and losses are coded at the level of each decision criterion. That is, the marginal and mental accounting criteria are each coded separately, and the overall net gain from the replacement purchase is the sum of the utilities of these two criteria. If the marginal benefit of the new reusable exceeds its marginal cost, the utility function  $u()$  operates on the marginal decision criterion. If the old reusable is replaced before breakeven, the write-off of the mental book value is a negative entry, and the disutility function  $w()$  operates on the mental accounting criterion. Individuals are loss averse (Kahneman, Knetsch, and Tversky 1990; Tversky and Kahneman 1991) and try to minimize losses in each of the accounts, before maximizing gains. Loss aversion is one factor that makes  $w()$  strictly steeper than  $u()$ . I distinguish between the two functions for expositional clarity and also because my argument involves not only the standard form of loss aversion but also waste aversion. People often forgo economically attractive choices in order to avoid waste (Arkes 1996). Waste aversion adds another psychological dimension to loss aversion.

The consumer's probability of product replacement should increase with the sum of the gain/loss of the two criteria:

$$u(E_1 - E_0 - P_1) - w[BV_0(t)] \tag{1}$$

Marginal
Mental Accounting

where  $E_0$  = expected total future enjoyment of the old reusable over planning horizon  $H$ ,  $E_1$  = expected total future enjoyment of the new reusable over planning horizon  $H$ ,  $P_1$  = purchase price of the new reusable, and  $BV_0(t)$  = remaining mental book value of the old reusable at time  $t$ .

The focus of this study is to get some insight into what goes on inside the parentheses. Linear utility and disutility

functions are assumed for simplicity.<sup>2</sup> This model can explain the consumer's preference for trade-ins as a reallocation of entries between the marginal and mental accounting decision criteria.

### The Trade-In

Because of loss and waste aversion, reducing the write-off of the mental book value has a greater impact than increasing the incremental gain of the new reusable by reducing the purchase price by the same amount. Take two cash equivalent offers, Sale and Trade. In Sale, the price of the new reusable is simply discounted from  $P$  to  $P - TI$ . In Trade, a trade-in of  $TI$  is given in exchange for the customer's old reusable, and the new reusable is sold at the higher regular price  $P$ . The end-state of Trade can be no more preferable to Sale, as the consumer gets to keep the old reusable in Sale, whereas in Trade he must surrender the old reusable in exchange for  $TI$ . However, the product replacement model in Equation 1 predicts that consumers would prefer Trade to Sale. The net gain from replacement purchase is:

$$u(E_1 - E_0 - P_{\text{Sale}}) - w[BV_0(t)] \quad \text{with Sale pricing} \tag{2}$$

Marginal
Mental Accounting

and

$$u[E_1 - E_0 - (P_{\text{Sale}} + TI)] - w[BV_0(t) - TI] \tag{3}$$

Marginal
Mental Accounting

with Trade pricing.

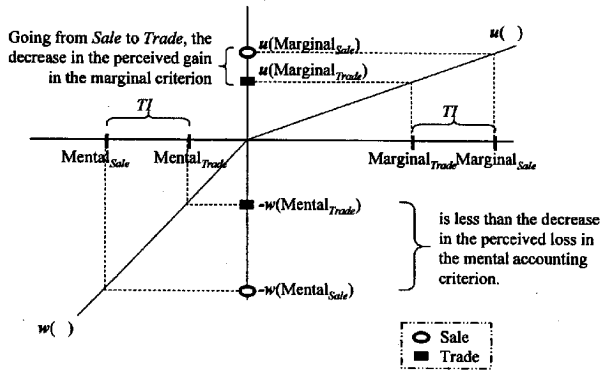
In comparing Equation 2 to Equation 3, the entries in the two criteria are equal in Sale and Trade, because they are equivalent in cash value. However, the parentheses grouping the entries differentiate Sale from Trade. Due to loss and waste aversion,  $w()$  is steeper than  $u()$ . Therefore Equation 3  $\geq$  Equation 2. A trade-in increases the net gain associated with a replacement purchase transaction when  $TI$  is taken from the steeper  $w()$  function and moved over to the milder  $u()$  function. This is shown schematically in Figure 1.

When the remaining mental book value is large and  $BV_0(t) > TI$ , a trade-in is most effective because the entire amount of  $TI$  is reallocated from a  $u()$  function to a  $w()$  function. As the mental book value decreases to  $BV_0(t) < TI$ , only a fraction of  $TI$  is reallocated from  $u()$  to  $w()$ , and the remaining fraction of  $TI$  becomes a transfer just between two  $u()$  functions. Therefore, a given trade-in is expected to become less effective in increasing sales as the mental

<sup>2</sup>After reference point dependence and loss aversion, a third characteristic of the value function (Kahneman and Tversky 1979) is decreasing marginal sensitivity to gains and losses. If both the mental book value of  $R_0$  and the marginal net gain of  $R_1$  are within a comparable range in dollar value, the assumption of linear utility and disutility functions should not be limiting. In fact, the insight gained is more generalizable if the effectiveness of trade-ins does not have to depend on the precise location of the two criteria on the concave  $u()$  or convex  $w()$  functions.

FIGURE 1

WHEN BOOK VALUE IS LARGE, TRADE-INS INCREASE THE NET GAIN ASSOCIATED WITH A REPLACEMENT PURCHASE TRANSACTION



book value decreases to  $BV_0(t) < TI$ . If a consumer has already broken even on the old reusable, the mental accounting criterion is no longer negative, and a trade-in becomes a reallocation entirely between two  $u(\cdot)$  functions and loses its effectiveness.

### EXPERIMENT 1

Experiment 1 was conducted to determine how normative and psychological mechanisms drive the replacement purchase. It also measured how effective trade-ins are in mitigating the mental costs associated with a replacement purchase.

#### Method

One hundred and ninety-two undergraduate and MBA students participated in the experiment. The subjects completed a questionnaire that presented two scenarios in which they had previously purchased a reusable, and while the reusable is still functional, an opportunity arises to upgrade to a more attractive reusable.

#### Design and Procedure

Two product classes were used in the experiments: a time-share at a beach house and a sports club membership. They both fall under the category of reusables, and there is little value in the old reusable once a newer, more attractive reusable is purchased. Also, they are product classes in which the subjects are interested and with which they are familiar. There were two levels of pricing, trade-in and sale. In the trade-in condition the new sports club membership was offered for \$200 with a \$100 trade-in for the old sports club membership, and in the sale condition the new sports club membership was discounted to \$100 from the original price

of \$200. In the trade-in condition the new time-share was offered for \$250 with a \$100 trade-in for the old time-share, and in the sale condition the new time-share was discounted to \$150 from the original \$250. Because the sports club membership and time-share were both nontransferable, and nonrefundable, the two pricing plans had equivalent cash values to the subjects. The experiment implemented a design according to Winer, plan 5 (1971). The design was a Latin square crossing two levels of product with two levels of pricing. Three between-subject manipulations, each of two levels (frequency of usage experience, quality of usage experience, and order), were crossed with the Latin square, for eight between-subject conditions. The subjects were randomly assigned either to group 1 or group 2 according to a Latin square design as shown. The design also controlled for order. Half of each of group 1 and group 2 saw the sports club membership scenario first: they were order 1. The other half of each of group 1 and group 2 saw the time-share scenario first and were order 2.

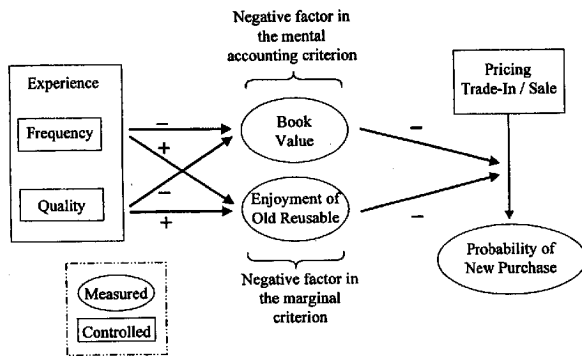
Product	Time Sports	Pricing	
		Trade-In	Sale
Group 1	Group 1		
	Group 2		
Group 2	Group 1		
	Group 2		

Each of the 192 subjects was randomly assigned to one of four usage experience conditions. Usage experience varied in terms of frequency and quality. Frequency refers to how frequent past usage has been, and there were two levels: frequent and infrequent. In the frequent (infrequent) condition, subjects were told they have been going to the sports club/time-share frequently (only rarely). Quality refers to how enjoyable past consumption has been, and there were also two levels: positive and negative. Subjects in the positive (negative) condition were told they have (not) had a very enjoyable experience the times that they have been there. There were a total of  $2 \times 2 = 4$  usage experience conditions, and there were 48 subjects in each of the positive frequent, positive infrequent, negative frequent, and negative infrequent conditions.

#### Measures

The subjects answered four questions about each of the two scenarios. They were asked how likely it was that they would purchase the new, more attractive time-share/sports club membership. This measure, probability of replacement purchase, was on a scale from 0 percent to 100 percent. They were also asked how much of their money's worth they felt they had gotten from the time-share/sports club membership that they currently own. This measures mental book value, or  $BV_0(t)$  in Equation 1. Mental book value was on a scale of 1 to 7, with 1 being "I have gotten a lot of my money's worth," and 7 being "I have not gotten my money's worth at all." High book value indicates that subjects feel there remains more value to be gained from the reusable. Low book value indicates that subjects feel they

**FIGURE 2**  
 PREDICTED MENTAL ACCOUNTING PROCESS AND ITS EFFECT ON PROBABILITY OF REPLACEMENT PURCHASE



have gotten sufficient value out of the reusable. The third question asked how much enjoyment they can expect to get from the continued usage of the current time-share/sports club membership. This measures expected total future enjoyment of the old reusable, or  $E_0$  in Equation 1. Enjoyment of the old reusable was also on a scale of 1 to 7, where 1 was "I will not get much enjoyment at all," and 7 was "I will continue to get a lot of enjoyment." Since enjoyment of the old reusable is the basis for comparison in estimating the incremental benefit of the new reusable, model 1 suggests that high enjoyment of the old reusable decreases the entries in the marginal criterion. The subjects were additionally asked how much enjoyment they expect to get from the new reusable. This measure was expected new enjoyment, also on a scale of 1 to 7, and estimated  $E_1$  in Equation 1. The purpose was to check the validity of the assumption that the expected total future enjoyment of the new reusable is independent of usage experience and that the effect of usage experience on the new reusable account is through the enjoyment of the old reusable only. Subjects first answered the likelihood of purchase questions for each scenario. Afterward, they answered the remaining three questions for each scenario.

**Predictions**

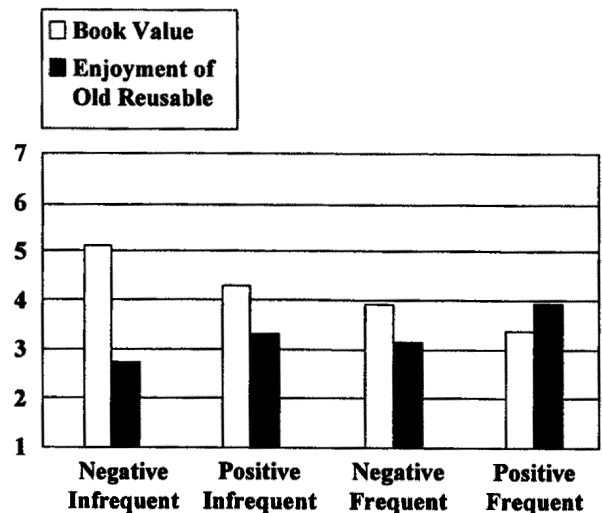
Experiment 1 was conducted to track the process as shown in Figure 2. Replacement purchase probability is predicted to decrease with enjoyment of the old reusable and decrease with book value. Also replacement purchase probability is predicted to be higher with a trade-in than with a straight sale of the same cash value. The difference between replacement purchase probabilities under the trade-in and sale conditions should decrease with book value. Enjoyment of the old reusable should be highest when usage experience has been positive and frequent, and lowest when usage experience has been negative and infrequent. A subject who

has had a bad usage experience would have lower expectations of the continued usage of the item than one who has had a good usage experience. Book value is predicted to be highest in the negative infrequent condition and lowest in the positive frequent condition. A subject who has had a bad usage experience should feel that he has not gotten as much of his money's worth out of his current reusable as one who has had a good usage experience. Trade-ins should be most effective in the negative infrequent condition and least effective in the positive frequent condition.

**Results**

*The Effect of Usage Experience on Book Value and Enjoyment of the Old Reusable.* Figure 3 shows how an individual's usage experience has two opposing effects on book value and enjoyment of the old reusable. An ANOVA of book value using the four between factors and two within factors and their relevant interactions as independent variables ( $F = 2.57, R^2 = .74$ ) demonstrated that subjects feel that they have gotten more of their money's worth out of their old reusable if they have used it more frequently ( $F = 47.78, p < .0001$ ), and if past experience has been enjoyable ( $F = 15.93, p < .0001$ ). As predicted and shown in Figure 3, book value was highest for the negative infrequent group at 5.0 (on a scale from 1 to 7), and lowest for the positive frequent group at 3.4. The interaction between frequency and quality of usage experience was not significant. Also, the sports club membership had a higher book value than the time-share ( $F = 4.95, p = .03$ ). None of the

**FIGURE 3**  
 BOOK VALUE DECREASES WITH FREQUENCY AND QUALITY, WHILE ENJOYMENT OF OLD REUSABLE INCREASES WITH FREQUENCY AND QUALITY



interactions was significant. Group and order were not significant, which demonstrated that the assignment of the subjects to each of the two groups was random and that there were no systematic differences in the subjects' responses to questions that were asked first versus second. These factors, group and order, are not discussed further.

An ANOVA of enjoyment of the old reusable using the same set of explanatory variables ( $F = 3.11, R^2 = .77$ ) showed that subjects expect more total future value out of the old reusable if they have used it more frequently ( $F = 6.49, p = .03$ ) and have had a positive experience ( $F = 42.09, p < .0001$ ). As predicted and also shown in Figure 3, enjoyment of the old reusable was lowest for the negative infrequent group at 2.6 and highest for the positive frequent group at 4.0. Enjoyment of the old reusable was higher for the sports club membership than for the time-share ( $F = 10.55, p = .001$ ).

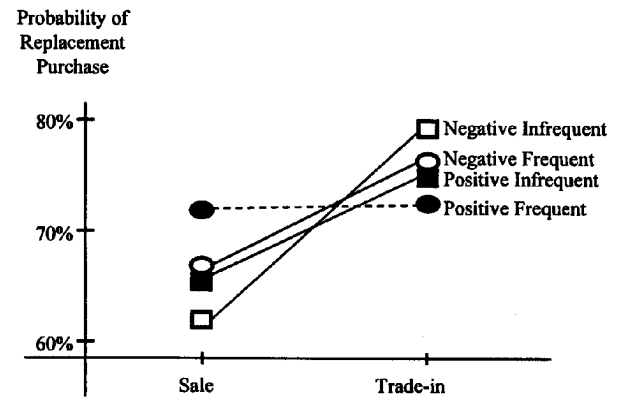
There was no difference in expected future enjoyment of the new reusable among the four usage experience conditions. This lends support to the assumption that for these scenarios enjoyment of new reusable is independent of usage experience ( $p > .33$  for frequency and  $p > .18$  for quality). Usage experience affects the marginal criterion only through enjoyment of the old reusable.

*Trade-in Moderates Replacement Purchase Probability.* Figure 4 graphically represents how trade-ins moderate the effect of book value on the probability of replacement purchase. The data were examined by an ANOVA of replacement purchase probability using the same set of independent variables as before ( $F = 2.48, R^2 = .73$ ). Overall, people were more likely to make a replacement purchase with a trade-in (76 percent) than without (66 percent;  $F = 26.45, p < .0001$ ), but as predicted, trade-ins are most effective in increasing sales when past usage experience has been negative and infrequent, and least effective when usage experience has been positive frequent. The solid lines for the negative infrequent, negative frequent, and positive infrequent groups represent statistically significant increases in the probability of replacement purchase when a trade-in is offered under those conditions, and the dotted line in the positive frequent group represents a statistically insignificant difference. As predicted, when the usage experience is negative and infrequent, book value is high and trade-ins effectively moderate the effect of book value, thereby increasing the probability from 62 percent to 79 percent. However, when the usage experience is positive and frequent, book value is low and trade-ins have no moderating effect and, hence, no effect at all on replacement probability (72 percent with a straight sale and 73 percent with a trade-in). The fan effect in Figure 4 indicates that trade-ins are most effective in increasing replacement purchase probability when past usage experience has been infrequent ( $F = 5.49, p = .020$ ) and negative ( $F = 5.76, p < .017$ ).

Book value and enjoyment of the old reusable were added as covariates to the ANOVA of probability of replacement purchase. Enjoyment of the new reusable was also included as a covariate to validate the intuitive assumption built into

FIGURE 4

TRADE-INS ARE MOST EFFECTIVE FOR CONSUMERS WHO HAVE HAD A NEGATIVE AND INFREQUENT USAGE EXPERIENCE



Equation 1, that the probability of replacement purchase should increase with the expected enjoyment of the new reusable. The results again support the prediction that trade-ins are most effective in increasing purchase probability when people feel that they have not gotten their money's worth from the current item. The  $F$ -value increased from 2.48 to 9.93 ( $R^2 = .92$ ), and all covariates had significant main effects. The effect of enjoyment of the new reusable on purchase probability supports the assumption made in Equation 1. The interaction between book value and trade-in ( $F = 29.44, p < .0001$ ) was also significant, which indicates that trade-ins moderate the effect of book value on replacement purchase.

Next the data were split into two subsets: one for the sale condition and another for the trade-in condition. The trade-in data and sale data each had 192 observations and were analyzed separately. An ANOVA of probability of replacement purchase showed that in both cases, probability of replacement purchase decreased with book value, but the negative impact of book value on replacement purchase probability was stronger in the sale condition ( $F = 233.01, p < .0001$ ) than in the trade-in condition ( $F = 118.51, p < .0001$ ). Book value is relatively more important in the absence of trade-ins than when trade-ins are offered. This once again suggests that trade-ins mitigate the effect of book value on probability of replacement purchase. Replacement purchase probability also decreased with enjoyment of the old reusable in both the trade-in ( $F = 234.72, p < .0001$ ) and sale conditions ( $F = 143.63, p < .0001$ ).

Discussion

Experiment 1 showed that mental book value decreases with frequency and quality of past usage experience, and has a negative impact on the mental accounting criterion.



It also showed that after a consumer has done the mental depreciation of the old reusable to arrive at its mental book value, pricing tools, such as trade-ins, can mitigate the write-off of the mental book value and help the consumer make a replacement purchase decision that is closer to the normative model.

Alternative explanations for the effectiveness of trade-ins do exist but do not fully capture the entire phenomenon. The replacement purchase model that was supported in experiment 1 was based on loss aversion, but a trade-in can alternatively be explained on the basis of the nonlinearity of the value function. Trade-ins may be perceived as a single gain, whereas a price discount may be perceived as a reduction in a greater loss, and a small gain has a larger marginal impact than a reduction of a greater loss. An explanation based on the concavity/convexity of the gain/loss function rather than loss aversion would predict that consumers would always prefer trade-ins over straight price discounts, regardless of their past usage experience. Though this is a viable explanation, it would not sufficiently explain the experimental data: specifically why trade-ins are differentially more effective when past usage experience is bad (and book value is high) than when past usage experience is good (and book value is low). Furthermore, this alternative explanation implies that the payment of purchase price is encoded as a stand alone loss, as opposed to being netted out against the greater gain of the expected utility of the purchased good, which is contrary to the conventional assumption in mental accounting (Kahneman and Tversky 1979, 1984; Thaler 1980, 1985).

There are alternative explanations based on economic factors as well, such as a reduction in disposal costs. If this were the only reason for the effectiveness of trade-ins, it would be an obvious, and not very interesting, reason for why consumers prefer trade-ins. The experiments controlled for this by using products that had no disposal costs. Unused portions of sports club memberships take up no physical space (unlike refrigerators) and incur no holding/insurance costs (unlike automobiles). Any disposal cost associated with the purchase of a replacement should only increase the consumer's preference for trade-ins.

## EXPERIMENT 2

Experiment 2 was conducted in order to (1) replicate the findings of experiment 1 and (2) test the robustness of the trade-in effect by relaxing some of the more stringent conditions of experiment 1. Experiment 2 explores the residual value of the old reusable as a factor that influences the value of trade-ins. Experiment 1 studied the case where the purchase of the new reusable made the old reusable completely useless to the consumer. However, in most upgrade situations, the old item retains some value to the consumer. Even if the consumer recognizes that the old reusable becomes useless to her after purchasing the new one, she may also recognize the value in either giving the old reusable away as a gift or selling it in exchange for cash and realizing some residual value  $RV_0(t)$ . If the residual value is positive

when the replacement purchase is made and the consumer has not yet gotten her money's worth from the old reusable, the entries in the mental accounting criterion are the write-off of the mental book value and the realization of the residual value to offset the write-off, for a total of  $BV_0(t) - RV_0(t)$ . Residual value is analogous to the salvage value in financial accounting that also offsets the write-off of the remaining book value of a retired asset. The replacement model in Equation 1 becomes

$$u(E_1 - E_0 - P_1) - w[BV_0(t) - RV_0(t)]$$

when  $RV_0(t) > 0$ . (4)

The probability of replacement purchase therefore increases with residual value. When a consumer expects a higher residual value, the pain associated with closing the old reusable account is attenuated, and he would be more likely to make an upgrade purchase. It makes sense that there would be less mental cost associated with making an upgrade purchase if the consumer believes he can give the old reusable away to someone else who will enjoy using it.

The preceding section of this study demonstrated how trade-ins can increase the probability of upgrade purchase when residual value is negligible, but when residual value is significant, the net gain from the replacement purchase transaction in Sale and Trade-in becomes, respectively,

$$u(E_1 - E_0 - P_{\text{Sale}}) - w[BV_0(t) - RV_0(t)]$$

Sale pricing when  $RV_0(t) > 0$ . (5)

$$u[E_1 - E_0 - (P_{\text{Sale}} + TI)] - w[BV_0(t) - TI]$$

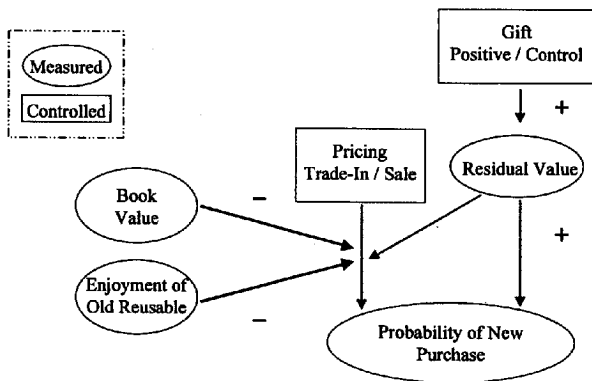
Trade pricing when  $RV_0(t) > 0$ . (6)

When residual value is zero or negligible, a trade-in is a direct transfer of  $TI$  from  $w()$  to  $u()$ . However, when residual value is positive, a trade-in decreases the absolute mental cost by attenuating the write-off of the mental book value by  $TI$  but also increases the absolute mental cost by requiring the consumer to forfeit the residual value. The net effect on the mental accounting criterion could be positive or negative. The higher purchase price with the trade-in offer has a definite negative effect of  $TI$  on the marginal net benefit of the new reusable. The net result may be an increase or a decrease in the likelihood of upgrade, depending on the size of the residual value relative to the trade-in.

A preliminary study suggests that in cases where residual value is positive and large, a trade-in may be less effective in increasing sales and, furthermore, may even reduce probability of replacement purchase. Subjects were asked how likely it was that they purchase a new bicycle of a significantly higher quality than the one that they currently owned. The new bicycle was offered to half of the subjects for (a) a sale price of \$200 instead of the regular price of \$300, and to the other half it was offered for (b) the regular price

FIGURE 5

PREDICTED EFFECTS OF GIFT OPPORTUNITY AND TRADE-IN ON PROBABILITY OF REPLACEMENT PURCHASE



of \$300 with a \$100 trade-in for the old bicycle. Again, these two pricing plans are equivalent in cash value. This time, the average probability of upgrade was significantly lower in *b* with a trade-in (46 percent) than in *a* with a straight sale (64 percent), which suggests that the effectiveness of trade-ins has its limits. A trade-in is effective when the value of the old item becomes negligible to the consumer with the purchase of the new item, but a used bicycle is reasonably and commonly sold or given as a gift.

In experiment 2, I use the concept of residual value to test the robustness of the trade-in effect. Trade-ins are effective, but when residual value is high, trade-ins should be much less likely to work.

Method, Design, and Procedure

Ninety-six undergraduate students participated in the experiment. It was conducted in the form of a questionnaire, in a similar design as before, with the following exceptions. I used two different product stimuli: a laptop computer and a Walkman-type personal stereo. These are both reusables that become useless to the subject after a replacement purchase is made, but they retain reasonable residual values as gifts.

The residual value of the old product was directly manipulated under two conditions of gift opportunity: the control and positive conditions. Half of the subjects were randomly assigned to the positive gift opportunity condition, and they were told that their grandparents/best friend had been looking for a laptop/personal stereo with simple features and would appreciate and get a lot of usage out of their old laptop/personal stereo. The other half in the control condition were not told anything explicitly about existing opportunities to give away the old laptop/personal stereo as a gift. Usage experience, which was manipulated across subjects in experiment 1, was held constant in experiment 2. The Latin square crossed product with pricing, within

each of the two conditions of gift opportunity. Experiment 2 tracked the process as shown in Figure 5.

Measures

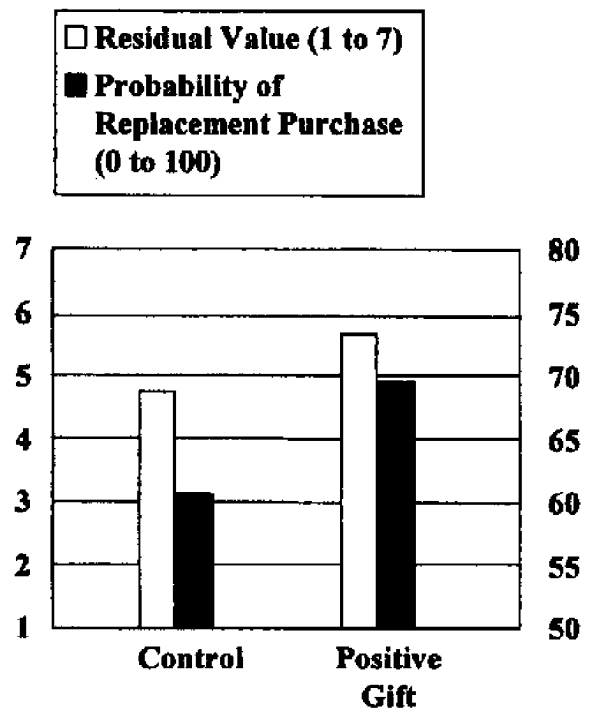
The first four measures were the same as in experiment 1 (probability of replacement purchase, book value, expected  $R_0$  enjoyment, and expected new enjoyment), and used the same scale. In addition, as a means of measuring residual value, subjects were asked how much enjoyment they expected to get out of giving away the old reusable as a gift. Residual value was on a scale from 1 to 7, with 1 being "I get no value at all out of giving away a gift like a used laptop/personal stereo," and 7 being "I get a lot of value out of giving away a gift like a used laptop/personal stereo." The two levels of gift opportunity were intended to directly manipulate residual value.

Results

*Manipulation Check.* As shown in Figure 6, residual value was higher in the positive gift opportunity condition than in the control ( $F = 17.63, p < .0001$ ), and the manip-

FIGURE 6

RESIDUAL VALUE AND PROBABILITY OF REPLACEMENT PURCHASE ARE BOTH HIGHER WHEN THERE IS AN EXPLICIT OPPORTUNITY TO GIVE AWAY THE OLD LAPTOP/PERSONAL STEREO AS A GIFT



ulation of residual value by gift opportunity was effective. The subjects who were told that their grandparents/best friend would be interested in their old laptop/personal stereo indicated that they would get more value out of giving away their old laptop/personal stereo as a gift (4.7 on a scale from 1 to 7), than those who were not told anything to that effect (3.8).

*The Impact of Gift on Probability and the Effectiveness of Trade-Ins.* As predicted, subjects were more likely to upgrade to a new laptop/personal stereo when they were told that their grandparents/best friend would be interested in their old laptop/personal computer (69 percent) than when there were not told anything to that effect (61 percent;  $F = 4.57, p < .04$ ). This is also shown in Figure 6. As shown in Figure 7, trade-ins are effective in the control condition, but countereffective in the positive gift opportunity condition ( $F = 11.93, p < .0008$ ). Trade-ins increased the replacement purchase probability from 55 percent to 66 percent for subjects who were not told anything explicitly about opportunities to give the old laptop/personal stereo away as a gift ( $F = 7.83, p < .0081$ ). In contrast, for subjects who were told explicitly about opportunities to give the old laptop/personal stereo away as a gift, the trade-in was actually detrimental. Replacement purchase probability decreased from 74 percent with a straight sale to 65 percent with a trade-in ( $F = 9.14, p < .0045$ ). As before, the solid lines in the graph represent significant differences. Telling people explicitly about gift opportunities moderates the effect of trade-ins on replacement purchase probability. Gift opportunity moderates the effect of trade-ins on probability of replacement purchase.

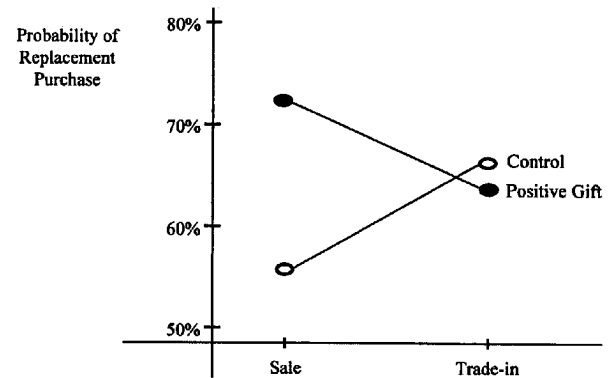
## Discussion

Experiment 2 demonstrated that an individual can get some value out of the old reusable if she can give it away as a gift to someone who will appreciate it. Giving away the old reusable as a gift is essentially one last usage that the consumer can get out of it before closing out the mental account. This residual value offsets the write-off of the remaining mental book value of the old reusable and, therefore, attenuates the mental cost of the upgrade purchase.

Writing off the remaining book value of an existing reusable can make a replacement purchase prohibitively costly, but a firm can in part mitigate the cost of the write-off by putting a high residual value on the old reusable. One way in which a firm can raise the residual value of the old reusable is by creating an opportunity for the consumer to give the old reusable away as a gift to someone who would appreciate and use it. Some firms advertise that they give a small percentage of their earnings to charity. Though the goal of social action is also served, the primary goal for most large U.S., Japanese, and Western European firms is profit maximization (Farmer and Hogue 1985). In the same spirit, firms can offer to take back old reusables from consumers who purchase upgrades, and they can give the old reusables to charity. There is actually an electronics store

FIGURE 7

TRADE-INS ARE EFFECTIVE, BUT MAY BE DETRIMENTAL IF THERE IS AN EXPLICIT GIFT OPPORTUNITY



near where I live that donates to charity old electronic equipment that its customers no longer use. Finding uses for an old reusable and giving them to charity may be an even more effective marketing plan than giving cash to charity. The former would directly offset the negative mental accounting criterion of a replacement purchase, whereas the latter would increase the marginal criterion.

Residual value would be even higher if there was accountability; that is, if the consumer knew who would receive the gift and that the gift would be appreciated. A more effective way of raising residual value may be for a firm to identify not just an organization but specific individuals to whom old reusables can be donated as gifts. Relief organizations often use this tactic. Rather than asking for a donation to be a small part of a big effort to help all poor children in the third world, they ask people to sponsor one individual child with a personal profile. A firm may keep a list of individuals who are in need of old reusables, which would allow the upgrading consumer to personalize the recipient of his gift.

## EXPERIMENT 3

The first two experiments examined how consumers arrive at a mental book value, how this book value becomes a significant determinant of replacement purchase probability, and how the impact of mental book value can be moderated. The next step of the research explores ways in which the calculation of the mental book value can be manipulated directly.

Individuals mentally depreciate their current reusable by the cumulative benefit they have gotten from the reusable up to the present. There may be guidelines other than an individual's actual usage experience that are used for mental depreciation. It is easy to keep track of how frequently a reusable has been consumed, but the quality of experience

is more subjective and less easily quantifiable. Therefore, an externally provided benchmark, such as a price for a single usage occasion, may serve as a guideline for estimating past enjoyment level and may facilitate the consumer's calculation of mental book value. Individuals often infer quality from price when the quality is unknown or ambiguous (Jones and Hudson 1996). Similarly, individuals may use the price of a comparable product to infer the enjoyment level that they experienced in the past. Also, an individual's recollection of experiences from the past may be influenced by stimuli that are present at the time of recall. Therefore, an individual who is presented with a high external reference price may recall a higher quality of usage experience. Therefore, the remaining mental book value of a previously purchased reusable is expected to be lower for an individual who observes a high one-time usage fee for a comparable reusable than for an individual who observes a low one-time usage fee for a comparable reusable. For example, a consumer who has bought a pair of skis may mentally depreciate the skis using the cost of daily ski rentals as a guideline. If the daily rental rate is high, the consumer may feel that he has gotten more value out of his purchased skis. A high external reference price should accelerate mental depreciation, which decreases the mental book value. Experiment 3 studies the effect of external reference on the mental book value of a product and the consumer's replacement probability.

Method

Experiment 3 was conducted, maintaining the general questionnaire format of experiment 1. One hundred ninety-two undergraduate and MBA students at the University of Pennsylvania participated in the experiment. The subjects were presented two scenarios about two different situations where they had purchased a reusable in the past, and while the reusable is still functional, an opportunity arises to upgrade to a more attractive reusable.

Design and Procedure

A design similar to that of experiment 1 was maintained with the following exception. The experimental design was a Latin square that crossed product with external reference within each of the four experience conditions. The same two product classes were used as in experiment 1 (a time-share at a beach house and a sports club membership), but the other within-subject factor (pricing that had two levels, trade-in and sale) in experiment 1 was replaced by a within-subject factor, external reference, in experiment 3. Reference is the manipulation of the one-time rental fee of a product that is comparable to the one that the subject has purchased in the past. There were two levels of reference: high and low. In the high external reference condition, subjects were presented with an \$80 one-time usage fee for a comparable time-share and a \$25 one-time usage fee for a comparable sports club. In the low external reference condition, the one-time usage fee was half the amount of the high reference

condition, \$30 for a comparable time-share, and \$10 for a comparable sports club.

Measures

The subjects were asked the same set of four questions about each of the same two products as in experiment 1. The measures—probability of replacement purchase, book value, expected enjoyment of the old reusable, and expected new enjoyment—were on the same scale as in the first experiment.

Predictions

Experiment 3 was conducted to track the process as shown in Figure 8. The prediction is that high external reference will accelerate mental depreciation. Therefore, book value is expected to be lower when the one-time rental fee is high than when the one-time rental fee is low. As before, low book value is expected to increase probability of replacement purchase.

Results

*The Effect of Reference on Book Value.* An ANOVA of book value showed that people who are shown a high one-time rental fee of a comparable reusable feel that they have gotten more of their money's worth out of their own reusable (and therefore a lower mental book value of 3.8 on a scale of 1 to 7) than those who are shown a low one-time rental fee (4.3;  $F = 17.96, p < .0001$ ). As predicted and shown in Figure 9, one-time usage fees are more effective in accelerating mental depreciation when the quality of the usage experience has been negative ( $F = 7.74, p = .006$ ) than positive. When usage experience was negative, high rental fees effectively decreased the mental book value from 4.7 (5.3 when usage experience is negative and infrequent, and 4.0 when it is negative and frequent) to 3.8 (4.3 when usage experience is negative and infrequent, and 3.4 when it is negative and frequent). These are significant

FIGURE 8

PREDICTED EFFECT OF EXTERNAL REFERENCE ON THE MENTAL ACCOUNTING PROCESS AND THE PROBABILITY OF REPLACEMENT PURCHASE

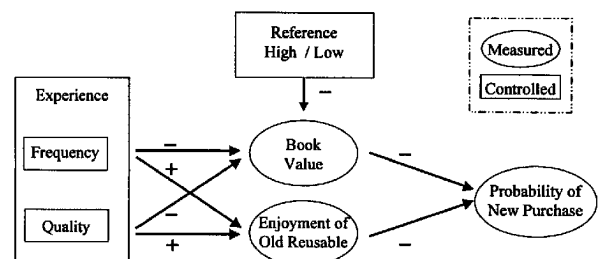
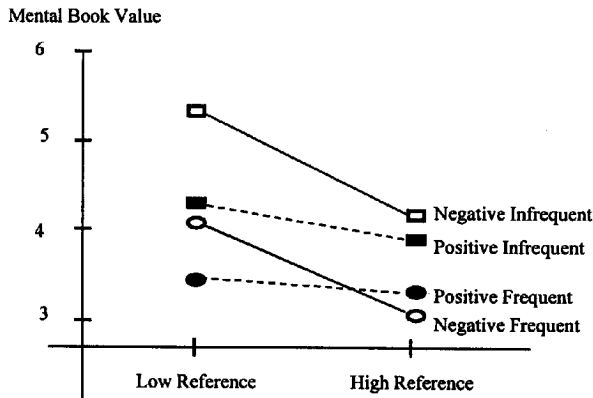


FIGURE 9

HIGH EXTERNAL REFERENCE LOWERS THE MENTAL BOOK VALUE FOR CONSUMERS WHO HAVE HAD A NEGATIVE USAGE EXPERIENCE



differences, as indicated by the solid lines in Figure 9. However, when usage experience was positive, book value decreased only marginally from 3.9 (4.3 when usage experience is positive and infrequent, and 3.5 when it is positive and infrequent) to 3.7 (4.0 when usage experience is positive and infrequent, and 3.4 when it is positive and frequent). These are not significant changes, as shown by the dotted lines in Figure 9. Frequency of usage experience, however, did not influence the effect of reference on book value. This is generally consistent with the prediction that subjects mentally depreciate the old reusable according to the cumulative benefit that they feel they have derived from it to arrive at the book value. The cumulative benefit is approximately the product of the quality and frequency of usage experience. The quality of usage experience may be difficult to quantify, and a one-time usage fee may be used as a guideline for how much enjoyment subjects get on each usage occasion. However, the frequency of usage experience is a more objective measure that would not be affected by external reference.

Book value decreased with quality ( $F = 7.74$ ,  $p = .0060$ ) and frequency ( $F = 29.17$ ,  $p < .0001$ ) of usage experience. This replicates the earlier findings of experiment 1. Again, book value was higher for sports club memberships than for time-shares ( $F = 10.87$ ,  $p = .0012$ ), which also replicates the findings of the first experiment.

*The Effect of Reference on Probability.* On average, people were more likely to purchase the upgrade when they were shown a high one-time rental fee for a comparable reusable ( $F = 15.51$ ,  $p < .0001$ ). One-time rental rates have a greater impact on replacement purchase probability when the quality of usage experience is negative than when it is positive ( $F = 6.77$ ,  $p = .0100$ ). As shown in Figure 10, high reference prices effectively increased replacement pur-

chase probability when usage experience was negative and infrequent and when it was negative and frequent. In the positive infrequent usage experience condition, the high reference price was effective only at the  $\alpha < .10$  level, as shown by the dashed line. In the positive frequent usage experience condition, external reference had no effect, as shown by the dotted line.

*The Effect of Reference on Probability through Its Mediator Book Value.* Book value was added as a covariate to the ANOVA above. As done before, two covariates were used: average book value, to account for differences across subjects, and book value. The  $F$ -value of this ANCOVA increased to 5.00 from 1.91 ( $R^2 = .85$  from .67). Both average book value ( $F = 165.86$ ,  $p < .0001$ ) and book value ( $F = 233.05$ ,  $p < .0001$ ) were significant. With the inclusion of the covariates, reference lost its significance. This establishes that the effect of reference on probability is mediated through book value. High reference lowers book value, which in turn increases probability of replacement purchase.

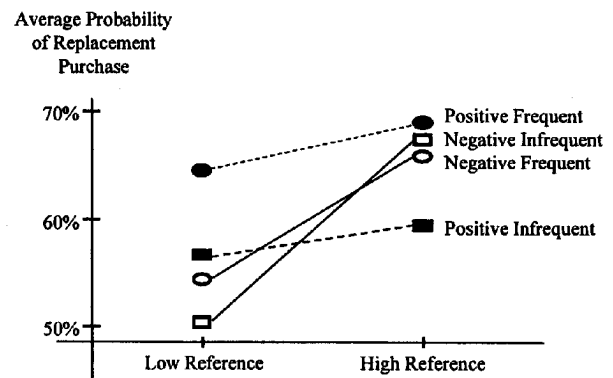
## Discussion

Experiment 3 demonstrated how mental depreciation is not only a function of a consumer's own usage experience but can also be accelerated by external factors, such as a one-time usage fee of a comparable reusable that is determined externally.

The findings of the study suggest that a firm can accelerate the mental depreciation of a consumer's current reusable by introducing a high one-time usage fee for a comparable product. Replacement purchase should increase as the mental cost associated with the transaction is decreased. Suppose a ski manufacturer introduces a new model every year and wants to sell the successive new models to customers who

FIGURE 10

SETTING A HIGH EXTERNAL REFERENCE IS MOST EFFECTIVE FOR CONSUMERS WHO HAVE HAD A NEGATIVE USAGE EXPERIENCE



have bought skis from them in the past. One way in which it can speed up the replacement purchase is to present its past customers with a high ski rental fee to help them accelerate the mental depreciation of the skis that they currently own. A high rental fee may not make the rental business successful, but it would help new ski sales. Firms sometimes introduce a new product not because they believe the new product will be successful, but because they believe the introduction of the new product will boost the sales of their other lines (Randall, Ulrich, and Reibstein 1998). In a similar manner, a business that is interested in increasing the sale of their product may consider entering the rental market and pricing the rental rate so that the sale of their product is increased.

### GENERAL DISCUSSION

The decision to upgrade to a new reusable, while the reusable that they currently own is still functional, can be a difficult one for consumers. The reason for this reluctance on the part of consumers is the remaining mental book value of the current reusable, which must be written off. The pain associated with retiring a reusable before it pays for itself through usage has a significantly negative impact on the decision to purchase an upgrade. In fact, an individual's replacement purchase decision may be more sensitive to this mental cost than any attribute of the new reusable itself, such as the price and quality of the new reusable. Any sentimental value that the current reusable may have for the consumer, which was not studied in this research, would only make the replacement purchase more difficult. Of course, if the current reusable is no longer functional, necessity can motivate a replacement purchase.

In this article, I study the balance between mental accounting and marginal decision making. This goes beyond previous research by recognizing both the economical and psychological components of decision making and how the two components together affect the decision outcome. People do act in ways that are consistent with economic theories of choice, and they employ the marginal cost-benefit criterion in replacement decision making. But they also act in ways that are inconsistent with economic theories of choice and employ the mental accounting criterion in the same decision making.

This research explored trade-in pricing, gift opportunities, and external reference prices as ways in which consumers can be guided to make replacement purchase decisions that are more closely aligned with normative choice. Whether or not marketers in practice are aware of the theory behind the phenomenon demonstrated in this study, there are examples of trade-in offers in industries where no active resale market operates. Joseph A. Bank retails men's suits, and it offers to buy back old suits from its customers for \$100 when they purchase a new suit. Sneaker Stadium sells athletic footwear, and it offers \$5–\$15 to its customers in exchange for their old sneakers when buying a new pair. Even though these traded-in items have no apparent monetary value to the sellers, this study presented a theory to

explain why these trade-ins can be more effective in increasing sales than a straight sale.

Prospective decisions that consider historic costs may not maximize the consumer's utility on a particular replacement purchase occasion, but in the long run over multiple purchase occasions, considering the remaining mental book value of a past purchase may train the utility-maximizing consumer to avoid making unnecessary or superfluous initial purchases. There are other examples of how behavior that may be suboptimal in one particular occasion to the utility-maximizing individual may in fact be beneficial in the long term. When purchasing vice goods such as cigarettes, consumers often forgo the option of purchasing larger quantities and getting the per-unit discounts and, instead, purchase smaller quantities at a per-unit price premium. Wertenbroch (1998) explains this behavior as a strategic choice by the consumer in an attempt for self-control.

The painful write-off of an old reusable's remaining book value may teach the consumer a valuable lesson to be more prudent in the future in making initial purchase decisions. However, mental accounting can go awry if the avoidance of pain becomes the sole or primary driver in prospective replacement purchase decisions. The best strategy for the individual in the short run and long run may be to account for the mental accounting criterion and marginal decision-making criterion in two sequential steps. First, take the write-off on the old reusable, feel the pain, and take away the lesson to be more prudent in the future about initial purchases. Then switch gears and make the prospective replacement decision considering just the marginal decision-making criterion.

One future extension of this study is to examine ways in which individuals can be trained to use mental accounting so that they can derive the benefits (the lessons) without being bound by the limitations (avoidance of pain). Larrick and his colleagues (Larrick, Morgan, and Nisbett 1990; Larrick, Nisbett, and Morgan 1993) have found that individuals can be trained to ignore sunk costs. However, mental accounting can serve a valuable purpose, and it may not be in the interest of the consumer to totally ignore mental accounting costs. The suggested extension will examine whether or not it is possible for individuals who make prospective replacement decisions without being bogged down by past decisions to actually learn the long-term lessons as well.

Another idea for a future study is to further examine the mental accounting process and study factors that may influence the structure of the upgrade model. If there is a "cost" associated with making a new purchase when consumers feel they have not gotten their money's worth, the weight of this cost may increase with accountability. Studies have shown that the sunk cost effect increases in magnitude with accountability (Staw 1976; Staw and Fox 1977). People who were held personally responsible for their past decisions were more likely to continue with their course of action than those who were not accountable. In the context of replacement purchases, when individuals are held accountable for their past purchase decisions, their loss aversion may be

amplified. That is, the  $w()$  function in the model  $u(E_1 - E_0 - P_1) - w[BV_0(t)]$  may become steeper. When loss aversion is heightened, trade-ins become even more effective in increasing the likelihood of upgrade.

Both normative and psychological mechanisms drive a consumer's replacement purchase decision. When applied appropriately, the psychological mechanism can help add value to the utility-maximizing consumer in the long run. However, when the psychological mechanism is misapplied, it results in a misallocation of resources that does not add any value from the perspective of utility maximization, either in the immediate occasion or in the long run. This study explored some external methods to mitigate the misallocation.

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