The Effects of Effort and Intrinsic Motivation on Risky Choice

Abstract

People often need to trade off between the probability and magnitude of the rewards that they could earn for investing effort. A prime example in marketing is frequency programs (hereafter, FPs), which have become ubiquitous in the marketplace and a key component of customer relationship management. A fundamental question regarding the evaluation of frequency programs and, more generally, of other cases where people need to invest effort to obtain some (probabilistic) outcome relates to people’s tradeoffs between the certainty and magnitude of rewards. The present paper proposes that the conjunction of two simple assumptions (relating effort-induced reward expectations to prospect theory’s value function) provides a parsimonious theory that predicts that the nature of the required effort will have a systematic effect on reward preferences. More specifically, several hypotheses are tested, including: (a) the presence (as opposed to absence) of effort requirements enhances the preference for sure-small rewards over large-uncertain rewards; (b) the preference for reward certainty is attenuated when the effort activity is intrinsically motivating; and (c) continuously increasing the effort level leads to an inverted-U effect on the preference for sure-small over large-uncertain rewards. These hypotheses are supported in a series of six studies involving both real and hypothetical decisions, with approximately 5,500 participants. The studies also employ process measures and examine the mechanisms underlying the impact of the effort stream on the tradeoff between the certainty and magnitude of rewards. In addition, the effect of effort is extended to riskless choice: it is shown that higher effort requirements affect the sensitivity toward the magnitude of sure rewards. The final section discusses the theoretical implications of this research as well as the practical implications with respect to frequency programs and other types of incentive systems.

(Consumer Behavior; Effort and Reward; Decision-Making; Decisions Under Risk; Frequency/Reward Programs; Incentive Systems)
People often need to trade off between the probability and magnitude of the rewards that they could earn for investing effort. Do we choose a job with stable income or with potentially larger, albeit uncertain compensation? Do we relegate a laborious manuscript to become an invited book chapter (a guaranteed publication) or submit it instead to a top journal (a risky but higher impact outlet)? Consumers, too, often face effort-contingent promotions and offers that differ in terms of payoff and likelihood, such as when they are enticed with rewards and (uncertain) prizes to complete surveys or participate in customer panels.

A fundamental question, then, is what influences people’s tradeoffs between the certainty and magnitude of effort-contingent rewards. This issue is closely related to past research on decision under risk, which has examined, for example, how people weigh probability versus payoff and choose among risky gambles (e.g., Kahneman and Tversky 1979; March and Shapira 1987; Payne, Laughhunn, and Crum 1980; Slovic, Fischhoff, and Lichtenstein 1977; Thaler and Johnson 1990). Nevertheless, the impact of effort on the tradeoff between the certainty and magnitude of reward is not addressed in that research or in the voluminous psychological work related to effort and reward, such as behaviorism (e.g., Hilgard and Bower 1975), achievement motivation (e.g., Atkinson 1957; Lewin 1951), and goal setting (Locke and Latham 1990). The present research proposes that the level and intrinsic interest of effort have a predictable effect on preferences toward the probability and magnitude of outcomes (e.g., choices between sure-small and large-uncertain rewards).

This proposition is tested using the case of frequency (or loyalty) programs. Such programs have become ubiquitous in the marketplace and a key component of customer relationship management, serving a critical role in developing relationships, stimulating product and service usage, and retaining customers (e.g., Borenstein 1996; Deighton 2000; Drèze and Hoch 1998; Kim, Shi, and Srinivasan 2001). Frequency programs (hereafter, FPs) share a common underlying structure, whereby customers need to invest a series of efforts (e.g., purchasing products and services, rating products, or completing surveys) in order to earn future rewards. These rewards often vary in terms of their magnitude and probability; for instance,
some FPs offer a choice between small rewards and entries into lotteries with (uncertain) large rewards (e.g., iWon), whereas other programs employ one type of incentive system exclusively (i.e., stochastic or deterministic).

To analyze how the tradeoff between the certainty and magnitude of rewards may depend on the characteristics of the required effort stream, two simple assumptions are made: (1) effort requirements create an expectation for reward (i.e., a reference point for evaluating the actual FP rewards), with higher requirements leading to greater expectations, and (2) the valuation of program rewards vis-à-vis the expectation follows the principles of prospect theory’s value function. Combined, these two assumptions provide a parsimonious and unifying framework that leads to a broad set of predications, which have not been recognized before, regarding the impact of effort on reward preferences. These hypotheses state that: (a) the presence (as opposed to absence) of effort requirements enhances the preference for sure-small rewards over large-uncertain rewards; (b) the preference for reward certainty is attenuated when the effort activity is intrinsically motivating; and (c) continuously increasing the effort level leads to an inverted-U effect on the preference for sure-small over large-uncertain rewards.

The paper is organized as follows: The next section provides a theoretical analysis of the impact of effort on the valuation of rewards using the two foregoing assumptions. This analysis leads to several hypotheses concerning the tradeoff between the certainty and magnitude of rewards. The hypotheses are tested in a series of six studies involving both real and hypothetical decisions, with approximately 5,500 participants. After investigating the basic tradeoff between the magnitude and probability of reward, a subsequent section examines how the required effort level affects consumers’ responsiveness to larger (sure) rewards. The final section discusses the theoretical implications of this research as well as the practical implications with respect to the design of FPs and other types of incentive systems.
THE IMPACT OF EFFORT ON THE EVALUATION OF REWARDS

In this section, the impact of effort on customer valuation of rewards is analyzed using the context of FPs. First, the underlying structure of such programs is discussed and two simple assumptions are made regarding the relationship between effort and the valuation of rewards. This analysis leads to the prediction that effort requirements sensitize consumers to the presence versus absence of rewards, which is tested in a preliminary study. The subsequent section builds on this analysis and examines the effect of effort on the tradeoff between the certainty and magnitude of rewards.

Frequency programs have two main components: required efforts and earned rewards. That is, earning rewards typically requires consumers to invest effort (see also Drèze and Hoch 1998; Hsee, Yu, and Zhang 2003; Kivetz and Simonson 2002). In many cases, such efforts are extended over time, and rewards are contingent on reaching a certain requirement level (e.g., the amount of required points or frequent flyer miles, completed surveys or product ratings, or purchases before reward attainment). Perceived (program) effort is defined here as any inconvenience inherent in complying with the program requirements, such as making a special effort to buy at a particular store, purchasing more than one would have otherwise bought, or repeatedly engaging in a certain task (e.g., completing surveys or browsing websites).

Recent research has begun exploring the relationship between FP efforts and rewards. For example, Kivetz and Simonson (2002) showed that consumers use the required program effort to justify their choices between luxury and necessity rewards. In addition, Hsee, Yu, and Zhang (2003) demonstrated that a program’s currency (e.g., points or miles) can mask an undesirable effort-reward relationship (e.g., diminishing returns to effort). Although this research has improved our understanding of customer preference toward FPs (see also van Osselaer, Alba, and Manchanda 2003), the more fundamental question of whether and how the nature of the required earning activity influences the tradeoff between the certainty and
magnitude of rewards has not yet been studied. To explore this question, two simple assumptions are made, as discussed next.

**Effort as a Determinant of Reward Expectations: Assumption 1**

Requiring consumers to invest a stream of future efforts is likely to raise expectations regarding the fair or appropriate size of the reward. Indeed, previous research on equity and justice (e.g., Adams 1965; Walster, Walster, and Berscheid 1978) suggests that people expect their outcomes (rewards) to be proportional to their inputs (efforts). For example, equity theory’s merit principle assumes that perceptions of (un)fairness are determined by the balance (or lack of balance) between people’s contributions and their rewards. Moreover, equity theory proposes that both satisfaction and behavior are linked not to objective outcomes but rather to outcomes received relative to those judged to be equitable.

In the context of FPs, a simple assumption (hereafter, assumption 1) is that increasing the required effort level will lead consumers to expect larger rewards. Further, rewards that fail to meet the expectation raised by the concomitant effort level will likely be coded as unfair losses, whereas rewards that meet or exceed the expectation level will be coded as gains. The assumption that consumers will evaluate the objective reward relative to some psychological expectation level is consistent with a great deal of prior research on reference-dependence (e.g., Kahneman and Tversky 1979; Thaler 1985; Winer 1986). Next, the basic assumption that effort gives rise to expectations is combined with the value function as a unifying framework for analyzing the impact of effort on preferences toward the certainty and magnitude of rewards.

**A Value Function Based Model for the Assessment of Rewards: Assumption 2**

Prospect theory’s value function (Kahneman and Tversky 1979; see also Thaler 1985; Tversky and Kahneman 1991) incorporates three behavioral principles that are essential for the analysis of the impact of effort on reward preferences: (1) options are coded as gains and losses relative to a neutral reference outcome, which is assigned a value of zero; (2) the value function is steeper for losses than for gains (i.e., loss aversion); and (3) the marginal value of both gains and
losses decreases with their magnitude (i.e., diminishing sensitivity). These three characteristics lead to an asymmetric value function that is concave for gains and convex for losses.

Although Kahneman and Tversky suggest that the reference point typically corresponds to the status quo or current asset position, they also recognize that “there are situations in which gains and losses are coded relative to an expectation or aspiration level that differs from the status quo” (Kahneman and Tversky 1979, p. 286). The present paper argues that FP effort requirements raise reward expectations that induce a shift in the reference away from the neutral status quo. Rewards are then coded as gains or losses relative to this labile, effort-contingent reference point; rewards that exceed the expectation level are perceived as gains, whereas those below are perceived as losses. Further, it is assumed that the valuation of program rewards vis-à-vis the expectation follows the principles of prospect theory’s value function (hereafter, assumption 2).

Figure 1 illustrates this analysis. Consumers who are not required to invest any effort to obtain a possible future award, \( x \), will perceive this award as a (free) gain with a subjective value of \( v_0(x) \). These consumers will construe not receiving a reward as the natural status quo and not as a loss [i.e., \( v_0(0) = 0 \)]. By contrast, consumers who are required to invest effort will expect to be compensated, and thus, their relevant reference point will increase from zero to \( r_E > 0 \). For these consumers, a lack of reward represents a loss [i.e., \( v_E(0) < 0 \)]. This analysis gives rise to the notion that effort requirements sensitize consumers to the absence of rewards. That is, given assumptions 1 and 2, loss aversion and concavity of gains imply that \( v_E(x) - v_E(0) > v_0(x) - v_0(0) \), which means that the difference in subjective value between being rewarded and not being rewarded is greater when consumers are required to invest effort. Next, before proceeding to the development of specific hypothesis, a pilot study testing the conjunction of assumptions 1 and 2 is reported.

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\(^1\) In this and the proceeding analyses, we employ the value function \( v(\ast) \) from prospect theory. For example, \( v_E(x) \) denotes the subjective value of outcome (or reward) \( x \), given the reference \( r_E \) (i.e., effort \( E \) is required to obtain \( x \)).
The respondents in the pilot study were 116 travelers, who were waiting for trains at sitting areas in a major train station. The idea was to present respondents with either a gift (no effort) or a FP (effort) scenario and to ask them how happy they you would be with winning [or not winning] a reward. Respondents were randomly assigned to one of four conditions in a 2 (effort level: gift vs. FP) x 2 (reward outcome: win vs. not win) between-subjects design. Based on the earlier analysis and the conjunction of assumptions 1 and 2, it was predicted that the difference in happiness between wining and not winning the reward would be greater in the effort as opposed to no-effort conditions; that is, respondents would be more sensitive to the presence versus absence of reward when they are required to invest effort.

The scenarios given to the respondents in the gift conditions were:

Imagine that you receive a free gift from a car rental company. The gift consists of a free entry into a lottery in which you could win seven free night stays at your choice of any luxury hotel chain. The chances of winning are one in fifty.

You now receive your lottery entry. As it turns out, you [do not] win.
By contrast, in the FP effort conditions, respondents received the following scenarios:

Imagine that you participate in a frequency program offered by a car rental company. According to this program, you are required to rent a car 10 times before earning a free entry into a lottery in which you could win seven free night stays at your choice of any luxury hotel chain. The chances of winning are one in fifty. You now complete the required ten car rentals and earn your lottery entry. As it turns out, you [do not] win.

Respondents were asked to rate how unhappy or happy they would be with the outcome they were assigned to, using an eleven-point scale ranging from -5 “Very Unhappy” to 5 “Very Happy” (the midpoint of the scale was denoted with 0 and labeled as “Neither unhappy nor happy”). The results were consistent with the two underlying assumptions and supported the notion that effort requirements sensitize consumers to the difference between winning and not winning a reward. Specifically, the difference in the mean happiness rating between winning and not winning the reward was greater in the effort conditions (3.8 vs. –1.8, respectively; difference = 5.6) than it was in the no-effort (gift) conditions (4.1 vs. –.3, respectively; difference = 4.4), as indicated by the significant interaction between effort level and reward outcome ($F = 4.4; df = 1; p < .05$). The data also supported the other premises underlying the preceding analysis and Figure 1 [i.e., $v_E(0) << 0 = v_0(0); v_E(x) < v_0(x)$]. Next, building on the notion of effort-induced reference shifts, the impact of effort on the tradeoff between the certainty and magnitude of rewards is considered using the case of sure-small and large-uncertain rewards.

**THE IMPACT OF EFFORT ON PREFERENCES BETWEEN SURE-SMALL REWARDS AND LARGE-UNCERTAIN REWARDS**

Consumer choice between sure-small rewards (e.g., a guaranteed winning of $10) and large-uncertain rewards (e.g., a 1% chance to win $1,000) is common in everyday life and increasingly in marketing promotions and programs. Accordingly, such choices have received a

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2 Specifically, respondents assigned to the loss condition were significantly more unhappy when the (unattained) reward was contingent on complying with a FP effort stream than when it was a gift ($M = -1.8$ vs. $M = - .3, t = 3.9; p < .001; medians = -2.0 vs. 0$). Moreover, while the average happiness rating of respondents in the effort-loss condition was significantly lower than the zero midpoint of the scale ($t = 5.4; p < .001$), the average happiness rating of respondents in the gift-loss condition was not ($t = 1.5; p > .1$). In addition, respondents assigned to the gain condition were directionally happier when the reward was a gift than when it was contingent on complying with effort ($M = 4.1$ vs. $M = 3.8, t = .6; p > .1$; both significantly greater than zero; medians = 5.0 vs. 4.0).
great deal of attention from consumer and decision researchers (see, e.g., Kahneman and Tversky 1979; 1981; Thaler and Johnson 1990). Normative theory indicates that decisions under risk should be influenced by consumers’ risk preferences, as determined by the shape (concavity) of their utility functions (Arrow 1971). However, previous research has revealed a number of behavioral factors that influence such decisions, including the framing of the decision problem (Kahneman and Tversky 1979; 1981) and prior outcomes (Laughhunn and Payne 1984; Thaler and Johnson 1990). In this article, it is argued that an important, yet unrecognized determinant of risky choice is the level and intrinsic interest of the required effort.

Specifically, building on the earlier analysis that effort sensitizes consumers to the presence (versus absence) of rewards, it is posited that the introduction of effort requirements will enhance the preference for sure-small rewards over larger-uncertain rewards. That is, as long as the sure-small reward is perceived as sufficient compensation for the required effort, ensuring that one does not work for nothing will serve as a compelling reason for choosing the sure-small reward. By contrast, selecting the large-uncertain reward leaves open the possibility of exerting effort in return for no reward, an outcome that is coded as a loss relative to the effort-induced reward expectation.

The notion that the presence (as opposed to absence) of effort requirements will shift consumer choice in favor of the certain reward can be predicted using the conjunction of the two assumptions discussed earlier [i.e., (1) effort creates an expectation or reference point; and (2) the valuation of FP rewards relative to the reward expectation is consistent with the value function]. To illustrate this argument, consider outcomes $s$ and $l$ shown in Figure 2, where $l > s$ but the probability of obtaining outcome $l$ is considerably smaller than the certainty of attaining outcome $s$ (i.e., $p_l << p_s = 1$). When no effort is required to obtain a choice between the sure-small and large-uncertain rewards, the difference in subjective value between these two rewards is equal to $v_0(s) - [p_l * v_0(l) + (1 - p_l) * v_0(0)]$. Conversely, when earning a choice between these rewards is

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3 In this and the subsequent analyses, we assume that consumers adopt the explicit probabilities (i.e., $p$) stated for the various rewards. Replacing these probabilities with prospect theory’s decision weights [i.e., $\pi(p)$] does not alter the nature or conclusions of the analyses.
contingent on effort, the shift in the reference point (due to a positive reward expectation) will
result in a different relative reward valuation, \( v_E(s) - [p_l * v_E(l) + (1 - p_l) * v_E(0)] \).

**Figure 2: The Impact of Effort-Induced Reference Shifts on Choices between Sure-Small and Large-Uncertain Rewards**

This shift in reference from zero to \( r_E > 0 \) leads to two opposing effects regarding the
relative value of the sure-small and large-uncertain rewards. On the one hand, loss aversion
means that the possibility \((1 - p_l)\) of not being rewarded for investing efforts (inherent in the
large-uncertain reward) will enhance the relative preference for the sure-small reward, which
guarantees winning [note that \( v_E(0) < v_0(0) = 0 \)]. On the other hand, the concavity of the gain
function implies that the perceived difference between \( l \) and \( s \) will be greater under the new
reference point \( r_E > 0 \) [i.e., \( v_E(l) - v_E(s) > v_0(l) - v_0(s) \)].
The relative strength of these two opposing effects will be determined by the probability of winning $l$; the lower $p_l$ is, the greater the impact of the loss aversion effect relative to the concavity effect. Appendix A (proposition 1) shows that under a highly plausible condition, namely a coefficient of loss aversion of at least two (e.g., Tversky and Kahneman 1991), the loss aversion effect always outweighs the concavity effect if the probability of winning $l$ is smaller than 0.5. Thus, as long as $p_l < 0.5$, and the sure-small reward meets or exceeds the expectation for reward raised by the effort requirement (i.e., $s \geq r_E$), the introduction of effort will enhance the relative preference for the sure-small reward over the large-uncertain reward. This conveys the intuition that, compared to a no-effort condition, consumers who are required to invest efforts will prefer a sure compensation ($s$) over a potentially larger reward ($l$) that is more likely to end up as a perceived loss [i.e., because $(1-p_l) = p_0 > 0.5$ and $v(0) < 0$].

The discussion leads to the following hypothesis:4

\textbf{H1:} Consumers are more likely to prefer sure-small rewards over large-uncertain rewards when they are rewarded for the expenditure of effort compared to when they are provided with effort-free rewards.

This prediction, of course, does not mean that higher effort will always enhance the relative share of the sure-small reward, considering that greater effort requirements can lead at some point to expectations that are not met by the sure-small reward. Thus, the condition that the sure-small reward satisfies consumers’ expectations is later relaxed, by examining the effects of an extended range of increases in the required effort. A subsequent section also investigates the impact of effort on the sensitivity toward the magnitude of rewards when both small and large rewards are certain (i.e., $p_s = p_l = 1$). These investigations reveal a systematic and conceptually rich association between required efforts and reward preferences. Next, a study designed to test hypotheses 1 is discussed.

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4 This hypothesis as well as hypotheses 2 and 3 discussed subsequently assume that the conditions delineated above are satisfied (i.e., $p_l < 0.5$ and $s \geq r_E$).
STUDY 1: CHOICES BETWEEN SURE-SMALL AND LARGE-UNCERTAIN REWARDS AS A FUNCTION OF EFFORT

Method

Participants. The participants in the study were 436 travelers, who were waiting for trains at sitting areas in a major train station. They were between 18 to 70 years old and represented a wide range of demographic characteristics.

Procedure and Design. Hypothesis 1 was tested in three scenarios involving a grocery store problem (152 respondents), a hotel problem (186 respondents), and a frequent cereal eater program (98 respondents). In each scenario, respondents were randomly assigned to one of two (between subjects) conditions, either an (FP) effort condition or a no-effort condition. Specifically, in the grocery store problem (see Appendix B), respondents received a choice between two rewards, either after they completed five grocery purchases or as an appreciation gift. In the hotel problem (see Appendix B), respondents could obtain a choice between rewards by participating in either a FP (that required ten night stays) or an (effortless) free raffle. And, in the frequent cereal eater program (see Figure 3), effort was manipulated by informing respondents that they would receive a choice between two rewards after either they or their friend purchased ten cereal boxes (i.e., presence vs. absence of personal effort, respectively). As shown in Figure 3 and Appendix B, the three problems had a similar format, with respondents choosing between a sure-small reward and a large-uncertain reward. In the hotel scenario, respondents also had the option of not participating in the FP [or raffle] (see Dhar and Simonson 2002).

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5 Although the scenarios were run separately, all three appear under Study 1 because they employed a similar methodology. Of the 131 participants in the frequent cereal eater program, 33 respondents were not included in the analysis (leaving 98 respondents), because these respondents indicated that they did not participate in any frequent flyer program and therefore the rewards (frequent flyer miles) were irrelevant to them.

6 In the hotel problem and in the frequent cereal eater program, the expected values of the sure-small and large-uncertain rewards were equal. In the grocery store problem, the expected value of the large-uncertain reward was greater than that of the sure-small reward.
Figure 3: Test of Hypothesis 1 --- Frequent Cereal Eater Scenario

**Effort Condition:**

**Frequent Cereal Eater Program**
Imagine that a national brand of cereals offers you the opportunity to participate in a “frequent cereal eater” program. According to this program, after you purchase ten boxes of this brand of cereals, you will earn a choice between the two rewards below:

<table>
<thead>
<tr>
<th>Reward A</th>
<th>Reward B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 frequent flyer miles</td>
<td>One in fifty chance to win 50,000 frequent flyer miles</td>
</tr>
<tr>
<td>(accepted by any frequent flyer program)</td>
<td>(accepted by any frequent flyer program)</td>
</tr>
</tbody>
</table>

Circle the reward that you prefer to receive if you complete ten purchases of cereal boxes:

A  B

**No Effort Condition:**

**Frequent Cereal Eater Program**
Imagine that a national brand of cereals offers a friend of yours the opportunity to participate in a “frequent cereal eater” program. According to this program, after your friend purchases ten boxes of this brand of cereals, s/he will earn a choice between the two rewards below. However, your friend is not interested in airline miles, and therefore, tells you that if s/he earns the reward, s/he will give it to you:

<table>
<thead>
<tr>
<th>Reward A</th>
<th>Reward B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 frequent flyer miles</td>
<td>One in fifty chance to win 50,000 frequent flyer miles</td>
</tr>
<tr>
<td>(accepted by any frequent flyer program)</td>
<td>(accepted by any frequent flyer program)</td>
</tr>
</tbody>
</table>

Circle the reward that you prefer to receive from your friend if s/he completes ten purchases of cereal boxes:

A  B

To examine more directly the mechanism underlying the reward preferences, respondents were asked (in the grocery and hotel problems) to explain their decision in writing after making their choice. Two independent judges, who were unaware of the study’s predictions, coded the choice explanations provided by participants. The inter-judge reliability was 89%, and disagreements were resolved by discussion. Given that the design and results of the two scenarios were similar, the analysis of the choice explanations is pooled across the two scenarios. In addition, as a check for the effort manipulation, respondents in all three problems rated the degree to which attaining the reward involved effort for them, using an eleven-point scale ranging from (0) “No effort at all” to (10) “Very high effort.”
Results

Manipulation Checks. In all three problems, the manipulation of effort produced the expected effort perceptions, with respondents in the FP effort condition indicating higher mean perceived effort compared to respondents in the no-effort condition (\(\bar{X} = 3.4\) vs. \(\bar{X} = 2.6\) in the grocery store problem, \(p = .06\); \(\bar{X} = 5.3\) vs. \(\bar{X} = 2.8\) in the hotel problem, and \(\bar{X} = 3.8\) vs. \(\bar{X} = 1.4\) in the frequent cereal eater program, both \(p’s < .05\)).

Reward Choices. The results of all three problems supported hypothesis 1. More specifically, in the grocery store problem, respondents were significantly more likely to choose the sure-small reward in the effort condition than in the no-effort condition (73% [60/82] vs. 49% [34/70]; \(t = 3.2\); \(p < .001\)). Similarly, in the hotel problem, the introduction of effort led to a significant increase in the relative share of the sure-small reward from 46% (i.e., 46 out of 99 respondents who chose a reward) in the no-effort condition to 74% (i.e., 51 out of 69 respondents who chose a reward) in the effort condition (\(t = 3.8\); \(p < .001\)). Finally, in the frequent cereal eater program, the choice share of the sure-small reward was higher in the effort condition than in the no-effort condition (77% [36 out of 47 respondents] vs. 61% [31 out of 51 respondents]; \(t = 1.7\); \(p < .05\)).

Analysis of Choice Explanations. Different codes were used for respondents who chose a sure-small reward versus respondents who chose a large-uncertain reward. Among respondents who chose the sure-small reward in the FP effort conditions (111/151), 36% explained their choice based on the notion that they expect a guaranteed reward in return for their investment of efforts. By contrast, none of the respondents who chose the sure-small reward in the gift or free raffle (no-effort) conditions (80/169) used this explanation. In coding explanations, only reasons that were unequivocally related to effort-contingent reward preferences were classified as such (e.g., “I’d like to know that there’s definitely some reward for my efforts”), whereas more ambiguous explanations were not. Of course, not every respondent who chose the sure-small reward over the large-uncertain reward was aware of or even driven by increased expectations arising due to the effort requirements. However, the prevalence of such explanations in the FP effort condition
compared to the no-effort condition supports the notion that a desire to avoid a perceived loss (judged relative to a heightened reward expectation) is an important cause of such preferences.

It is also informative to examine the explanations provided by respondents who chose the large-uncertain reward over the sure-small reward in the FP effort conditions (40/151) and the no-effort conditions (89/169). In both groups, a substantial proportion of respondents (28% and 24%, respectively) chose the large-uncertain reward because they perceived their effort in obtaining the reward as minimal or nonexistent, and therefore, had no expectation for reward and did not construe its absence as a loss (using reasons like: “It’s found money. If I stay at the hotel anyway, I have nothing to lose;” “Any amount (even 0) is appropriate as a gift”).

Discussion

The results provide support for the role of effort in determining reward preferences, indicating that when rewards are contingent on complying with an effort stream consumers’ preferences shift in favor of sure-small rewards at the expense of large-uncertain rewards. The analysis of the choice explanations supported the notion that a main consideration underlying the choices is the required effort stream and the desire to guarantee recompense. Next, two studies are presented that address more directly the mechanisms underlying the impact of effort on the tradeoff between the certainty and magnitude of rewards. In particular, these studies investigate whether the preference for sure-small rewards over large-uncertain rewards is greater among consumers with lower intrinsic motivation to engage in the required effort activity. A second way in which the theoretical explanation is tested is by manipulating (rather than measuring) the intrinsic interest of an effort activity and examining the impact of effort (relative to a no-effort condition) on the preferred reward.

THE ROLE OF INTRINSIC MOTIVATION

The impact of effort on preference for sure-small rewards was predicted based on the notion that effort requirements gives rise to reward expectations, and therefore, to a feeling of loss when no reward is afforded. However, people who see themselves as intrinsically motivated to
engage in an effort activity are less likely to make the attribution that they are engaging in the activity only to obtain some extrinsic incentive and are rather more likely to attribute their participation to the enjoyment, satisfaction, and/or interest inherent in the effort activity (see, e.g., Deci and Ryan 1985; Lepper 1981; Lepper and Greene 1978). Further, because the expectation for (extrinsic) reward is likely to be lower for intrinsically motivated individuals, it is predicted that the preference for sure-small rewards will be weaker among such individuals. Thus:

**H2:** Relative to individuals with high intrinsic motivation to engage in an effort activity, individuals with low intrinsic motivation are more likely to prefer sure-small rewards over large-uncertain rewards.

Relatedly, when an effort activity is inherently enjoyable (i.e., intrinsically motivating), it is likely to lead to lower reward expectations and, therefore, have a weaker effect on FP reward preferences. For instance, a program that requires consumers to review products (e.g., Epinions.com) is less likely to raise an expectation of reward if consuming (and reviewing) the relevant products is enjoyable. Accordingly, it is predicted that the introduction of an effort requirement will have a stronger positive effect on the relative share of the sure-small reward when the effort activity is not intrinsically motivating. This leads to the following interaction hypothesis:

**H3:** The positive impact of effort (compared to an effort-free condition) on the preference for sure-small over large-uncertain rewards is stronger for effort activities that are not intrinsically motivating.

Hypotheses 2 and 3 were examined in the following two studies. The first study tests the role of intrinsic motivation in determining reward preferences by measuring participants’ pre-existing interests in the required effort activity.

**STUDY 2: INTRINSIC MOTIVATION AS A DETERMINANT OF REWARD PREFERENCES**

Hypothesis 2 was tested by measuring participants’ intrinsic motivation to engage in an effort activity. Moreover, to allow for a strong test of the role of intrinsic motivation, the
participants in this study made real choices. In addition, to further explore the mechanisms underlying the impact of effort on reward preferences, the choice explanations provided by these participants are subsequently examined.

Method

Participants. The participants were 232 students at an East Coast high school. Participants were recruited by schoolteachers at the beginning of a regular classroom session. As explained later, the participants were randomly assigned to conditions.

Procedure and Design. At the beginning of a regular classroom session, several of the high school teachers informed their classes that the school was considering introducing some new learning materials. Therefore, these students have been selected to participate in a four-week study during which they will have to use and evaluate these learning materials. The teachers then distributed to their students a (supposedly) official survey from the high school. Students were randomly assigned to one of two possible versions of the survey, regarding either a new math curriculum or a new poetry curriculum. In both survey conditions, students were informed that they would be asked to solve three math problems [read and critically analyze three poems] per week for four consecutive weeks. Further, once a week, after solving the math problems [reading and analyzing the poems], they would need to complete a survey evaluating the math workbook [poetry collection]. In order to familiarize students with their future task, both survey versions asked students to review a set of sample math problems [poems] and evaluation questions, which were printed on a separate sheet of blue card stock paper. The sample math problems were taken from the January 2001 Mandelbrot Competition Greater Testing Concepts company and from the Round 4, Academic Year 2000-2001 USA Mathematical Talent Search. The sample poems were taken from the Real SAT II: Subject Tests (College Board 1998).

Students in both conditions were informed that completion of the required effort would earn one of two rewards, either $20 in cash (a sure-small reward) or a one in twenty five chance to win $600 in cash (a large-uncertain reward). Students were asked to indicate in advance
which reward they choose to earn upon completion of the required effort, so that the school could plan ahead. After they chose a reward, students were asked to return their survey to the teacher. Students were then given an additional page on which they were asked to rate how much they like math and poetry. The ratings were on a seven-point scale ranging from “I like math [poetry] much less than typical students” (1) to “I like math [poetry] much more than typical students” (7). These math/poetry liking ratings served as a measure of participants’ intrinsic motivation to engage in the effort activity. In addition, students were asked to indicate how many times they solved a math problem [read a poem] in a typical month. Students were also asked to explain their choice of reward in writing. Students next listed, in free response, any other thoughts they had about the curriculum survey. None of the participants expressed suspicion about the survey’s purpose or articulated the actual hypotheses being tested.

Results

Participants assigned to the math task were divided into two groups, “math haters” and “math lovers,” based on a median split of their reported liking of math (means and standard deviations of math liking ratings in the “math haters” vs. “math lovers” groups were 2.8 [s.d. = 1.1] vs. 5.7 [s.d. = .7], respectively). Similarly, participants assigned to the poetry task were divided into two groups, “poetry haters” and “poetry lovers,” based on a median split of their reported liking of poetry (means and standard deviations of poetry liking ratings in the “poetry haters” vs. “poetry lovers” groups were 2.7 [s.d. = 1.1] vs. 5.9 [s.d. = .8], respectively).

Participants’ reward choices were then examined to test hypothesis 2, which predicts that math [poetry] haters will be more likely to choose the sure-small reward compared to math [poetry] lovers. Consistent with the intrinsic motivation hypothesis, the choice share of the sure-small reward was higher among “math haters” than among “math lovers” (79% vs. 64%; t = 1.8; p < .05). Similarly, the share of the sure-small reward was higher among “poetry haters” than among “poetry lovers” (84% vs. 70%; t = 1.8; p < .05).
In addition, students were asked to indicate whether they participated in the school’s math team (a math club involving yearlong national competitions in math). Consistent with the notion that individuals are less likely to expect an extrinsic reward for engaging in an activity that they view as intrinsically interesting, in the math condition, students who were members of the math team were less likely to choose the sure-small reward compared to students who were not members of the math team (56% vs. 74%; \( t = 1.6; p < .06 \)). This result cannot be explained as reflecting a greater tendency of math team members to calculate the expected value of the rewards (which was lower for the sure-small reward) because, in the poetry condition, math team members were not less likely to prefer the sure-small reward compared to non-members (84% vs. 76%; \( t = .9; p > .1 \)).

In summary, this study demonstrated the impact of intrinsic motivation using an unobtrusive measure of task liking, in the context of an actual rewards program with real potential consequences. Consistent with the notion that intrinsically motivated individuals are less likely to expect a reward, the results indicate that the preference for the sure-small reward is significantly weaker among such participants. Next, a study is reported that further examines the role of intrinsic motivation and tests H3, which predicts that enjoyable effort has a weaker effect on preferences for sure-small rewards.

**STUDY 3: INTRINSIC MOTIVATION AS A MODERATOR OF THE IMPACT OF EFFORT ON PREFERRED REWARDS**

Hypothesis 3 was tested by manipulating the enjoyment inherent in an effort task (reading and reviewing magazines) and examining the interaction between intrinsic motivation and the level of effort with respect to preferences between sure-small and large-uncertain rewards. To vary the level of task enjoyment, a pretest was conducted in which respondents (148 travelers waiting for trains) were asked which weekly magazines they read most often and which magazine topic most interests them. On the basis of the pretest results, two magazines were
chosen of low versus high intrinsic interest for the respondent population (i.e., Better Homes & Gardens versus TIME, respectively).

Method

The participants in the study were 311 travelers, who were waiting for trains at sitting areas in a major train station. Participants were randomly assigned to one of four conditions in a 2 (effort level: no effort vs. FP effort) x 2 (interest level: low vs. high) between-subjects design. Respondents were first asked to familiarize themselves with the magazine they were assigned to, either Better Homes & Gardens (low intrinsic interest) or Time (high intrinsic interest). They received a description and photograph of the magazine, adopted with minor adjustments from MagazineOutlet.com and Epinions.com. After reading about the magazine, respondents considered either a free promotion or a frequency program, both offered by the magazine they read about earlier. In the free promotion (no effort) condition, respondents were told that in an attempt to increase awareness of the magazine, the publishers are sending them four free issues as well as a free gift, which consisted of a choice between two rewards. In the FP effort condition, respondents were told that in an attempt to improve the magazine’s content and design, the publishers are offering them the option of earning a reward in return for reading and providing feedback on four (free) issues of the magazine (once a week, after reading the magazine, they would need to complete a three-minute phone survey). In both conditions, respondents were asked to choose between two alternative rewards, either two free movie tickets (a sure-small reward) or a free entry into a lottery with a one in a hundred chance to win a vacation package for two in Hawaii (a large-uncertain reward). Respondents were also given the option of not participating.

As a check for the manipulation of intrinsic interest, a sub-sample of respondents rated (after making their choice) the extent to which they enjoyed (or would enjoy) reading the two magazines on an eleven-point scale ranging from “I would not enjoy it at all” (0) to “I would enjoy it greatly” (10). These respondents also indicated how many times they read each magazine in a typical month. As expected, reading Time was rated as significantly more enjoyable than reading
Better Homes & Gardens ($M = 6.0$ vs. $M = 4.0$, $t = 4.2$; $p < .001$); further, the average enjoyment rating for Time was significantly higher than the scale midpoint of five ($t = 2.4$; $p < .05$), whereas the average rating for Better Homes and Gardens was significantly lower ($t = 2.4$; $p < .05$). The enjoyment ratings were also significantly correlated with the frequency of reading the magazines ($r = .5$ and $r = .6$ for Time and Better Homes & Gardens, respectively; both $p$’s < .001).

Combined, these checks confirm that the manipulation of magazine type affected respondents’ intrinsic motivation in the expected direction.

**Results**

Consistent with Study 1 and hypothesis 1, in both magazine versions, the relative choice share of the sure-small reward was higher in the FP effort condition than in the no-effort (gift) condition. Pooled across the level of intrinsic motivation, there was a significant main effect of effort level on the preference for the sure-small reward (60% vs. 43%; $t = 2.9$; $p < .005$). More importantly, consistent with hypothesis 3, whereas the effect of effort in the Better Homes & Gardens condition (low intrinsic motivation) was statistically significant, the effect in the group that considered Time magazine (high intrinsic motivation) was weaker and not statistically significant.

Specifically, in the low intrinsic motivation condition, when the reward was not contingent on effort (i.e., it was a gift), 38% (27 out of 71) of respondents chose the sure-small reward over the large-uncertain reward. However, when earning the reward required investing effort, 66% (41 out of 62) preferred the sure-small reward, an increase of 28% ($t = 3.4$; $p < .001$). By contrast, in the high intrinsic motivation condition, when the reward was a gift, 48% (35 out of 73) of respondents chose the sure-small reward over the large-uncertain reward. However, when the reward required investing efforts, the relative share of the certain reward was 55% (41 out of 74), an increase of only 7% ($t = .9$; $p > .1$). The difference between the two intrinsic motivation conditions in the impact of effort on reward choice was statistically significant (28% vs. 7%; $t = 1.8$; $p < .05$). In addition, respondents assigned to the FP effort conditions were more
likely to choose the sure-small reward when the effort activity was not intrinsically motivating (reading and reviewing Better Homes & Gardens) than when the effort activity was intrinsically motivating (reading and reviewing Time). This effect, which was marginally significant (66% vs. 55%; \( t = 1.3; p < .1 \)), is consistent with hypothesis 2 and the results of Study 2.

The Role of Intrinsic Motivation: Discussion

Using two methodologies, it was demonstrated that the preference between sure-small and large-uncertain rewards depends on the intrinsic motivation to engage in the required effort activity. Consistent with the notion that intrinsically motivating effort is less likely to lead to an expectation of extrinsic reward, it was shown that individuals who liked a particular effort activity (e.g., solving and reviewing math problems) were less likely to prefer the sure-small reward compared to individuals who disliked this activity. While this demonstration was based on a measurement of participants’ pre-existing tastes, a second study involved a manipulation of the interest inherent in the effort tasks (using low vs. high enjoyment magazines). And, as suggested by the notion that engaging in intrinsically motivating (or rewarding) effort lowers the expectation for extrinsic reinforcement, the findings indicate that the positive impact of an effort requirement (compared to a no-effort condition) on the preference for reward certainty was attenuated when the effort was enjoyable.

To further examine the proposed account for effort-contingent reward preferences and the role of intrinsic motivation, the choice explanations from Study 2 were analyzed; these explanations were provided by the 232 high school students who made a real choice between $20 in cash (a sure-small reward) and a one in twenty five chance to win $600 in cash (a large-uncertain reward). Two independent judges, who were unaware of the study’s predictions, coded the choice explanations; the inter-judge reliability was 92%, and disagreements were resolved by discussion. Given that the results pertaining to the poetry and math tasks were similar, the analysis is pooled across these two conditions. This analysis contrasts the reasons provided by participants with low versus high intrinsic motivation to engage in the required effort activity.
Among participants with low intrinsic interest in the effort task (math and poetry “haters”) who chose the sure-small reward (94/115), 31% explained their choice based on the notion that they expect a guaranteed reward in return for investing (dislikable) efforts. By contrast, among participants with high interest in the effort activity (math and poetry “lovers”) who chose the sure-small reward (78/117), only 4% used this explanation. The following are examples of explanations for choosing the sure-small reward that were coded as reflecting effort-contingent reward preferences:

- “I would want to be guaranteed the money because I don’t like poetry that much.”
- “$20 is guaranteed. $600 is nice, but big chance of getting NOTHING in return. That would be horrible.”
- “I’m lazy as hell about math. I only do things that I like, such as reading, acting, or critiquing films. So I want a definite reward.”

The finding that participants were more likely to explain choosing the sure-small reward based on the required effort when they disliked rather than liked the effort activity supports the notion of effort-contingent reward preferences and the moderating role of intrinsic motivation.

In addition, analysis of the reasons provided by intrinsically motivated participants who chose the large-uncertain reward indicated that 33% explained their choice based on the notion that the (likable) effort activity is rewarding in itself, and therefore, a lack of extrinsic reinforcement would not constitute a loss or disappointment. Conversely, none of the participants with low intrinsic motivation who chose the uncertain reward used this explanation. Examples of such reasons include:

- “I like math so it would be okay if I didn’t win anything and why not have the chance to win $600.”
- “At first I thought $20, but changed my mind - $20 isn’t that much money and I’d be reading poetry anyway, so I don’t feel like I’d HAVE to be compensated for it.”
- “To me, math is pretty much nothing – in fact, I like doing math. So getting paid for doing something I like to do is a bonus.”

Interestingly, however, among participants who chose the uncertain reward, those with lower intrinsic motivation were much more likely (43% vs. 3%) to explain their choice as an attempt to “break-even” (Thaler and Johnson 1990). That is, these participants indicated that the
sure-small reward was insufficient as a compensation for the (dislikable) effort involved, using reasons like: “Twenty dollars is not enough to compensate for reading poetry for four weeks. Six-hundred dollars is;” “$20 is not significant enough for the amount of work involved. Maybe if the reward was $50+ I would take it, but I would rather take a chance (1/25 isn’t too bad) at the big cash prize.” Accordingly, the next section examines the effect of a systematic manipulation of required efforts, whereby beyond a certain effort level, the impact of effort on preferences between sure-small and large-uncertain rewards reverses.

**THE CURVILINEAR RELATIONSHIP BETWEEN EFFORT AND PREFERENCE FOR SURE-SMALL OVER LARGE-UNCERTAIN REWARDS**

So far, we have focused on situations in which most consumers perceived the sure-small reward as sufficiently large relative to the effort-induced reward expectation and examined the impact of the presence versus absence of effort on reward preferences. Here, it is suggested that, as long as the sure-small reward is satisfactory, further increasing the required efforts and the concomitant reward expectations will enhance the aversion and perceived loss related to the potential absence of reward (inherent in the large-uncertain reward). Thus, because the sure-small reward eliminates the possibility of such a (perceived) loss, the preference for this reward is predicted to increase with greater effort.

This intuition is illustrated in the left-hand side of Figure 4, which depicts incremental effort-induced reference shifts that do not exceed the magnitude of the sure-small reward (i.e., $s > r_{E2} > r_{E1} > 0$). As discussed earlier, under this condition, increasing the reference point leads to two opposing forces regarding the relative value of the sure-small and large-uncertain rewards. The concavity of the gain function implies an increasing difference between the perceived values of $l$ and $s$. However, as long as the probability of obtaining the large-uncertain reward is reasonably low (i.e., $p_l < 0.5$), this effect will be outweighed by the impact of loss aversion. That is, as the reference point increases, the considerable possibility ($1 - p_l$) of not being rewarded for
investing efforts becomes more aversive and looms larger than the enhanced sensitivity to the size of rewards (see Appendix A, proposition 2 for a formal proof).  

Figure 4: The Curvilinear Relationship between Effort and Preference for Sure-Small over Large-Uncertain Rewards

Reward Expectations Satisfied by Sure-Small Reward

Reward Expectations Not Satisfied by Sure-Small Reward

However, reward expectations that exceed the magnitude of the sure-small reward give rise to a diametrically opposed effect. Specifically, in such cases, the sure-small reward is perceived as a sure loss, whereas the large-uncertain reward provides the possibility (albeit low)

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7 As shown in Appendix A (proposition 2), because the gain function may become very steep close to the reference point, the range of reference shifts (increases) in which this effect will occur may have an upper bound of $s/2$ as opposed to $s$. The essence of the argument made in this section holds even with this lower limit.
of avoiding such a loss and receiving adequate compensation. Thus, to escape what they perceive as a certain loss, consumers may switch to the large-uncertain reward when their reward expectations surpass the sure-small reward. In such situations, further increasing the effort requirements is predicted to enhance the preference for the large-uncertain reward, because the rising expectations increase the perceived loss associated with the unsatisfactory small reward. The notion that consumers will prefer the large-uncertain reward when the sure-small reward does not meet their expectation is supported by the findings of risk seeking in the domain of losses (e.g., Kahneman and Tversky 1979; Payne, Laughhunn, and Crum 1980) and break-even effects (Thaler and Johnson 1990), whereby consumers tolerate more risk when they are offered the opportunity to eliminate prior losses.

This conceptualization is depicted in the right-hand side of Figure 4, in which the effort-based reference shifts occur to the right of the sure-small reward (i.e., $s = r_{E3} < r_{E4} < r_{E5}$). In this case, increasing the reference point leads to two consistent effects, namely loss aversion and diminishing sensitivity of the gain and loss functions; both of these effects enhance the value of the large-uncertain reward relative to the sure-small reward.

The discussion leads to the following hypothesis:

**H4:** The preference for the sure-small reward relative to the large-uncertain reward is an inverse U-function of the required effort level.

This prediction, of course, does not mean that once the expectation exceeds the sure-small reward higher effort will always enhance the relative share of the larger reward, considering that greater effort requirements can lead at some point to heightened expectations that overshadow even the larger reward (see Appendix A, proposition 2) and can eliminate participation in the program (see also Dhar 1997; Dhar and Simonson 2002). Next, two studies are described that were designed to test H4 by systematically increasing the level of required effort and eliciting reward choices with real consequences.
STUDY 4: THE CURVILINEAR EFFECT OF EFFORT ON REWARD PREFERENCES ---
THE ONLINE MUSIC PROGRAM

Method

The participants in the study were 161 students at a large East Coast university, recruited outside of the main university library. Participants were informed that a group of MBA students were launching a new online (Internet) music site that would reward users for reviewing and rating songs and would provide free news and information about concerts and other music events. Participants were asked to complete a questionnaire that was described as part of an effort to determine the best rewards for the music website.

Participants were randomly assigned to one of four conditions. Three (effort) conditions involved reviewing and rating (5, 30, or 70) songs over the Internet. In these three conditions, completion of the required effort would earn a choice between two rewards, either a free music CD of the participants choice (a sure-small reward) or a free entry into a lottery with a one in a thirty chance to win a portable MP3-CD player (a large-uncertain reward). The fourth condition did not involve any effort, but rather a choice between two (effort-free) rewards (described above) that were part of a free promotion. In all four conditions, respondents were also given the option of not choosing either reward (and not participating in the FP or promotion). The information provided to participants about the music website was held constant across the four conditions.

After making their choice, participants were given an additional page on which they rated the degree to which attaining the reward involved effort for them, using an eleven-point scale ranging from (0) “No effort at all” to (10) “Very high effort.” These ratings served as a check for the effort manipulation.

Results

Participants’ effort ratings confirmed that the manipulation affected perceived effort in the expected direction. Specifically, the mean perceived effort rating strictly increased with the
number of required song ratings, with each requirement condition perceived as significantly more effortful than the adjacent lower effort condition (see Table 1).

Table 1: Perceived Effort Ratings as a Function of Effort Requirements in the Online Music Program

<table>
<thead>
<tr>
<th># of Required Song Ratings</th>
<th>Mean Perceived Effort Rating</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.3</td>
<td>.34</td>
<td>2.7</td>
</tr>
<tr>
<td>5</td>
<td>4.3</td>
<td>.36</td>
<td>3.6</td>
</tr>
<tr>
<td>30</td>
<td>5.6</td>
<td>.32</td>
<td>5.0</td>
</tr>
<tr>
<td>70</td>
<td>6.4</td>
<td>.32</td>
<td>5.8</td>
</tr>
</tbody>
</table>

A logistic regression was used to test hypothesis 4, which predicts that the preference for the sure-small reward over the large-uncertain reward will be an inverse U-function of the required effort level. The (dummy) dependent variable received a value of 1 [0] if the sure-small [large-uncertain] reward was chosen. The independent variables included the effort requirement level (0, 5, 30, or 70 song ratings) and a (mean centered) quadratic effort term. As predicted by hypothesis 4, the quadratic term was statistically significant and in the hypothesized direction (wald-\(\chi^2 = 5.2; p < .05\)), indicating a significant curvilinear effect of effort. Specifically, in the no effort condition, the relative choice share of the sure-small reward was 60% (24 out of 40 participants), whereas in the five, thirty, and seventy song ratings (effort) conditions, the relative share of this reward increased to 88% (29/33), but then decreased to 84% (36/43) and 65% (28/43), respectively (see Figure 5).

To further examine the relationship between the construct of effort and reward preferences, a logistic regression was used in which the independent variables were the eleven-point perceived effort ratings and a (mean centered) quadratic perceived effort term. Consistent with hypothesis 4, the quadratic perceived effort term was statistically significant and in the hypothesized direction (wald-\(\chi^2 = 4.1; p < .05\)), indicating that the share of the sure-small reward was an inverse U-function of the perceived effort ratings.

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8 Wald \(\chi^2\) is the statistical test used in logistic regressions throughout the article.
The results of the previous study supported the hypothesis that effort has a curvilinear effect on the preference for sure-small over large-uncertain rewards. However, only a limited number of effort levels were used. Accordingly, the present study was designed to allow for a stronger test of the inverse-U hypothesis by employing a greater number of effort levels (i.e., seven). In addition, a process measure was used to investigate more directly the notion that higher effort requirements increase consumers’ reward expectations.

The current study was also used to examine the effect of a systematic manipulation of whether the rewards are the primary or secondary motivation for engaging in the effort activity. Specifically, when consumers are directly compensated (e.g., with substantial monetary payments) for their efforts, the expectation of additional extrinsic reward is likely to be attenuated. In such cases, consumers are predicted to be less averse to the possibility of not receiving a FP reward.

Method

The participants in the study were 465 travelers, who were waiting for trains at sitting areas in a major train station. Participants were informed that the business school (of a large East Coast university) was implementing a program in which people complete short surveys online in return for rewards. Participants were asked to complete a questionnaire that was described as
part of an effort to determine the best reward for the program.

Participants were randomly assigned to one of seven conditions. Five (effort) conditions involved completing (3, 5, 8, 10, or 15) surveys over the Internet (each survey was described as taking about 5 minutes to answer). In these five conditions, completion of the required effort would earn a choice between two rewards, either two movie tickets (a sure-small reward) or an entry into a lottery with a one in a thirty chance to win eighty movie tickets (a large-uncertain reward). A sixth condition did not involve any effort, but rather a choice between the two rewards as part of a free promotion. A seventh condition was designed to test the prediction that reward expectations are attenuated when consumers have another primary motivation for engaging in the required efforts. This condition was identical to the five-survey condition mentioned earlier, except that completing each survey earned $50 (a total of $250 for five surveys). Completion of the five surveys also earned a choice between the two rewards discussed above. It was expected that the preference for the sure-small reward would be stronger when no ($50) monetary compensation was given on a per survey basis. In all seven conditions, respondents were also given the option of not choosing a reward. The information provided about the program was held constant across the seven conditions.

After making their choice, participants were asked to indicate whether or not each of the two rewards was sufficiently large. The binary (yes/no) responses served as a measure for participants’ reward expectations. It was expected that greater effort requirements would decrease the share of participants for whom two movie tickets would suffice, but would have no effect regarding the eighty movie tickets (assuming these 80 tickets are guaranteed). Participants also rated the degree to which attaining the reward involved effort for them, using the eleven-point perceived effort scale discussed earlier.

Results

Participants’ effort ratings confirmed that the manipulation affected the perceived effort in the expected direction. Specifically, a planned contrast indicated a significant linear trend in
the mean perceived effort rating as a function of higher number of required surveys ($p < .01$; see Table 2). Moreover, as expected, the share of participants who indicated that the sure-small reward was sufficient decreased with both the number of required online surveys (see Table 2) and with the perceived effort ratings ($\text{wald-}\chi^2 = 18.9, p < .001$; and $\text{wald-}\chi^2 = 26.3, p < .001$; respectively). It is noteworthy that there was no curvilinear effect of required surveys or perceived effort on the tendency to view the sure-small reward as sufficient. Further, as expected, the percentage of participants who indicated that the large-uncertain reward was sufficient remained high (over 80%) across all requirement conditions. These results suggest that higher required efforts increased consumers’ reward expectations (and reference points) for evaluating the program rewards. Consequently, greater effort requirements increased the chances that the sure-small reward would not suffice as a compensation, whereas the uncertain reward was apparently large enough to satisfy the reward expectations of most consumers across the range of effort requirements.

Table 2: Perceived Effort Ratings and Reward Satisfaction as a Function of Effort Requirements in the Online Survey Program

<table>
<thead>
<tr>
<th># of Required Surveys</th>
<th>Mean Perceived Effort Rating (0-10)</th>
<th>Percent Satisfied with Sure-Small Reward</th>
<th>Percent Satisfied with Large-Uncertain Reward</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.3</td>
<td>76%</td>
<td>92%</td>
</tr>
<tr>
<td>3</td>
<td>4.4</td>
<td>62%</td>
<td>84%</td>
</tr>
<tr>
<td>5</td>
<td>4.6</td>
<td>62%</td>
<td>83%</td>
</tr>
<tr>
<td>8</td>
<td>4.7</td>
<td>55%</td>
<td>85%</td>
</tr>
<tr>
<td>10</td>
<td>4.9</td>
<td>54%</td>
<td>83%</td>
</tr>
<tr>
<td>15</td>
<td>5.4</td>
<td>38%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Hypothesis 4, which predicts an inverse-U effect of effort on the preference for the sure-small reward, was tested using a logistic regression; the independent variables included the effort requirement level (0, 3, 5, 8, 10, or 15 online surveys) and a (mean centered) quadratic effort term. Consistent with hypothesis 4, the quadratic term was statistically significant and in the hypothesized direction ($\text{wald-}\chi^2 = 4.1; p < .05$), indicating a significant curvilinear effect of effort. In particular, in the no-effort condition, the relative choice share of the sure-small reward was 69% (47 out of 68 participants), whereas in the three and five online surveys (effort)
conditions the share of this reward increased to 79% (42/53) and 84% (42/50), respectively. However, when the effort requirements were further raised to eight, ten, and fifteen online surveys, the relative share of the sure-small reward declined to 80% (47/59), 71% (47/66), and 67% (34/51), respectively (see Figure 6).

Figure 6: The Curvilinear Effect of Effort Requirements on Preference for Sure-Small over Large-Uncertain Rewards --- The Online Survey Program

To further examine the relationship between the effort construct and consumers’ reward preferences, a logistic regression was used in which the independent variables were the eleven-point perceived effort ratings and a (mean centered) quadratic perceived effort term. Consistent with hypothesis 4, the quadratic perceived effort term was statistically significant and in the hypothesized direction (wald-$\chi^2 = 3.9; p < .05$), indicating that the share of the sure-small reward was an inverse U-function of the perceived effort.

The results also supported the prediction that the preference for the sure-small reward would be weaker when completing (five) surveys is linked to a direct ($50 per survey) monetary compensation. Specifically, whereas 84% of participants in the five survey condition chose the sure-small over the large-uncertain reward, only 62% (34/55) chose the certain reward when completion of the five surveys also earned $250 ($= 2.7; p < .005$). Apparently, when consumers have a primary motivation for engaging in the efforts, the expectation of (additional) FP rewards is attenuated, thereby increasing the tolerance of risk.
The Curvilinear Relationship between Effort and Preference for Sure-Small Rewards: Discussion

Building on the notion that greater effort requirements increase the expectation of reward, thereby inducing a shift in the reference used to evaluate the actual program rewards (assumptions 1 and 2), it was predicted that effort would have a curvilinear effect on the preference for sure-small over large-uncertain rewards. Specifically, as long as the sure-small reward is sufficient relative to consumers’ reward expectations, a higher reference point means that the considerable possibility (inherent in the large-uncertain reward) of not receiving any compensation would be coded as a greater (aversive) loss. Therefore, the attraction of the sure-small reward, which eliminates the possibility of such a perceived loss, was predicted to increase with greater effort requirements. However, the effect of effort was expected to reverse once consumers’ perceived the sure-small reward as insufficient relative to the effort-contingent expectation. In such a case, the large-uncertain reward offers the possibility of escaping the increasing certain loss (i.e., due to higher effort) inherent in the sure-small reward. Appendix A provides a formal proof of the curvilinear effect of effort based on this conceptualization and assumptions 1 and 2.

The empirical evidence provides strong support for the inverted-U hypothesis. In particular, the results of two studies that elicited FP choices with real consequences demonstrated that greater effort requirements had a curvilinear effect on the preference for reward certainty. Process measures supported the notion that the mechanism underlying this effect is the effort-induced shifts in the reward expectations. In particular, the results of the online survey study showed that greater effort requirements (and perceived effort) had a negative linear effect on the likelihood of perceiving the sure-small reward as sufficient. The choice explanations (from Studies 1 and 2) are also consistent with the conceptual framework.

THE IMPACT OF EFFORT ON THE SENSITIVITY TOWARD THE MAGNITUDE OF SURE REWARDS

So far, we have focused on consumer choice in situations that involved a tradeoff between the certainty and magnitude of rewards. Furthermore, the preceding analysis relied on
the requirement that the probability of winning the large-uncertain reward (given completion of the effort stream) was low (i.e., lower than 50%). However, in many situations, the decision facing consumers is not which of two rewards to choose, but whether to enroll in a FP that offers a (sure) reward of a particular size (see also Hsee and Leclerc 1998; Nowlis and Simonson 1997).

In this section, we consider how effort influences consumer response to programs that offer sure rewards of different magnitudes. It is first shown that consumers should (normatively) care less about the magnitude of the reward when the required effort is high, because higher efforts imply lower probabilities of completing the program and reaching the reward. Accordingly, it is demonstrated that, when the reward contingency is explicitly stated in terms of the probability of complying with the effort requirements, lower compliance probabilities (corresponding to higher effort requirements) decrease the sensitivity toward the magnitude of the reward. However, it is then shown that the proposed (descriptive) theory of effort-dependent reward preferences predicts opposite results. Specifically, when reward contingencies are restated using effort, higher effort requirements (i.e., lower compliance probabilities) increase the sensitivity toward the magnitude of the reward.

The question, then, is whether and how effort affects consumers’ sensitivity (and responsiveness) to bigger rewards. To answer this question from a normative perspective, let us contrast a FP that offers a reward \( x \) after every twenty purchases versus a corresponding FP that offers the same reward \( x \) after every ten purchases. Note that for every \( x \) earned in the former, more challenging program, consumers can earn \( 2^x \) in the latter FP. Therefore, the impact of increasing the reward magnitude to \( x+\Delta \) from \( x \) is magnified in the case of the easier program. For instance, after the enhancement of the reward, a consumer who would earn \( x+\Delta \) in the difficult FP could earn \( 2^x + 2^\Delta \) in the more lenient program (i.e., an increase of \( 2^\Delta \) rather than just \( \Delta \)). Thus, consumers’ sensitivity to larger rewards should increase with lower efforts because rewards will be earned more frequently.

\[ \text{It is easy to verify that an increase of } \Delta \text{ in the reward magnitude would translate into an increase of at least } 2^\Delta \text{ when the requirements are decreased by 50% and assuming the consumer would earn the reward at least once in the} \]
Restated in probabilistic terms, the lower the required effort, the more likely consumers are to reach the program reward, and therefore, the size of this reward should be more consequential to them. A study was conducted to test whether consumers follow this simple rule of expected utility theory (von Neumann and Morgenstern 1947) using an actual “frequent sandwich” program. There were two main effort conditions (manipulated between-subjects) in this program, completing either ten or twenty sandwich purchases (low versus high required effort, respectively). These two effort conditions were further crossed (between-subjects) with two possible rewards, either one free sandwich or two free sandwiches (small versus large reward, respectively). Thus, in total, there were four between-subjects conditions in this frequent sandwich program.

The results indicated that participants’ median estimate of their probability of completing the program (and reaching the reward) was 90% in the ten sandwiches condition, compared to 50% in the more effortful twenty sandwiches condition (the magnitude of the reward did not affect these probability estimates). A different group of participants (sampled from the same population; n = 180) was then randomly assigned to one of four new conditions of an equivalent frequent sandwich program. In this new program, the number of sandwich purchases required to earn the reward (i.e., the level of effort) was not explicitly mentioned, but instead, the median estimated probability of reaching the reward (90% vs. 50%) was provided. These two main conditions were crossed with the two possible reward magnitudes (one sandwich vs. two sandwiches). Participants were asked to indicate whether or not they would join the program (which required paying a one-time membership fee of $2). Participants were also asked to rate the likelihood that they would join this program on an eleven-point scale ranging from “Very Unlikely to Join this program” (-5) to “Very Likely to Join this program” (5). It is important to note that an increase of \( \Delta \) in the reward magnitude could actually mean an increase of more than 2*\( \Delta \) when requirements are halved, because a consumer may exert enough effort to reach the higher threshold \( n \) times, which could mean reaching the lower threshold more than 2*\( n \) times (e.g., in the above scenario, a consumer who made 30 purchases would obtain three vs. one units of \( x \) in the low vs. high requirements FP, respectively).
note that the two versions of the frequent sandwich program were identical in all aspects, except that in one the reward contingency was stated in terms of effort (i.e., number of required sandwich purchases), whereas in the other this contingency was stated in probabilistic terms (i.e., probability of complying with the corresponding requirement level).

The results obtained using the (explicitly) probabilistic version of the frequent sandwich program indicated that participants’ decisions were consistent with expected utility theory. Specifically, when the probability of complying with the program requirements and reaching the reward was explicitly stated as 90%, increasing the reward from one to two free sandwiches led to a statistically significant increase of 19% in the share of participants who chose to join the program (64% vs. 83%; \( t = 2.0; p < .05 \)). Conversely, when the provided probability of complying with the requirements was only 50%, increasing the magnitude of the reward led to an increase of only 4% in the share of participants who chose to join the program (62% vs. 66%; \( t = .4; p > .1 \)). A similar pattern of results emerged for the eleven-point joining likelihood dependent variable. In particular, when the stated probability of earning the reward was 90% (high explicit probability), greater reward magnitude led to a significantly higher rated likelihood of joining (\( M = 1.2 \) vs. \( M = 2.4; t = 1.8; p < .05 \)). By contrast, when the probability of earning the reward was only 50% (low explicit probability), a larger reward did not lead to a higher likelihood of joining (\( M = 0.9 \) vs. \( M = 0.8; t = 0.2; p > .1 \)).

As predicted by expected utility theory, these (unsurprising) results demonstrated that a higher compliance probability led to a greater positive impact of reward magnitude on the decision to join the program. That is, if consumers are presented with the explicit probability of earning a reward, then they are more sensitive toward the magnitude of this reward when they are more likely to attain it. It is noteworthy that a sub-sample of participants, who were asked to indicate how many sandwich purchases they thought were required by the program, estimated that the low probability (50%) program required purchasing more sandwiches than did the high probability (90%) program (modes = 20 vs. 10; medians = 15 vs. 10). Thus, consumers realize that higher [lower] probabilities of compliance imply lower [greater] effort requirements.
Nevertheless, consumers may behave quite differently when the reward contingency is explicitly stated in terms of effort (e.g., required purchases) instead of compliance probability. Psychologically, consumers may follow the intuition conveyed in the saying “never look a gift horse in the mouth” (Saint Jerome, On the Epistle to the Ephesians). In other words, when the required efforts are low, consumers may feel that the size of the reward is not particularly important. As the requirements increase, however, consumers are likely to experience a greater urge to justify their efforts, thus forming higher reward expectations. These heightened expectations, in turn, lead to a reference shift and an increase in the sensitivity to larger rewards.

This prediction is incorporated in Figure 4, which illustrates effort-contingent reward valuations (based on assumptions 1 and 2). Specifically, when the small award satisfies the reward expectation, the concavity of the gain function implies that increasing the reference point will enhance the difference between the perceived values of the (sure) large ($l$) and small ($s$) rewards [e.g., $v_{E2}(l) - v_{E2}(s) > v_{E1}(l) - v_{E1}(s)$]. Further, when the expectation exceeds the small reward, both concavity of the gain function and loss aversion magnify the difference between the perceived values of $l$ and $s$ [e.g., $v_{E4}(l) - v_{E4}(s) > v_{E3}(l) - v_{E3}(s)$]. Interested readers are referred to Appendix A (proposition 3) for a formal proof of this proposition. The discussion leads to the following interaction hypothesis:

**H5**: Higher required efforts will enhance the positive impact of larger (sure) rewards on the likelihood of joining frequency programs.

Next, hypothesis 5 is tested in the context of an actual FP with real potential consequences.

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10 It is important to note that, due to the diminishing sensitivity of the loss function, this analysis holds only within a reasonable empirical range of effort requirements (see Appendix A, proposition 3 for further details). Further, at very high effort levels, it is expected that incremental effort will have no effect on the relative value of rewards (i.e., most consumers will simply not consider the program and any rewards it may provide).
STUDY 6: THE IMPACT OF EFFORT ON SENSITIVITY TOWARD THE MAGNITUDE OF REWARDS

Method

The participants were 349 students at a large East Coast university who were recruited at on-campus food courts and library lounges. Participants were informed that there was a plan under consideration to start a “frequent sandwich” program that would reward students for their patronage at the various dining locations on the university campus. Participants were asked to complete a questionnaire that was described as part of an effort to determine the level of interest in such a program and whether it should be launched.

Participants were randomly assigned to one of four conditions in a 2 (effort requirement level: low vs. high) x 2 (reward magnitude: small vs. large) between-subjects design. All participants were told that they would be required to pay a one-time membership fee of $2 and carry a “Frequent Sandwich Card” that would be used for tracking their purchases. The low requirements condition involved buying ten sandwiches at any on-campus dining location, whereas the high requirements condition involved buying twenty sandwiches. In both conditions, completion of the required effort would earn either one or two free sandwiches (small vs. large reward, respectively). Figure 7 presents the “Frequent Sandwich Card” shown to participants in the low effort, small reward condition.

Figure 7: Frequent Sandwich Program Card (Low Effort, Small Reward Condition)

Frequent Sandwich Program
After every ten sandwiches you buy (at any on-campus cafeteria or dining location), you will earn one free sandwich (good at any on-campus cafeteria and dining location). --- see program card below ---

sandwich Plus
BUY 10 SANDWICHES AT ANY [UNIVERSITY] RESTAURANT AND EARN ONE FREE SANDWICH

One stamp per visit, per customer
Participants were asked to indicate whether or not they would join the program. They were also asked to rate their likelihood of joining using the eleven-point scale described earlier. Next, participants were asked to indicate how likely they thought they would be to complete the sandwich purchases required by the program (assuming they actually joined) by indicating a number between 0% and 100%. In addition, as a check for the effort manipulation, participants were asked to rate how difficult or easy it would be for them to complete the required sandwich purchases at on-campus restaurants. Ratings were made on a seven-point scale ranging from “Very difficult for me” (1) to “Very easy for me” (7).

Results

The manipulation affected the perceived effort in the expected direction. Specifically, participants perceived the program as significantly more difficult when the required effort level was increased to twenty from ten sandwich purchases ($\bar{X} = 3.8$ vs. $\bar{X} = 4.7$, $t = 4.0$; $df = 347$; $p < .001$). More importantly, consistent with hypothesis 5, the interaction between the level of effort and the magnitude of the reward on the decision to join the program was statistically significant and in the hypothesized direction ($t = 1.8$; $p < .05$). Specifically, when the program required making twenty sandwich purchases (high effort), increasing the reward magnitude from one to two free sandwiches led to a significantly higher share of participants who chose to join the program (40% vs. 56%; $t = 2.2$; $p < .05$). Conversely, when the program required making only ten sandwich purchases (low effort), increasing the reward did not lead to a higher rate of joining (67% vs. 64%; $t = .3$; $p > .1$).

A similar pattern of results emerged for the eleven-point joining likelihood dependent variable. In particular, consistent with hypothesis 5, there was a marginally significant interaction between the level of effort and the reward magnitude ($F = 3.6$; $df = 1$; $p < .06$). In the high effort requirement condition, a larger reward led to a significantly higher rated likelihood of joining ($M = -0.6$ vs. $M = 0.4$; $t = 2.0$; $p < .05$), whereas in the low effort condition, a larger reward did not lead to a higher likelihood of joining ($M = 1.4$ vs. $M = 1.1$; $t = .6$; $p > .1$).
Finally, as reported previously, participants recognized that they were less likely to comply with the program requirements and obtain the reward when the required effort was high as opposed to low. Specifically, participants’ median estimate of their probability of completing the program (and reaching the reward) was 90% in the ten sandwiches condition, compared to 50% in the more effortful twenty sandwiches condition (means = 73% vs. 53%, respectively). Accordingly, there was a significant negative main effect of effort on the estimated compliance probability ($F = 25.2; \text{df} = 1; p < .001$), but no main effect of reward magnitude or interaction between the level of effort and the magnitude of reward (both $p$’s > .4).

The Impact of Effort on the Sensitivity toward the Magnitude of Sure Rewards: Discussion

The frequent sandwich study investigated the impact of effort on consumers’ response to the magnitude of sure rewards in the context of an actual frequency program with real potential consequences. Consistent with the notion of effort-contingent reward preferences, participants who faced high effort requirements were more sensitive toward the magnitude of the program’s reward than were those who evaluated the lower effort program. Apparently, higher program requirements create a greater need to justify the efforts and increase the reward expectation, thus sensitizing consumers to the size of the reward.

Indeed, one might argue that evaluating rewards more carefully when they require greater effort is a reasonable heuristic that reflects a cost-benefit analysis of efforts and rewards. Whereas low effort programs allow consumers to clearly benefit from participating, difficult programs require a more careful assessment of reward versus effort to determine the utility of joining. Yet, if consumers are systematically more sensitive toward the magnitude of rewards when the required effort is higher, as demonstrated in the frequent sandwich study, then their preferences violate a common sense principle of expected utility theory. Specifically, because higher effort requirements are less likely to be fulfilled, as indicated by consumers’ own probability estimates, the rewards contingent on such high efforts are less consequential. Indeed, when participants’ own probability estimates of complying with the program were used as the
explicit reward contingency, participants were more responsive to the reward magnitude when this probability was high rather than low. Thus, the framing of reward contingencies using effort versus the equivalent probability of compliance leads to diametrically opposed interaction effects between the contingency level and the reward size.

These results were replicated in eight additional (hypothetical) frequency programs (e.g., gas station FP, bloomingdale’s store FP), using variations of the experimental design and the manipulations, including two tests in which the reward magnitude was manipulated within-subjects (see Appendix C). For example, the results of the credit card FP \( n = 386 \) indicated that there was a significant interaction between the level of effort and the reward magnitude \( F = 4.2; df = 1; p < .05 \) on the likelihood of joining the program [rated on an eleven-point scale ranging from “Very Unlikely to Join” (0) to “Very Likely to Join” (10)]. While in the high effort condition (accumulating $20,000 of charges on the card) increasing the reward from one to two free nights at Marriott led to a significantly higher likelihood of joining \( M = 2.0 \) vs. \( M = 3.8; t = 4.6; p < .001 \), in the low effort condition ($10,000 of charges), increasing the reward did not lead to a significantly higher likelihood of joining \( M = 3.4 \) vs. \( M = 3.9; t = 1.1; p > .1 \). A second group of respondents (sampled from the same population; \( n = 291 \)) were then randomly assigned to one of the four conditions of the same credit card FP, but instead of rating their joining likelihood, they estimated the probability that they would complete the program and earn the reward (assuming they actually joined). The median estimated compliance probability in the high effort condition was 10%, compared to 40% in the low effort condition (the magnitude of the reward did not affect these probability estimates).

These median estimated compliance probabilities were used to design a corresponding credit card lottery. A third group of respondents (sampled from the same population; \( n = 199 \)) was randomly assigned to one of four conditions of this lottery in a 2 (probability of winning reward: low vs. high) x 2 (reward magnitude: small vs. large) between-subjects design. Respondents were asked to rate the likelihood that they would purchase the lottery ticket for $4 [using an eleven-point scale ranging from “Very unlikely to purchase” (0) to “Very likely to
purchase” (10)]. The results of this lottery were diametrically opposed to those of the corresponding FP. Specifically, when the chances of winning the reward were 40% (corresponding to the low effort FP version), increasing the reward led to a significantly higher likelihood of purchasing the lottery ticket ($M = 3.2$ vs. $M = 4.7$; $t = 2.1$; $p < .05$), whereas when the winning chances were only 10% (corresponding to the high effort FP version), increasing the reward did not affect the purchase likelihood ($M = 3.5$ vs. $M = 3.8$; $t = .3$; $p > .1$). Thus, in summary, the evidence provides strong support for the basic proposition that greater effort requirements lead to higher reward expectations and therefore to increased sensitivity toward the magnitude of sure rewards, even though this leads to sub-optimal decisions.

**GENERAL DISCUSSION**

The fruits of effort often vary in terms of their likelihood and size. A fundamental question, then, is what determines preferences toward the certainty and magnitude of effort-contingent rewards. The present paper investigates this question in the context of FPs, which have been widely adopted by companies and have received a great deal of attention from marketers, consultants, and, to a lesser degree, academics. Two simple assumptions are made: (1) effort leads to reward expectations, and (2) the valuation of actual rewards vis-à-vis the expectation is consistent with the value function. The conjunction of these two assumptions is shown to provide a parsimonious and unifying theory that predicts a wide range of findings regarding the impact of effort on preferences toward the magnitude and certainty of rewards. This section briefly reviews the key results and discusses their theoretical and practical implications for FPs and other types of incentive systems.

**Key Findings and Theoretical Implications**

*Review of Key Findings.* A series of studies, involving both real and hypothetical decisions, demonstrated that the required effort stream influences consumers’ tradeoffs between the certainty and magnitude of rewards. Specifically, it was shown that (a) the presence (as
opposed to absence) of effort requirements increases consumer preference for sure-small rewards over large-uncertain rewards (Study 1), and (b) when required efforts are further increased the preference for sure-small rewards reverses; that is, the preference for sure-small rewards over large-uncertain rewards is an inverse U-function of the effort level (Studies 4 and 5). These results were predicted based on the conjunction of the two simple assumptions mentioned above.

Process measures, including analyses of choice explanations and satisfaction with rewards, provided support for the idea that reward choices are motivated by effort-contingent expectations. Moreover, a key test of the conceptual framework involved examining the impact of intrinsic motivation on reward preferences. It was posited that intrinsic motivation decreases the expectation of extrinsic reinforcement, thus attenuating the impact of effort on FP reward preferences. Consistent with this analysis, Study 2 demonstrated that individuals with high versus low intrinsic interest in the required effort activity (e.g., “math lovers” vs. “math haters”) were less likely to choose a sure-small reward over a large-uncertain reward. Study 3 further tested this account by manipulating rather than measuring participants’ intrinsic motivation. And, as expected, the results demonstrated that the positive impact of effort (compared to a no-effort condition) on the relative preference for sure-small rewards was weaker for an effort activity that was intrinsically motivating (enjoyable) than for a similar activity that was not motivating. Combined, these findings demonstrate that the nature of the required earning activity is an important determinant of consumer choice under risk.

The conceptual framework also led to the prediction that greater effort requirements will increase the positive impact of (or sensitivity to) larger rewards. This hypothesis was supported in Study 6 (frequent sandwich program), which used decisions with real consequences, as well as in a series of eight hypothetical programs. These tests show that consumers disregard the probability (and frequency) of earning the reward, and rather follow a mental utility model in which the benefit of larger rewards increases with greater effort. It is important to note that consumers recognize that higher efforts imply a lower probability of earning the reward. Further, when reward contingencies were explicitly stated in terms of the probability of complying with
the program, consumers’ sensitivity toward the magnitude of rewards increased with higher probabilities (corresponding to lower required efforts). Future research can examine whether asking consumers to first assess their probability of reaching the reward debiases the impact of effort on the sensitivity to reward magnitude.

**Antecedents of Effort-induced Reward Expectations.** The notion that consumers’ choice of rewards is contingent on the level and type of required effort can be seen as another illustration of the construction of preferences (e.g., Bettman, Luce, and Payne 1998; Payne, Bettman, and Johnson 1992). Here, consumers appear to evaluate rewards relative to an effort-induced reward expectation that serves as a malleable reference point. This conceptualization is related to a growing body of diverse research on the reference- and context-dependence of consumer choice (e.g., Heath, Larrick, and Wu 1999; Hoch and Loewenstein 1991; Prelec and Loewenstein 1998; Simonson and Tversky 1992; Thaler 1985; Tversky and Kahneman 1991; Winer 1986). The present paper sheds lights on the important yet under-researched issue of how consumers construct reference points and highlights the key role of effort.

A question that naturally arises is what factors influence the degree to which effort requirements affect the reward expectation (or reference point). The present research has underscored one such moderator, namely the level of intrinsic motivation for engaging in the required effort activity. Specifically, higher intrinsic motivation weakens the expectation of extrinsic reward, and consequently, attenuates the effect of effort on reward choice. Relatedly, the expectation of FP rewards is likely to be lower when these rewards serve as the secondary rather than primary motivation for engaging in the effort stream. Support for this conjecture was found in Study 4 (online survey program), in which the preference for a sure-small over a large-uncertain reward was significantly lower when consumers received an additional direct compensation ($50/survey) for their efforts (completing five online surveys).

Moreover, some consumers may intrinsically value the effort activity so much that the effort requirements do not increase their reward expectations, but rather may even decrease them
(e.g., movie aficionados who are asked to preview and critique unreleased films). For these consumers, the effort requirements may lead to a “negative” reward expectation (i.e., a left shift in the neutral reference point), consequently enhancing their risk tolerance and decreasing their sensitivity to the magnitude of the program rewards. Essentially, a left-shift in the reference point implies that the prospect of no (FP) reward is still coded as a gain relative to the “negative” reward expectation. Consistent with this conceptualization, participants in the online survey program chose the large-uncertain reward more often when they were required to complete five surveys for an (exaggerated) fee of $250 than when they received an effort-free reward.

Future research can examine whether the framing of the program and its communications can lower the (reference) reward expectation, for example, by suggesting that consumers are lucky to be selected for an exclusive program. Relatedly, because extrinsic rewards may distract consumers from their intrinsic motivations (e.g., Deci and Ryan 1985; Lepper 1981), consumers may be more likely to invest effort when no (extrinsic) reward is offered compared to when an inadequate (i.e., too small or unlikely) reward is provided. The antecedents and consequences of FP reward expectations raise a variety of other important and interesting conceptual questions relating to such issues as (1) whether obtaining the reward was the intention or rather an incidental byproduct of investing the effort; (2) whether the choice of reward is performed before or after complying with the effort requirements; and (3) the nature of the required effort stream (e.g., luxury vs. necessity consumption).

**Practical Implications**

Beyond the theoretical significance of understanding the impact of effort on preferences toward the certainty and magnitude of rewards, this issue has important practical implications for frequency programs and other types of incentive systems. The advent of the Internet and other new technologies (e.g., CRM software; smart cards) has led to a proliferation of programs that reward consumers for the investment of various efforts, including reviewing products, completing surveys, shopping, exercising, and much more. These myriad FPs offer different
types and magnitudes of rewards, including uncertain ones. Nevertheless, as several FP experts have argued, many of these programs are structured with a limited understanding of consumer preference (e.g., Barlow 1999; O’Brien and Jones 1995). Indeed, whereas some programs have been highly successful (e.g., frequent flier programs), others have been resounding failures (see, e.g., Barlow 1999). Although a complete understanding of the determinants of FP success requires a great deal of additional study, the present research provides insights regarding the matching of efforts with rewards and the design, promotion, and targeting of FPs.

With respect to the design of FPs, the findings imply that, as the level of program requirements increases, marketers should vary (in a non-linear way) the relative share of sure-small versus large uncertain rewards in their “reward mix.” Marketers can also offer simultaneously two or more FPs, with either deterministic of stochastic reward systems and different levels of program requirements. Furthermore, a straightforward implication of the present research is that when the effort activity is not inherently motivating, marketers should refrain from relying solely on probabilistic reward systems. Indeed, even the Internet portal iWon, famous for its use of sweepstakes entries as an incentive for website browsing, has recently extended its program by also offering points that are redeemable for sure rewards.

The findings of this research provide some general guidelines regarding the manner in which FPs can be promoted. For example, by emphasizing the intrinsic value of the effort activity and the secondary role of the program rewards, marketers may be able to reduce the program’s funding rate (the reward-to-effort ratio), without a significant drop in participation rates. Although existing FPs do not permit a rigorous test of this implication, there are indications that various programs were able to lower their funding rates by using related tactics, for instance, by stressing the pleasure of rating music (Moodlogic Inc.) or the benefits of voicing one’s opinions and learning how they compare with others’ opinions (HarrisPollOnline Rewards) over the extrinsic rewards of the program. Relatedly, FPs can increase the intrinsic motivation of participants (thus de-emphasizing the need for costly rewards) by providing identity-related
“soft” benefits (see, e.g., Lind and Tyler 1988) such as ranking and congratulating top members, fostering a sense of community, and/or treating members as unique, valuable individuals.

The findings of the present research also suggest bases for segmenting customers and customizing FPs to match their individual profile. In particular, marketers might offer customers different rewards (deterministic vs. stochastic; small vs. large) depending on the level and type of effort that they individually would have to expend to comply with the program requirements. Thus, for example, intrinsically motivated members for whom fulfilling the program requirements is enjoyable may participate in programs with uncertain rewards, whereas other customers must be enticed with sure (even if smaller) rewards. Furthermore, if marketers can obtain, through surveys or other means, information regarding the degree to which individual customers intrinsically value the effort activity, they could target their programs toward highly motivated individuals, thus allowing a reduction in the program’s funding rate and costs (assuming a representative sample of consumers is not required).

Finally, the present research may provide insights regarding other types of incentive systems, such as employment contracts, sales-force compensation plans, and even academic tenure tracks. For example, salespeople can often earn cash bonuses or non-monetary rewards for reaching a specific sales quota. Understanding the relationship between efforts and preferred rewards may improve the design of such bonus plans. Further, interestingly, the compensation structure of workers in intrinsically motivating professions (e.g., athletes, artists, politicians) is often stochastic, whereas that of laborers in low intrinsic motivation occupations is invariably deterministic (e.g., sanitary workers; prison guards). The extension of the present research to labor market psychology and economics is an interesting avenue for future research.

Let us conclude by noting the advice often given to junior professors – “just enjoy your research!” Indeed, given the uncertainty inherent in the outcome of the research process (e.g., publications and tenure), focusing on the intrinsic rewards of scholarship is a good way to reduce any possible perceptions of loss and disappointment due to insufficient extrinsic rewards.
Appendix A: Formal Proof of the Conceptual Framework

This appendix shows that the conjunction of two simple assumptions provides a unifying framework for the findings of the present paper regarding the impact of effort on reward preferences. The two assumptions are:

1. effort requirements create an expectation for reward (i.e., a reference point for evaluating the actual FP rewards), with higher requirements leading to greater expectations; and
2. the valuation of program rewards vis-à-vis the reward expectation (or reference point) follows the principles of prospect theory’s value function (i.e., reference-dependence, loss aversion, and diminishing sensitivity).

Thus, in the proceeding analyses, \( v_E(x) \) is the subjective value of outcome \( x \) given a reference point \( r_E \), where the reference point \( r_E \) (equivalent to the expected fair reward) increases with greater effort requirements \( E \).

Diminishing sensitivity implies that, for \( x > r_E \), \( v_E''(x) < 0 \), whereas for \( x < r_E \), \( v_E''(x) > 0 \). Further, following Tversky and Kahneman (1991), it is assumed that the value function exhibits constant loss aversion, captured by the loss aversion coefficient, \( \lambda \). Thus, the reference-dependent value function can be expressed as:

\[
v_E(x) \begin{cases} 
g(x - r_E) & \text{if } x \geq r_E \\
-\lambda g(r_E - x) & \text{if } x < r_E 
\end{cases}
\]

where \( g(0) = 0, g' > 0, g'' < 0, g''' \geq 0, \lambda > 1, \) and \( r_E \) increases in effort.\(^{[12]}\)

Proposition 1: As long as the sure-small reward satisfies the reward expectation (i.e., \( s \geq r_E \)), and the probability of winning the large-uncertain reward is reasonably low (i.e., \( p_l < \hat{p}_l \)), the preference for sure-small rewards over large-uncertain rewards will increase when the rewards are contingent on effort (\( r_E > 0 \)) compared to when the rewards are effort-free (\( r_E = 0 \)).

When \( \lambda = 2, \hat{p}_l = 0.5 \).

Note that the sure-small reward (S) is a riskless prospect that offers \( s \) with probability 1. Conversely, the large-uncertain reward (LU) yields outcome \( l \) with probability \( p_l \) (where \( p_l < p_r = 1 \) and \( l \geq r_E \)) and outcome 0 with probability \( 1-p_l \). Given a reference point \( r_E \), we have the following reward valuations (\( V \)):

\[
V(S|r_E) = g(s - r_E) \quad \text{versus} \quad V(LU|r_E) = p_l * g(l - r_E) - [\lambda * (1-p_l) * g(r_E)]
\]

For any pair of sure-small and large-uncertain rewards that satisfy the above conditions, we define the relative preference for (or advantage of) S over LU, given a reference point \( r_E \), as \( A(S,LU| r_E) \). Thus:

\[
A(S,LU| r_E) = V(S|r_E) - V(LU|r_E) = g(s - r_E) - p_l * g(l - r_E) + [\lambda * (1-p_l) * g(r_E)]
\]

11 I am indebted to Oleg Urminsky for his invaluable input and contribution to this proof.
12 The assumption that \( g''' \geq 0 \) (i.e., convexity of marginal utility) ensures non-increasing risk aversion (see Pratt 1964) and is consistent with a power function formulation for the value function, as proposed by Tversky and Kahneman (1992) and estimated in their and other studies (e.g., Camerer and Ho 1994; Donkers, Melenberg, and van Soest 2001; Wu and Gonzalez 1996).
13 In this and the subsequent analyses, consumers are assumed to adopt the explicit probabilities (i.e., \( p \)) stated for the various rewards. Replacing these probabilities with prospect theory’s decision weights [i.e., \( \pi(p) \)] does not alter the nature or conclusions of the analyses.
14 The relative advantage of S over LU (i.e., \( A \)), which equals the difference in their utilities, can be used to compute the probability of choosing S over LU by employing a “single-agent stochastic choice model” (see Camerer and Ho 1994). Such a model assumes a single preference structure for all consumers (the deterministic component of utility), and an additional random utility component that leads to variations in consumers’ choices (for further details see Camerer and Ho 1994).
We wish to examine the impact on $A(S,LU \mid r_E)$ of increasing the reference point from zero to $r_E > 0$ (i.e., making the rewards contingent on effort $E$ rather than no effort). The change in the components of $A(S,LU \mid r_E)$ as the reference point shifts from 0 to $r_E$ (where $s \geq r_E > 0$) can be written as:

\[
\begin{align*}
\Delta g(s) &= g(s - r_E) - g(s - 0) = g(s - r_E) - g(s) < 0 \\
\Delta g(l) &= g(l - r_E) - g(l - 0) = g(l - r_E) - g(l) < 0 \\
\Delta g(r_E) &= g(r_E) - g(0) = g(r_E) > 0
\end{align*}
\]

Thus, the change in $A(S,LU \mid r_E)$ as the reference increases from zero to $r_E$ can be expressed as:

\[
\Delta A(S,LU \mid r_E) = A(S,LU \mid r_E) - A(S,LU \mid 0) = \Delta g(s) - p_l \Delta g(l) + [\lambda \Delta g(r_E)]
\]

It is proposed that there exists a $p_l$ such that $\Delta A(S,LU \mid r_E) > 0$ for all $p_l < p_l^*$. To identify $p_l^*$, we search for the smallest $p_l$ that satisfies the inequality: $\Delta A(S,LU \mid r_E) > 0$.

Solving for $p_l$, we get:

\[
\begin{align*}
\Delta g(s) - p_l \Delta g(l) + \lambda \Delta g(r_E) &> 0 \\
p_l \Delta g(l) + \lambda \Delta g(r_E) &< \Delta g(s)
\end{align*}
\]

Because $g$ is strictly concave and $g(0) = 0$, $g(s - r_E) > g(s) > g(l - r_E) > g(l)$ [see Lemma 1 below]. Therefore, $\Delta g(s) > \lambda \Delta g(r_E) > 0$ and $\Delta g(l) + \lambda \Delta g(r_E) > 0$ whenever $\lambda > 1$. Since both terms are positive, the inequality can be rewritten as:

\[
p_l < \frac{\Delta g(s) + \lambda \Delta g(r_E)}{\Delta g(l) + \lambda \Delta g(r_E)}
\]

Thus, we are searching for $p_l^* = \text{Min} \{\Delta g(s) + \lambda \Delta g(r_E) / \Delta g(l) + \lambda \Delta g(r_E)\}$. This $p_l^*$ is minimized when $\Delta g(s) < 0$ is at its minimum and $\Delta g(l) < 0$ is at its maximum. By definition, $\text{Min} \Delta g(s) = \text{Min} \{g(s - r_E) - g(s)\}$. We have noted above that, because $g$ is strictly concave and $g(0) = 0$, $g(s - r_E) > g(s)$, and therefore, $g(s - r_E) - g(s) > -g(r_E)$. Thus, $\text{Min} \Delta g(s) = -g(r_E)$. The maximum of $\Delta g(l)$ is less than zero, since $\Delta g(l) = g(l - r_E) - g(l) < 0$. Therefore:

\[
p_l < \min \left\{ -g(r_E) + \lambda \Delta g(r_E) / [0 + \lambda \Delta g(r_E)] = (\lambda - 1) / \lambda \right\}
\]

Thus, $p_l^* = (\lambda - 1) / \lambda$, and consequently, for all $p_l < p_l^*$, $\Delta A > 0$.

Moreover, based on empirical evidence (e.g., Heath et al. 1999; Kahneman, Knetsch, and Thaler 1990; Tversky and Kahneman 1991, 1992), it is assumed that $\lambda \geq 2$. In the specific case, $\lambda = 2$, we have $p_l^* = .5$. 

---

*Note: This text is a simplified representation of the content from the provided image. The equations and inequalities are simplified for clarity and may not fully capture the complexity of the original text.*
Proposition 2: Assuming $\lambda \geq 2$ and $p_1 < 0.5$, there exist $r^* < r^{**}$ (where $s/2 < r^* \leq s$), such that:

(Hypothesis 4)

- When $0 \leq r_E < r^*$, $\frac{\partial A}{\partial r_E} > 0$.
- When $r^* < r_E$, $\frac{\partial A}{\partial r_E} < 0$ (for all $r_E < r^{**}$).

Equivalently, as long as $r_E < r^{**}$, the advantage $A(S,L,U \mid r_E)$ is a curvilinear (i.e., inverse-U shape) function of the required effort level (or reference point, $r_E$), with a peak at $r^*$ (where $s/2 < r^* \leq s$).

Corollary 1: For any $p_1, r^{**} > (l + s) / 2 > s$.

Corollary 2: $r^{**}$ shifts to the right, toward $l$, as the probability $p_1$ decreases (where $0 < p_1 < 1$). Further, when $p_1 \to 0$, $r^{**} \to \infty$.

Proposition 2 is demonstrated in three steps. First, it is shown:

**Proposition 2a:** If $p_1 < \hat{p}_1$ [where $\hat{p}_1 = (\lambda - 1) / \lambda$], then $r^* > s/2$. When $\lambda = 2$, $\hat{p}_1 = 0.5$.

Consider $0 \leq r_E \leq s/2$. We want to show that in this range $A$ increases in $r_E$. This can be expressed as the partial derivative $A' = \frac{\partial A}{\partial r_E} > 0$. Thus, we want to show that:

$$A' = -g^*(s - r_E) + p_1(1-p_1)g'(r_E) > 0$$

Because $r_E \leq s/2$, $-g'(s - r_E) > g'(r_E)$. Therefore, we can write $g'(r_E) = b \cdot g'(s - r_E)$ where $b \geq 1$. Thus:

$$A' = -g^*(s - r_E) + p_1(1-p_1) \cdot b \cdot g'(s - r_E)$$

$$= p_1(1-p_1) \cdot [\lambda - (1-p_1) - b] \cdot g'(s - r_E)$$

Because $g'(s - r_E) > 0$ and $g^*(s - r_E) > 0$, we have $A' > 0$ if $\lambda - (1-p_1) - b \geq 0$, or equivalently, if $\lambda - (1-p_1) - b \geq 1$.

Given that $b \geq 1$, it suffices to show that $\lambda - (1-p_1) - 1 \geq 0$ to show that $A' > 0$.

This is true when $\lambda - \lambda \cdot p_1 \geq 1$ or equivalently, when $p_1 \leq (\lambda - 1) / \lambda$.

Since we defined $\hat{p}_1 = (\lambda - 1) / \lambda$, for all $p_1 < \hat{p}_1$, $A' > 0$ (i.e. $A$ is strictly increasing) for any $r_E \leq s/2$. Thus, $r^* > s/2$.

Assuming $\lambda = 2$ (e.g., Tversky and Kahneman 1991), we have $\hat{p}_1 = 0.5$. Note that $\hat{p}_1$ increases with higher $\lambda$.

Next, we show that:

**Proposition 2b:** For any $p_1, r^* \leq s$.

Consider $s < r_E < (l + s)/2$.

By concavity, $g'(r_E - s) > g'(r_E)$

Since $r_E < (l + s)/2$, we can show $r_E - s < l - r_E$.

Therefore, $g'(r_E - s) > g'(l - r_E)$

We want to show that $A' < 0$. Because $s < r_E$, this can be rewritten as:

$$A' = -\lambda \cdot g^*(s - r_E) + p_1(1-p_1) \cdot g'(l - r_E) + \lambda(1-p_1) \cdot g'(r_E) < 0$$

or equivalently:

$$-\lambda \cdot g^*(r_E - s) + p_1(1-p_1) \cdot g'(l - r_E) - \lambda(1-p_1) \cdot g'(r_E)$$

$$g'(r_E - s) > (p_1 / \lambda) \cdot g'(l - r_E) + (1-p_1) \cdot g'(r_E)$$

Since $\lambda > 1$, it suffices to show: $g'(r_E - s) > p_1(1-p_1) \cdot g'(l - r_E) + (1-p_1) \cdot g'(r_E)$

This must be true for any $p_1$, since $g'(r_E - s) > g'(r_E)$ and $g'(r_E - s) > g'(l - r_E)$.

Thus, as $r_E$ increases past $s$ (toward $l$), $A$ declines, and therefore, $r^* \leq s$.

Next, in order to complete the proof of Proposition 2, it remains to show that:

**Proposition 2c:** For any $p_1$, if $s/2 < r_E < s$, then $A' = 0$ holds at no more than one point $r_E = r^*$.

Since $A' > 0$ for $r_E < s/2$ and $A' < 0$ for $r_E > s$, and $A'$ is continuous in the range $(s/2, s)$, then either $A' > 0$ for all $r_E < s$, or there must exist some point $r^*$ at which $A' = 0$.

If $A' > 0$ for all $r_E < s$, then $r^* = s$ is the only local maximum in the range $[0, r^{**}]$.

If, on the other hand, there exists some point $r^*$ at which $A' = 0$, then we will show that point $r^*$ is unique.

Consider any other point $r^* = r^* + \Delta r$, where $\Delta r > 0$ and $s/2 < r^* < s$. At this point $r^*$, the slope is:

$$A' = -g^*(s - r^*) + p_1(1-p_1) \cdot g'(l - r^*) + \lambda(1-p_1) \cdot g'(r^*)$$
We know that, by definition, at \( r^* \):
\[
A' = -g'(s - r^*) + p_l \cdot g'(l - r^*) + \lambda * (1-p_l) * g'(r^*) = 0
\]
So, we can subtract, and express the slope at \( r^* \) as:
\[
A' = -g'(s - r^*) + p_l \cdot g'(l - r^*) + \lambda * (1-p_l) * g'(r^*) - [-g'(s - r^*) + p_l \cdot g'(l - r^*) + \lambda * (1-p_l) * g'(r^*)] = A' = -g'(s - r^*) + p_l \cdot g'(l - r^*) + \lambda * (1-p_l) * {g'(r^*)}^+\]
\[
A' = -[g'(s - r^*) - g'(s - r^*)] + p_l \cdot [g'(l - r^*) - g'(l - r^*)] + \lambda * (1-p_l) * [g'(r^*) - g'(r^*)]
\]
Since \( \Delta r > 0 \), \( r^* > r^* \). Therefore, the three terms of \( A' \) are:
\[
- [g'(s - r^*) - g'(s - r^*)] < 0
\]
\[
p_l \cdot [g'(l - r^*) - g'(l - r^*)] > 0
\]
\[
\lambda * (1-p_l) * [g'(r^*) - g'(r^*)] > 0
\]
Since \( g'' > 0 \), \( g' \) is convex, and the rate of change of \( g' \) is non-increasing. Therefore, given \( s < l \), the rate of change in \( g' \) at \( s - r^* \) is greater than or equal to the rate of change in \( g' \) at \( l - r^* \). Thus, \( g'(s - r^*) - g'(s - r^*) \geq g'(l - r^*) - g'(l - r^*) \).
This implies that:
\[
- [g'(s - r^*) - g'(s - r^*)] + p_l \cdot [g'(l - r^*) - g'(l - r^*)] \leq 0.
\]
Since \( \lambda * (1-p_l) * [g'(r^*) - g'(r^*)] > 0 \), we have shown that \( A' < 0 \) for \( r^* > r^* \).

Alternatively, consider \( \Delta r < 0 \). Then \( r^* + \Delta r < r^* \), and the three terms of \( A' \) are:
\[
- [g'(s - r^*) - g'(s - r^*)] > 0
\]
\[
p_l \cdot [g'(l - r^*) - g'(l - r^*)] < 0
\]
\[
\lambda * (1-p_l) * [g'(r^*) - g'(r^*)] > 0
\]
Since \( g'' > 0 \), and \( s < l \), the rate of change in \( g' \) at \( s - r^* \) is greater than or equal to the rate at \( l - r^* \).
Thus, \( g'(s - r^*) - g'(s - r^*) \leq g'(l - r^*) - g'(l - r^*) \).
This implies that:
\[
- [g'(s - r^*) - g'(s - r^*)] + p_l \cdot [g'(l - r^*) - g'(l - r^*)] \geq 0.
\]
Since \( \lambda * (1-p_l) * [g'(r^*) - g'(r^*)] > 0 \), we have shown that \( A' > 0 \) for \( r^* < r^* \).

Thus, we have shown that \( r^* \) exists and is unique.

**Corollary 1:** For any \( p_l \), \( r^* > (l + s)/2 > s \).

This follows directly from the proof of Proposition 2b.

**Corollary 2:** \( r^{**} \) decreases in \( p_l \) (where \( 0 < p_l < 1 \) and \( r^{**} \leq l \)).

Consider \( l \geq r^* > (l + s)/2 \). Let \( r_E = r^{**} \).

Since \( r_E > (l + s)/2 \), we know that \( r_E > r_E - s > l - r_E \). Therefore, \( g'(r_E) < g'(r_E - s) < g'(l - r_E) \).

We also know that at \( r_E = r^{**} \), \( A' = 0 \). We can rewrite this as:
\[
\lambda * g'(r_E - s) = p_l \cdot g'(l - r_E) + \lambda * (1-p_l) * g'(r_E).
\]

Since \( p_l + (1-p_l) = 1 \) and \( \lambda * g'(r_E - s) > \lambda * g'(r_E) \), this can only be true if:
\[
g'(l - r_E) > \lambda * g'(r_E - s),
\]
which implies that \( g'(l - r_E) > \lambda * g'(r_E) \).

Let us now decrease \( p_l \) by some amount \( k \), where \( 0 < k < p_l \). The new slope of \( A \) at \( r_E \) is expressed as:
\[
A' = -\lambda * g'(r_E - s) + (p_l - k) * g'(l - r_E) + \lambda * (1-p_l + k) * g'(r_E)
\]
\[
= [-\lambda * g'(r_E - s) + p_l \cdot g'(l - r_E) + \lambda * (1-p_l) * g'(r_E)] + k * [\lambda * g'(r_E) - g'(l - r_E)].
\]

We know that, given \( p_l \), \( [-\lambda * g'(r_E - s) + p_l \cdot g'(l - r_E) + \lambda * (1-p_l) * g'(r_E)] = A'(r_E = r^{**}) = 0 \).

Therefore, if \( p_l \) is decreased by \( k \), then \( A' = 0 + k * [\lambda * g'(r_E) - g'(l - r_E)] \).

Further, it was shown above that \( g'(l - r_E) > \lambda * g'(r_E) \) and we chose \( k > 0 \).

Hence, \( A' < 0 \), and we have shown that \( r^{**} \) shifts to the right, toward \( l \), as the probability \( p_l \) decreases.

Next, it is shown that when \( p_l \rightarrow 0 \), \( r^{**} \rightarrow \infty \).

By Corollary 2, decreasing \( p_l \) increases \( r^{**} \). In the limit, \( p_l \rightarrow 0 \), implies \( A' \rightarrow -\lambda * g'(r_E - s) + \lambda * g'(r_E) \), which can be rewritten as:
\[
A' \rightarrow -\lambda * [g'(r_E - s) - g'(r_E - s)] < 0,
\]
and \( A \) declines continuously.

Note that \( A \) is continuously differentiable in the interval \((s, \infty)\). Therefore, we can say that in the limit, as \( p_l \) approaches 0, \( r^{**} \) approaches infinity.
Proposition 3: When rewards are certain \((p_l = p_s = 1\) and \(l > s > 0\)), assuming \(\lambda > 1\), as long as \(r_E \leq 0.5^* (l + s)\), increasing (due to higher efforts) the reference point \(r_E\) enhances the relative preference for the large reward over the small reward.

Equivalently, for any \(r_E \leq 0.5^* (l + s)\), the advantage \(A(S,LU | r_E)\) decreases in \(r_E\).

Let \(s = \phi^* l\), where \(0 < \phi < 1\), so that \(s = \phi^* l < l\).

First, consider \(r_E \leq s = \phi^* l\).

\[A(S,LU | r_E) = g(s - r_E) - g(l - r_E) = g(\phi^* l - r_E) - g(l - r_E).\]

We want to show that \(A' = \frac{\partial A}{\partial r_E} < 0\) for any \(r_E \leq \phi^* l = s\). Thus, we want to prove: \(A' = -g' (\phi^* l - r_E) + g' (l - r_E) < 0\).

Because \(0 < \phi < 1\), \((\phi^* l - r_E) < (l - r_E)\), and therefore, by concavity, \(g' (\phi^* l - r_E) > g'(l - r_E) > 0\).

Hence, \(A' = -g' (\phi^* l - r_E) + g' (l - r_E) < 0\), which demonstrates that \(A\) is strictly decreasing in \(r_E\) as long as \(r_E \leq s\).

Next, consider \(r_E\) in the range \((s, l)\). Thus, \(\phi^* l < r_E < l\).

\[A = -\lambda \* g(r_E - \phi^* l) - g(l - r_E).\]

Hence:

\[A' = -\lambda \* g' (r_E - \phi^* l) + g'(l - r_E).\]

In order to prove that \(A' < 0\), it has to be shown that:

\[-\lambda \* g' (r_E - \phi^* l) + g'(l - r_E) < 0 \Rightarrow g'(l - r_E) < \lambda \* g' (r_E - \phi^* l) \Rightarrow g'(l - r_E) / g'(r_E - \phi^* l) < \lambda,\]

where \(\lambda > 1\).

By concavity, we know that as long as \((l - r_E) \geq (r_E - \phi^* l)\):

\[g'(l - r_E) \geq g'(r_E - \phi^* l)\]

\[g'(l - r_E) / g'(r_E - \phi^* l) \leq 1 / \lambda.\]

Therefore, \(A' < 0\).

Thus, \(A' < 0\) for any \(r_E \leq [(1+\phi)/2] * l = 0.5^* (l + s)\).

---

Lemma 1: Under strict concavity of function \(f\), assuming \(f(0) = 0, f(a + b) < f(a) + f(b)\).

Assume, without loss of generality, that \(0 < a < b\).

By strict concavity, \(f(a + b) < f(b) + a \* f'(b)\). We will show that \(f(a) > a \* f'(b)\).

Note that for any \(0 < a < b, a \* f'(a) > a \* f'(b)\).

It now remains to be shown that \(f(a) \geq a \* f'(a)\).

For any \(0 < x \leq a, f'(a) \geq f'(x) \Rightarrow a \* f'(a) \leq \int_0^a f'(x) dx = f(a) - f(0) = f(a)\).

\(\Rightarrow f(a) \geq a \* f'(a) > a \* f'(b)\), and we have proved that \(f(a + b) < f(a) + f(b)\). 

---

15 Note that when \(s\) approaches \(l\), \(A' < 0\) for any \(r_E < l\). By contrast, when \(s\) approaches 0, \(A' < 0\) for any \(r_E < 0.5^* l\).

Thus, \(A' < 0\) as long as \(r_E \leq r^{**}\), where \(r^{**} \in (0.5^* l, l)\). Note that \(l > s\) implies that \(r^{**} > s\).

16 The empirical tests of Proposition 3 (i.e., hypothesis 5) employed \(s = 0.5^* l\) (i.e., with the exception of the Restaurant FP; see Study 5 and Appendix C). In such cases, \(A' < 0\) for the considerable empirical range of \(r_E \leq 0.75^* l\). In fact, given that a conservative estimate for \(\lambda\) was used (i.e., \(\lambda > 1\)), this range is likely to even be greater. Accordingly, in all of the empirical tests, increasing \(r_E\) led to a decrease in \(A\) (\(A\) was obviously always negative because \(p_l = p_s = 1\) and \(l > s > 0\)).
Appendix B: Additional Tests of Hypothesis 1

Grocery Store Scenario --- Effort Condition:

**Grocery Store Rewards**
Imagine that your grocery store offers its frequent customers the opportunity to earn one of the following two rewards:

**Reward A**: After you purchase groceries at the grocery store 5 times (each purchase must be over $30), you will earn a 1/50 chance to win a $1,000 grocery certificate good toward future grocery purchases (one out of every 50 participants wins).

**Reward B**: After you purchase groceries at the grocery store 5 times (each purchase must be over $30), you will earn a $15 grocery certificate good toward future grocery purchases.

Circle the reward you would prefer to earn:  A  B

---

Grocery Store Scenario --- No Effort Condition:

**Grocery Store Rewards**
Imagine that as an appreciation gift your grocery store offers a choice between the following two rewards:

**Reward A**: A 1/50 chance to win a $1,000 grocery certificate good toward future grocery purchases (one out of every 50 participants wins).

**Reward B**: A $15 grocery certificate good toward future grocery purchases.

Circle the reward you would prefer to receive:  A  B

---

Hotel Scenario --- Effort Condition:

**Hotel Frequency Program**
Imagine that a luxury hotel chain offers guests the opportunity to earn one of the following two rewards:

**Reward A**: If you stay ten nights (not necessarily on one occasion) at the chain’s hotels, you will earn a $100 cash award (the award distribution takes place one week after you accumulate ten nights).

**Reward B**: If you stay ten nights (not necessarily on one occasion) at the chain’s hotels, you will earn an entry into a lottery with a 1/1000 chance to win a $100,000 cash award (one out of every one thousand participants wins; the lottery and award distribution take place one week after you accumulate ten nights).

Circle the reward you would prefer to earn:  A  B  Wouldn’t join this program

---

Hotel Scenario --- No Effort Condition:

**Hotel Raffle**
Imagine that a luxury hotel chain offers guests the opportunity to win one of the following two rewards in a free raffle:

**Reward A**: If you win the raffle, you will receive a $100 cash award (the award distribution takes place one week after you win the raffle).

**Reward B**: If you win the raffle, you will receive an entry into a lottery with a 1/1000 chance to win a $100,000 cash award (one out of every one thousand participants wins; the lottery and award distribution take place one week after you win the raffle).

Circle the reward you would prefer to receive:  A  B  Wouldn’t want either reward
APPENDIX C: THE IMPACT OF EFFORT ON THE SENSITIVITY TOWARD THE MAGNITUDE OF SURE REWARDS --- ADDITIONAL TESTS

<table>
<thead>
<tr>
<th>Credit Card Problem</th>
<th>Mean Likelihood of Joining (0-10) the Credit Card Frequency Program (n = 386)</th>
<th>Median Estimate of Probability (0-100%) of Completing the Program (n = 291)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Reward</td>
<td>Large Reward</td>
</tr>
<tr>
<td>Low Effort: ($10,000 of charges on card)</td>
<td>3.4</td>
<td>3.9</td>
</tr>
<tr>
<td>High Effort: ($20,000 of charges on the card)</td>
<td>2.0</td>
<td>3.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean Likelihood of Purchasing (0-10) the Credit Card Lottery (n = 199)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Reward</td>
</tr>
<tr>
<td>High Probability of Winning (40%):</td>
</tr>
<tr>
<td>High Probability of Winning (10%):</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>bloomingdale’s Problem</th>
<th>Mean Likelihood of Joining (0-10) the bloomingdale’s Frequency Program (n = 331)</th>
<th>Median Estimate of Probability (0-100%) of Completing the Program (n = 542)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Reward</td>
<td>Large Reward</td>
</tr>
<tr>
<td>Low Effort: ($2,000 of purchases)</td>
<td>4.7</td>
<td>4.8</td>
</tr>
<tr>
<td>High Effort: ($4,000 of purchases)</td>
<td>3.2</td>
<td>4.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean Likelihood of Purchasing (0-10) the bloomingdale’s Lottery (n = 193)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Reward</td>
</tr>
<tr>
<td>High Probability of Winning (10%):</td>
</tr>
<tr>
<td>High Probability of Winning (1%) :</td>
</tr>
</tbody>
</table>

---

17 In all six problems, all factors were manipulated between-subjects. The results of the bloomingdale’s and restaurant FPs were replicated in two additional studies in which the reward magnitude was manipulated within-subjects.
### Movie Theater Frequency Program (n = 269) *

<table>
<thead>
<tr>
<th></th>
<th>Mean Likelihood of Joining the Program (0-10)</th>
<th>Median Estimate of Probability (0-100%) of Completing the Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Reward (1 music CD)</td>
<td>Large Reward (2 music CDs)</td>
</tr>
<tr>
<td>Low Effort: (Seeing 10 movies)</td>
<td>6.1</td>
<td>6.3</td>
</tr>
<tr>
<td>High Effort: (Seeing 20 movies)</td>
<td>4.1</td>
<td>5.1</td>
</tr>
</tbody>
</table>

* The same respondents who indicated their likelihood of joining the movie theater FP also estimated the probability that they would complete the requirements of this program and earn the reward.

### Restaurant Frequency Program

<table>
<thead>
<tr>
<th></th>
<th>Mean Likelihood of Joining (0-10) the Program (n = 331)</th>
<th>Median Estimate of Probability (0-100%) of Completing the Program (n = 343)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Reward (1/2 year Internet service)</td>
<td>Large Reward (2 year Internet service)</td>
</tr>
<tr>
<td>Low Effort: (6 dinners for two)</td>
<td>3.8</td>
<td>4.8</td>
</tr>
<tr>
<td>High Effort: (12 dinners for two)</td>
<td>2.9</td>
<td>4.6</td>
</tr>
</tbody>
</table>

### Credit Card Frequency Program (n = 330)

<table>
<thead>
<tr>
<th></th>
<th>Mean Likelihood of Joining the Program (0-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Reward (7 car rental days)</td>
</tr>
<tr>
<td>Low Effort: (Purchasing with card four roundtrip plane tickets)</td>
<td>5.9</td>
</tr>
<tr>
<td>High Effort: (Purchasing with card ten roundtrip plane tickets)</td>
<td>4.0</td>
</tr>
</tbody>
</table>

### Gas Station Frequency Program (n = 352)

<table>
<thead>
<tr>
<th></th>
<th>Mean Likelihood of Joining the Program (0-10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small Reward (car wash)</td>
</tr>
<tr>
<td>Low Effort: (Purchasing gas 15 times at station located nearby)</td>
<td>6.9</td>
</tr>
<tr>
<td>High Effort: (Purchasing gas 15 times at station located 10 miles away)</td>
<td>4.2</td>
</tr>
</tbody>
</table>
REFERENCES


