A GENERALIZED UTILITY MODEL OF DISAPPOINTMENT AND REGRET EFFECTS ON POST-CHOICE VALUATION

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Marketing Science, Vol. 16, No. 2, 1997

One-Line Abstract

Can what you could have had influence your valuation of what you do have?

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Abstract

In this paper we show that performance information about "forgone" alternatives (i.e., alternative that were considered but not chosen) can have a significant impact on post-choice valuation. Our approach introduces a new and parsimonious way of looking at satisfaction that combines the literature on post-choice valuation with research regarding generalized expected utility theory. While the post-valuation literature focuses on the selected brand as the valuation's basis (e.g., Anderson and Sullivan 1993, Bolton and Drew 1991), we draw on a stream of research in generalized expected utility theory that considers both chosen and forgone alternatives as the basis for valuation (e.g., Bell 1983, 1985, Loomes and Sugden 1982, 1986). The result is a combined model of post-choice valuation that explicitly incorporates both concepts.

Specifically, we extend the existing paradigm of post-choice valuation to include buyers' regret concerning forgone alternatives, proposing a generalized utility theory-based treatment of post-choice product assessment that uses the intuitively appealing concepts of disappointment and regret as the basis. We propose a model for conceptualizing post-choice valuation that is consistent with the existing literature, discuss how this model extends the construct to consider the influence of forgone alternatives, and report results of an empirical test that contrasts our model to important recent work in the area (e.g., Boulding et al. 1993).

Our generalized model of post-choice valuation is based on the sum of three components that represent factors that may contribute to consumers' assessment of a chosen product or service. The first component is expected performance. The second component is disappointment, which captures the discrepancy between actual and expected performance (much as the disconfirmation construct in traditional satisfaction research). The third component is regret, which captures the difference between the performance of the chosen product/service and the performance of a forgone product/service. This perspective is useful in that risk is captured by the disappointment and regret terms, providing an intuitively appealing decomposition of post-choice valuation and offering several advances over previous representations of disappointment and regret.

We test our model via a choice experiment. Participants in the empirical study were asked to make choices between successive lottery pairs. They were then given outcome feedback on the forgone alternative as well as on the chosen alternative in each lottery pair. Immediately following outcome feedback for each choice, subjects were asked to evaluate their decision. Our results clearly suggest an effect of regret on post-choice valuation - information about the forgone alternative influenced subjects' valuation of the chosen alternative. We also find evidence that, as predicted, the effects of

disappointment and regret on post-choice valuation are asymmetric. Specifically, the negative effect of disappointment on post-choice valuation was greater than the positive effect of elation. Similarly, the negative effect of regret was greater than the positive impact of rejoicing.

Our research offers five contributions to the literature on post-choice valuation. First, our results illustrate the advantage of using generalized utility theory as the basis for conceptualizing and modeling post-choice valuation. We derive a model of post-choice valuation that formally captures the components of disappointment and regret and show that the outcome of both the chosen alternative (through disappointment) and a forgone alternative (through regret) can influence the chosen alternative's valuation. Second, we formally integrate the concepts of disappointment and regret, which have been examined separately for many years, into a single model based on a multiattribute preference structure. Third, we argue that the effects of disappointment and regret on post-choice valuation are asymmetric and present empirical evidence in this regard. Fourth, our results suggest that word-of-mouth regarding forgone alternatives may affect post-choice valuation, extending research which has not heretofore considered forgone outcomes' role in this process.

Finally, our development provides a preconsumption measure of "potential disappointment and regret" in modeling choice. At the time of choice, consumers may visualize the feelings of disappointment and/or regret that will be derived at consumption, taking into account both the chosen brand and forgone brands. Our generalized utility theory-based approach to the post-choice valuation construct can be useful in examining the role of disappointment and regret as preconsumption constructs.

(Keywords: Buyer Behavior; Utility Theory; Disappointment; Regret; Post-Choice Valuation; Satisfaction)

1. Introduction

> You were recently in the market for a new car and, after narrowing your search, chose the Saab 900S over the Volvo 850 and the Pontiac Bonneville. The Saab performs in accordance with your expectations. On the way to dinner one evening, your wife mentions that a car buff co-worker told her that the Volvo 850 is the best designed car he has seen. How do you feel about your Saab now?

Post-purchase valuation is generally conceptualized as a comparison between actual experience with a particular good or service[1] and pre-purchase expectations of that product's performance. However, as the above scenario suggests, performance information about "forgone" alternatives may also have a significant impact on post-choice valuation and, consequently, on buyers' post-choice attitudes and behavior. This paper extends the existing paradigm of post-choice valuation to explicitly include buyers' regret concerning forgone alternatives. We accomplish this by explicitly modeling the effect of information about the performance of forgone alternatives on a buyer's post-choice valuation of the chosen brand. In doing so, we build on the pioneering work of Boulding, Kalra, Staelin, and Zeithaml (1993) who implicitly consider the impact of forgone alternatives in their concept of "*should*" expectations. Further, our approach introduces a new and parsimonious way of looking at satisfaction that combines the stream of research on post-choice valuation with research on generalized expected utility theory. While the post-valuation literature focuses on the selected brand as the valuation's basis (e.g., Anderson and Sullivan 1993, Bolton and Drew 1991), we draw on a stream of research in generalized expected utility theory that considers both chosen and forgone alternatives as the basis for valuation (e.g., Bell 1983, 1985, Loomes and Sugden 1982, 1986). The result is a combined model of post-choice valuation that explicitly incorporates both notions.

Specifically, we discuss how the concepts of disappointment (Allais 1979, Bell 1985, Loomes and Sugden 1986) and regret (Bell 1982, 1983, Loomes and Sugden 1982, 1987, Fishburn 1988, Sugden 1991) can be used as the basis for an extended paradigm of post-choice valuation in a natural way. The potential implications of such a model are fivefold.

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[1] For brevity, hereafter we use the term "product" to refer to both a good and a service.

First, the resulting model enables us to extend the post-choice valuation construct to incorporate the effect of forgone alternatives on post-choice evaluation of the chosen alternative. Explicitly breaking post-choice valuation into separate components related to the chosen alternative and to forgone alternatives allows one to assess the relative impact of these two sources on post-choice valuation. Second, we formally integrate the concepts of disappointment and regret, which have heretofore been examined separately, into a single model based on a multiattribute preference structure. Third, our model suggests that post-choice information such as word-of-mouth about forgone alternatives may affect post-choice valuation and its consequence, satisfaction. This extends the body of research which has not considered forgone alternatives and has primarily examined the reverse relationship - that between post-choice valuation and generation of word-of-mouth (e.g., Anderson 1994). Fourth, we propose that the effects of disappointment and regret on post-choice valuation are asymmetric and present empirical support for this thesis. Specifically, we argue that the effect of disappointment has a greater impact on post-choice valuation than elation and regret has a greater impact than rejoicing. Finally, our development also provides a preconsumption measure of “potential disappointment and regret” in modeling choice.

In the field of decision analysis, a distinction is commonly made between normative and descriptive models of choice. Historically, decision analysts, economists, and others have relied on the axioms of von Neumann and Morgenstern (1947) as the theoretical justification for maximizing expected utility in decision making under risk. However, much research during the 1980's was focused on developing "generalized" utility theories that can accommodate actual decision behavior (Fishburn 1988, 1989). While these generalized utility theories are not considered to be appropriate by some as a guide to normative decisions (see Fishburn 1989), they do provide descriptive models of choice based on explicit assumptions and axioms.

Generalized utility theory is potentially useful in modeling post-choice valuation because it provides a framework based on explicit axioms that characterize the underlying assumptions regarding consumer behavior. As Sugden (1991) argues, an axiom system can

provide a compact description of a theory and can be useful in differentiating it rigorously from other theories. If the axioms themselves can be given intuitively appealing and mutually consistent psychological interpretations, then the resulting theory can be made more transparent and plausible.

The generalized utility models that seem most appropriate for modeling post-choice valuation are motivated by the concepts of disappointment (i.e., the psychological state induced by comparing an outcome to an expected outcome) and regret (i.e., the psychological state induced by comparing an outcome to the outcome of a forgone alternative) that might be associated with risky choices. For example, similar to the opening vignette, a consumer may be considering the purchase of a new stereo, deciding between Model A and Model B. Having chosen Model A, the consumer's valuation of Model A may be influenced by the stereo's performance versus the consumer's prior expectations (a disappointment effect). Further, if the consumer becomes aware of the performance of forgone Model B, perhaps through a visit to the home of a friend who has purchased this model, his/her valuation of Model A might also be influenced by the performance of the friend's Model B (a regret effect).

In contrast to the normative theme in decision theory, research in how consumers evaluate the quality of a chosen product has focused on descriptive models of consumer choice and product response behaviors inspired by theories from the social sciences (e.g., Helson 1964, Meeks 1984, Olshavsky and Miller 1972, Sherif and Hovland 1961). Generally, consumers are hypothesized to form an overall evaluation of their purchase experience by comparing the recent experience with the product against an expectation based on their accumulated experience with the product. Historically, models of perceived product quality have not explicitly examined the process by which forgone alternatives influence the formation of quality perceptions. An important exception is the recent work of Boulding et al. (1993), hereafter referenced as BKSZ.

In their dynamic model of service quality, BKSZ implicitly consider the impact of forgone alternatives on perceived quality by introducing the concept of *should* expectations, the service level that the consumer feels s/he deserves. Specifically, “new information

reaching the consumer between service contacts, such as changes in price, firm communications, and *competitive service delivery* (italics added, p. 10)" is incorporated into their model of *should* expectations as an information vector which affects the consumer's expectations regarding what should happen on the next service encounter. Thus, valuation of the subsequent encounter may not be simply a direct function of that particular encounter and experience with that particular provider, but also an indirect function of the consumer's expectations about the service s/he would have received had s/he chosen a competitive provider. We compare our model with the BKSZ model in more depth in the next section.

The paper unfolds as follows. In the next section, we develop our generalized model of disappointment and regret effects based on generalized utility theory. We then present an experiment in Section 3 that tests the model's implications by estimating the model's parameters to explicitly test the effect of each model component on post-choice valuation. Finally, we discuss the implications of our view of post-choice valuation for researchers and practitioners and discuss directions for future research.

2. Post-Purchase Valuation as Disappointment and Regret

2.1 The Basic Model

Generalized models of choice that incorporate the intuitively appealing notions of disappointment and regret have been developed independently of one another (Bell 1982, 1985, Loomes and Sugden 1982, 1986, 1987). Here we are interested in a model of post-choice valuation that simultaneously includes both notions, so it is illuminating to consider a novel development of this model that highlights the underlying assumptions that are required for its justification. The generalized model of post-choice valuation that we propose is based on the sum of three components, each representing a factor that logically should contribute to consumers' assessment of a chosen product. The first component is the expected performance of the product, which allows post-choice valuation to be directly influenced by anticipated performance. The second component is disappointment, which captures the discrepancy between actual and anticipated performance of the product. The third component

is regret, which captures the difference between the performance of the chosen product and the performance of a forgone product. This perspective is useful in that the inherent risks of consumer choice are taken into account by the disappointment and regret terms, providing an intuitively appealing decomposition of post-choice valuation. Further, this approach enables our generalized model to be used as a pre-choice model, as discussed in the Appendix. However, we leave this application to future research.

If some independence conditions (see the Appendix) are satisfied, we can derive the following generalized model for post-choice valuation:

$$U(\overline{X}, \mathrm{D}, \mathrm{R}) = u_1(\overline{X}) + u_2(\mathrm{D}) + u_3(\mathrm{R}) \qquad [1]$$

where $\overline{X}$ is the expected performance of the chosen alternative X, $\mathrm{D}=X_r-\overline{X}$ where X_r is the realized (i.e., actual) outcome of the alternative X, $\mathrm{R}= X_r- Y_r$ where Y_r is the realized outcome of the forgone alternative Y, u_1, u_2 and u_3 are utility measures for expected performance, disappointment and regret respectively, and U is the overall utility measure for post-choice valuation.[2]

The formal derivation of model [1] is shown in the Appendix. The advantage of this preference model is that it allows us to assess (or specify) each of the three component utility functions independently. Note that we use anticipated performance (not actual performance) as the anchor for both pre-evaluation and post-evaluation. In the case of post-evaluation, anticipated performance serves as the anchor and adjustments are then made to formulate consumer valuation based on realized disappointment/elation (i.e., utility of the difference between actual performance and the anticipated performance) and realized regret/rejoicing (i.e., utility of the difference between the chosen alternative's actual performance and the forgone alternative's actual performance). This anchor and adjustment interpretation provides a heuristic process in constructing consumer valuation.[3]

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[2] For simplicity, we use D and R for the disappointment and regret, respectively, associated with alternative X rather than D_x and R_x (see Appendix).

[3] If we choose the first term in our model to be actual performance, then the disappointment effect on consumer satisfaction cannot be captured in the model. Further, this formulation is consistent with BKSZ's

Our model offers several advances over previous representations of disappointment and regret. First, the measure of disappointment that we propose generalizes Bell's (1985) measure that is only applicable to two outcome lotteries. Second, we formally integrate the concepts of disappointment and regret, which have been discussed separately for many years, into a single model based on a multiattribute preference structure. Third, the independence conditions allow us to simplify the general form of our model and to treat the three components independently. In this way, we obtain a simple separable model based on explicit and rigorous preference assumptions. This also makes our study different from some previous studies that use additive models without deriving the implications. Fourth, our model can be used for both pre-choice decision evaluation and post-outcome valuation. In this paper we focus on the latter, but we do address the former as well in Section 4.2 and the Appendix. In sum, our model captures the effects of both disappointment and regret on post-choice valuation in a clear, intuitive, and rigorous fashion. We now briefly discuss alternative choices for the functions u_1, u_2, and u_3.

2.2 The Measure of Performance

In addition to measures of disappointment and regret, [1] includes a term that represents the impact of a consumer's expectation regarding product performance (measured by $\overline{X}$), which is consistent with the literature on post-choice valuation. From a technical standpoint, an unusual feature of [1] is that the first term is defined as the utility function value (or the subjective value) of the expected performance, $u_1(\overline{X})$, rather than the mean of the utility function value defined on performance, $E^X[u_1(X)]$. In general, these two terms will not be the same; the latter term will be smaller for a risk averse utility function. In this development, we use the former measure of expected performance because the "risks" associated with the consumer's choice are captured by the disappointment and regret terms, rather than through the effective discounting of expected value that is the result of the use of a risk averse utility function for risky choice.

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empirical finding that consumers' expectations of an offering affect their information processing strategy such that higher prior expectations lead to greater weight being given to more positive dimensions of the offering.

A special case of [1] is obtained by defining a linear function of the expected performance, $u_1(\overline{X}) = c_0 \overline{X}$, where $c_0 > 0$ is a constant. A linear effect is the most common assumption in the perceived product quality literature (e.g., Boulding et al. 1993, Anderson, Fornell, and Lehmann 1994) and also in the development of disappointment models (Bell 1985, Loomes and Sugden 1986). We use this simple linear model in our empirical studies.[4] It is important to note that other developments are possible by modifying our assumption using expected performance. Alternative choices for the prior expectation of performance that have been suggested include the concept of equitable performance (Woodruff, Cadotte, and Jenkins 1983, Oliver and Swan 1989), the ideal point model (Holbrook 1984), and brand or product category norms (Woodruff et al. 1983). The substitution of measures such as these for $\overline{X}$ would be straightforward.

2.3 The Measure of Disappointment

Bell (1985) first proposed a disappointment model for risky choice. According to Bell, disappointment is a psychological reaction to a choice outcome that does not meet one's expectation. Bell used the expected value of a risky alternative as one's psychological expectation. If an outcome is worse than the expected value, then one would be disappointed. Otherwise, one would experience elation. Bell assumed that the measure of disappointment or elation is proportional to the difference between an outcome and the expected value, and that disappointment has a relatively larger influence on preference than elation for the same magnitude of this difference. However, Bell's disappointment model was developed only for decision problems with two outcomes. Following Bell's basic assumptions, we can develop a more general measure of disappointment (or elation) as follows:

$$u_2(D) = \begin{cases} c_1 D & \text{when } D \geq 0 \\ c_2 D & \text{when } D < 0 \end{cases} \qquad [2]$$

where $c_2 > 0$ and $c_1 > 0$ are constants, and $D = X_r - \overline{X}$ as defined before. This piece-wise linear model includes Bell's (1985) disappointment measure as a special case, but provides a

[4] According to Jia and Dyer (1996b), a linear measure of expected performance does not imply risk neutrality in [1] (viewing the disappointment and regret measures as one risk measure), but constant risk aversion.

generalization for risky choices with more than two outcomes. An advantage of the simple form of this model is that it is very convenient for empirical investigations. Some empirical studies have found that disappointment has a larger impact on post-choice valuation than elation (e.g., Anderson and Sullivan 1993), and this asymmetrical effect on preference can be captured in a clear fashion by this model (i.e., $c_2 > c_1$). Thus, our model can treat asymmetric disappointment for performance that is worse than the expected value and elation for performance that exceeds the expected value.[5]

The relationship between the concept of disappointment and the disconfirmation construct from the quality literature is clear. The disappointment measure in our model addresses the traditional disconfirmation construct as determined by a comparison of a preconsumption standard with actual product performance. Further, our disappointment model [2] is sufficiently general to represent alternative hypotheses regarding the details of the disconfirmation response (see Tse and Wilton 1988). Simple algebraic differences between product performance and the comparison standard are again the most common assumption and correspond to the choice of $\overline{X}$ as the point of reference for measuring differences. However, different assumptions regarding the point of reference and the difference measures for disappointment/elation would allow this formulation to include subjective disconfirmation models as well (e.g., Anderson 1995, Oliver 1980, Churchill and Surprenant 1982).

2.4 The Measure of Regret

The formalization of the concept of regret or rejoicing is based on the comparison between a chosen alternative and a forgone alternative. For post-choice valuation, a consumer would experience regret if the actual performance of a chosen product is worse than the actual performance of a forgone product, and would rejoice otherwise. Similar to the effects of disappointment and elation, regret implies a perceived loss and rejoicing implies a perceived gain. Consistent with our development of the disappointment/elation measure [2], we also use a piece-wise linear utility model for the regret/rejoicing component:

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[5] This choice of the parameters also implies (global) risk aversion or loss aversion for this utility model (Jia and Dyer 1996b).

$$u_3(R) = \begin{cases} c_3 R & \text{when } R \geq 0 \\ c_4 R & \text{when } R < 0 \end{cases} \quad [3]$$

where $c_3>0$ and $c_4>0$ are constants and $R= X_r- Y_r$ as defined previously. Analogous to our discussion of the effects of disappointment and elation on valuation, if consumers are more affected when a forgone alternative outperforms the chosen alternative than when the opposite occurs (i.e., the negative impact of regret on post-choice valuation is greater than the positive effect of the same magnitude of rejoicing), we should find that $c_4 > c_3$. Thus, our asymmetric effects model of post-choice valuation is:

$$PCV = c_0 \overline{X} + c_1 D^+ + c_2 D^- + c_3 R^+ + c_4 R^- \quad [1a]$$

where PCV is post-choice valuation, $\overline{X}$ is the expected value or anticipated performance, D^+ and D^- are positive (i.e., elation) and negative (i.e., disappointment) values of D, respectively, and R^+ and R^- are positive (i.e., rejoicing) and negative (i.e., regret) values of R, respectively.[6]

Although *should* expectations introduced by BKSZ and regret are conceptually distinct constructs, it is useful to compare our model [1a] to the model proposed by BKSZ. In fact, if one ignores the asymmetric effects and assumes that forgone alternatives are the same as *should* expectations (i.e., Y_r =SE), Equation [1a] can be rewritten as an approximation of the BKSZ model:

$$PCV = b_0 \overline{X} + b_1 D + b_2 R \quad [1b]$$

$$= b_0 \overline{X} + b_1 (X_r - \overline{X}) + b_2 (X_r - Y_r)$$

$$= (b_0 - b_1) \overline{X} + (b_1 + b_2) X_r - b_2 Y_r \quad [1c]$$

Examining [1c], we would expect a positive weight for anticipated performance ($\overline{X}$) and the actual outcome (X_r) and a negative weight for the forgone outcome (what

[6] Note that D^+ and D^- (elation and disappointment, respectively) cannot occur simultaneously, nor can R^+ and R^- (rejoicing and regret, respectively).

could/should have happened). However, the models differ in several key respects. First, BKSZ consider product quality, which is an antecedent (albeit a highly related one) to our focal construct, post-choice valuation. We use the term "post-choice valuation" to describe the utility that is ultimately enjoyed by the decision-maker, or "realized utility." Strictly speaking, perceived service quality is an antecedent of post-choice valuation and is only relevant in the context of services. In practice, however, these constructs are difficult to separate and tend to be used interchangeably. While BKSZ focus on service quality, we examine the more general construct of post-choice valuation. However, we would also argue that BKSZ's model is pertinent to contexts other than services per se.

Second, the BKSZ model assumes that *should* expectations mediate the effect of forgone alternative outcomes on post-choice valuation, while we posit a direct effect. Third, BKSZ do not explicitly account for the possibility of asymmetric effects of disconfirmation (i.e., negative outcomes may have a larger effect than positive outcomes) on post-choice valuation. Finally, our model is based on multiattribute utility theory, providing a conceptual foundation and theory-based explanation for the various model components and allowing our model to double as a model of choice.

Our purpose is not to argue the benefits of our model versus that of BKSZ. Rather, our focus is to introduce disappointment and regret as potentially useful constructs in modeling the effects of "competition" on post-choice valuation. Indeed, we feel that regret and *should* expectations are conceptually quite distinct and probably operate in different situations. While we leave the interleaving of these two models for future research, we discuss the possibilities of such an endeavor in Section 5. In the next section we discuss an experiment which we conducted to evaluate our generalized post-choice valuation model. We had three objectives in mind: to assess the impact of forgone outcomes on post-choice valuation, to estimate the parameters in [1a], and to compare our model to the approximation to the BKSZ model in [1c].

3. Empirical Test

3.1 Methodology

One hundred and five undergraduate business students at the University of Texas-Austin participated in the study. Using a computer-based program written for the experiment, subjects were asked to make choices between successive lottery pairs. They were then given outcome feedback for each choice and their valuation of their decision was assessed. Subjects were told that their winnings would be totaled and that the results would be posted. Making subjects accountable for their choices has been used successfully to increase subjects' interest and attention (e.g., Tetlock 1985).

Each subject was asked to make eight successive choices between two-outcome lottery pairs as shown below. The potential outcomes, probabilities, expected values and variances (shown in Table 1) were varied across lottery pairs.

CHOICE i

Lottery 1	Lottery 2
=========	=========
A 50% chance of $200	A 25% chance of $500
AND	AND
A 50% chance of $100	A 75% chance of $ 0

After the completion of all eight choices, the lottery outcomes were resolved and displayed. We provided this feedback after the choices were made to eliminate the possibility of the outcomes of a subject's earlier choices affecting the subject's subsequent choices (Thaler and Johnson 1990). Outcomes for particular lotteries were randomized across subjects. While each subject was told that the outcomes were resolved randomly, the outcomes were actually predetermined for each subject so that each subject won four lotteries and lost four lotteries. Subjects were provided outcome feedback on the forgone alternative as well as on the chosen alternative in each lottery pair. Immediately following outcome feedback for each

choice, subjects were asked to evaluate their decision[7] on a horizontal 12 point scale in response to the question, 'How happy are you with your decision?' The scale was anchored by 'unhappy' and 'happy.' Most subjects completed the experiment in less than 20 minutes. Observation of the subjects suggested that they were highly involved with the task. Upon debriefing, subjects did not seem to be aware of the study's true purpose.

3.2 Results

We first examine the effect of the chosen alternative's outcome on post-choice valuation. If consistent with past research, subjects should have been happier when their choice performed well than when it performed poorly. This is the case, as subjects evaluated their decision more favorably when the outcome of the chosen alternative resulted in the greater of the two possible outcomes than when the chosen alternative's outcome was unfavorable (10.5 versus 7.8). Further, consistent with regret theory, subjects evaluated their decision lower when the forgone alternative performed favorably versus when it performed unfavorably (7.9 versus 10.4). However, these are composite results and do not account for possible within-subject effects, as each subject made eight choices. We account for this in our estimation of [1a] by including subject dummies (similar to a repeated measures ANOVA).

We now estimate the parameters for the generalized model of post-choice valuation in [1a]. Specifically, we pool subjects and generate estimates of each parameter in [1a] using subjects' valuation reports.[8] It may appear that our model is over-parameterized, given a 2x2 design. Numbering these cells, let the first value be for the chosen lottery and the second value be for the forgone lottery: 1) won, won; 2) won, lost; 3) lost, won; and 4) lost, lost. Using this categorization, it is clear that elation is captured by cells 1 and 2, while disappointment is captured by cells 3 and 4. It may seem that rejoicing is only possible in cell 2 and regret is only possible in cell 3. However, subjects could also experience rejoicing or regret in cells 1 and 4. For example, although they may experience elation (i.e., they won), in

[7] It is possible that earlier outcomes may have influenced subjects' valuation of later outcomes. To control for this, we counterbalanced the order of the outcomes and added subject indicator variables to our analysis to account for within-subject error.

[8] Assuming that post-choice valuation is a linear function of utility, then the parameters in [1] can be estimated up to a monotonic linear transformation.

several lottery pairs (see Table 1) they might have fared even better with the other, forgone, lottery. Such instances should induce regret. Further, since the expected outcome varied across the eight pairs, there is potential variance in post-choice valuation to be explained by anticipated performance.

We performed a series of nested tests (shown in Table 2). First, we estimated Equation [1b] to examine the role of expectations, overall disappointment (i.e., the difference between actual performance of the chosen alternative versus expectations), overall regret (i.e., the difference between the performance of the chosen alternative versus that of the forgone alternative). The results show that, inconsistent with our simplified model [1b], prior expectations did not directly exert a significant effect on the valuation of the chosen alternative (b_0=0.0011, NS). However, the effects of overall disappointment and regret (i.e., ignoring possible asymmetries) are clearly present - the parameter for overall disappointment is statistically significant (b_1=0.0031, p<.001), as is that of the overall regret component (b_2=0.0079, p<.001). Thus, prior expectations exert an effect on valuation of the chosen alternative through the overall disappointment measure. Model R^2 is 0.56.

Table 2 also shows the parameter estimates for the approximation to the BKSZ model in [1c]. In terms of the BKSZ model, our results suggest a significant effect for performance (b_1+b_2=0.0109, p<.001) and *should* expectations (i.e., -b_2 above, assuming that *should* expectations are the same as the forgone outcome). However, the effect of *will* expectations is not significant (b_0-b_1= -0.0020, NS). We emphasize that the specification in [1c] is only an approximation to the BKSZ model, as *will* and *should* expectations were not explicitly measured, so these results only provide a rough benchmark of the BKSZ specification for our asymmetric effects model. The key result is that actual and forgone performance exhibit significant effects in both specifications.

Following our initial estimation, we sought to estimate our full model in [1a] incorporating asymmetric disappointment and regret effects. To do this, we began by partitioning overall disappointment into separate components to capture elation (i.e., D^+ in [1a]) and disappointment (i.e., D^- in [1a]). As evinced by the significant F value ($F_{1,731}$=25.55,

$p<.001$), the effect of negative disconfirmation (i.e., disappointment) is different from that of positive disconfirmation (i.e., elation). Specifically, as expected, disappointment has a greater effect than elation on post-choice valuation (i.e., $c_2 > c_1$ in [1a]), as the positive disconfirmation parameter is not statistically significant ($c_1=0.0007$, NS), while the negative disconfirmation parameter is significant ($c_2=0.0091$, $p<.001$).

Similarly, we partitioned overall regret into a rejoicing term (i.e., R^+ in [1a]) and a regret term (i.e., R^- in [1a]). Again demonstrating asymmetric effects, the effect of the forgone alternative outperforming the chosen alternative is different than when the chosen alternative outperformed the forgone alternative, as shown by the significant F statistic ($F_{1,730}=21.76$, $p<.001$). More specifically, as expected, the effect on post-choice valuation of the forgone outcome exceeding the chosen outcome (i.e., regret) is greater than the opposite, rejoicing effect (i.e., $c_4 > c_3$ in [1a]). In fact, the impact of regret ($c_4=0.0102$, $p<.001$) is almost three times greater than the rejoicing impact ($c_3=0.0036$, $p<.01$). Importantly, when the asymmetric disappointment and regret effects are introduced, the effect of anticipated performance (i.e., the first term in [1a]) is statistically significant ($c_0=0.0037$, $p<.01$). The model R^2 is 0.59. In summary, the empirical study supports the structure of our model [1a], but not the simplified forms [1b] and [1c].

Recall that the model specified in [1a] is based on the simplifying assumption that disappointment and regret do not interact (i.e., it represents an operationalization of Equation [A2] in the Appendix). However, if this assumption is not supported, then the more general equation [A1] should be used. To empirically test this assumption, we added an interaction term between the disappointment and regret terms to [1a] and re-estimated the model. The results are shown in the last column in Table 2. The other model parameters are relatively unchanged with the addition of the disappointment x regret interaction term and this term's parameter is not statistically significant. Thus, it is not surprising that the addition of this term did not result in a significant improvement in model fit ($F_{1,729}=2.18$, NS).

4. Discussion

4.1 Post-Choice Implications

Our results offer four main implications for researchers. Most important, they clearly suggest an effect of regret on post-choice valuation - information about the forgone alternative influenced subjects' valuation of the chosen alternative. This suggests that the post-choice valuation and satisfaction constructs be extended to consider those situations in which the performance of forgone alternatives affects consumer assessment of the chosen brand. For example, one might extend Bolton and Drew's (1991) model of consumers' assessment of service quality of local telephone service into the area of long distance telephone service, where the effect of forgone alternatives might affect consumers' assessment of the service quality of the chosen long distance carrier.

As mentioned earlier, an advantage of explicitly considering the effects of disappointment and regret are that each component's relative impact on post-choice valuation can be assessed. In our study, the effect of forgone alternatives on post-choice valuation was substantial. In fact, if the regret terms are omitted from the model, the R^2 falls from 0.59 to 0.40. Thus, models which only consider performance feedback on the chosen alternative risk omitted variable bias in estimates of disconfirmation effects. At a minimum, forgone alternative effects should be controlled for in such models (e.g., BKSZ's approach).

Second, these results suggest that generalized utility theory offers a basis for conceptualizing and modeling post-choice valuation. As discussed in Section 2, the generalized utility theory-based construct of disappointment is equivalent to the traditional disconfirmation construct and the direct effects models that have recently been proposed (Anderson and Sullivan 1993, Boulding et al. 1993, Fornell 1992). Further, the generalized utility construct of regret offers an intuitively appealing and theory-based explanation for the effect of forgone alternatives on post-choice valuation.

Third, we found evidence that the effects of disappointment and regret on post-choice valuation are asymmetric. Specifically, consistent with our prediction, the effect of disappointment has a greater impact on post-choice valuation than elation and regret has a

greater impact than rejoicing. This suggests that our model provides a better description of post-choice valuation behavior than previous models. It also suggests that setting consumer expectations unrealistically high may be counterproductive because (a) it makes elation less likely and (b) the positive impact of increased anticipated performance (0.0037 in the empirical analysis) may be outweighed by the negative effect of disappointment (0.0091 in the empirical analysis). Further, our results demonstrate the imperative need to provide superior (or at least comparable) performance versus competitive offerings.

Finally, the results of the experiment suggest that post-choice third-party information about the chosen and forgone alternatives can affect the valuation of the chosen brand, implying that word-of-mouth influences post-choice valuation. Previous research (e.g., Anderson and Sullivan 1993, Anderson 1994, Westbrook 1987), has examined the influence of post-choice valuation on the generation of word-of-mouth. Further, Yi (1991) discusses reasons why there should be a word-of-mouth->satisfaction relationship and researchers have extensively examined word-of-mouth's influence on preference and choice (e.g., Arndt 1967, Brown and Reingen 1987, Dichter 1966, Engel, Blackwell and Kerregeis 1969). However, this work has focused on the effect of word-of-mouth regarding the chosen alternative on satisfaction with the chosen alternative. Ours is the first research that offers evidence that word-of-mouth about forgone alternatives can affect satisfaction with the chosen alternative. Clearly, researchers developing models of post-choice valuation in period t on word-of-mouth in period t+1 should control for the influence of both chosen and forgone alternatives word-of-mouth in period t-1 on post-choice valuation in period t.

For managers, our results suggest the ability of "disappointment" and "regret" oriented messages to influence the post-choice valuation of consumers who have chosen a manufacturer's brand and of consumers who have not chosen the brand. For instance, in a recent advertisement AT&T depicts a consumer who remained with AT&T long distance praising their service. This ad attempts to influence loyal consumers through a "disappointment" appeal by making these consumers happier with having chosen AT&T. The

ad also attempts to influence consumers who chose another long distance carrier via a "regret" appeal by demonstrating AT&T's favorable performance as a forgone alternative.

Managers can also use our results to value the benefit of using promotions which reduce potential consumer regret, thereby increasing the perceived utility of their product or service. For instance, our results help explain why consumers value price guarantees (e.g., offering to refund the difference if a customer finds the brand at a lower price within 30 days) and performance guarantees (e.g., offering free upgrades on software for 12 months). Further, managers might add regret-oriented attributes to their products and use our model to assess the effect. For example, our model could be used to measure the perceived benefit to consumers of a credit card which offers price protection to its users.

4.2 Choice Implications

Our focus has been on post-choice valuation. However, as mentioned previously, our development also provides the basis for applying the anticipation of disappointment and regret in modeling consumer choice (see the Appendix). At the point of choice, consumers may visualize the feelings of disappointment and/or regret that will be derived at consumption, taking into account both the chosen brand and forgone brands. Our generalized utility theory-based approach to the post-choice valuation construct can be used to examine their role as preconsumption constructs.

To explore this possibility, we used the pooled utility function based on the valuation scores in Experiment 1 to predict subjects' choices for each lottery pair by substituting the parameter estimates into [1a]. As a basis of comparison, we used both a mean-variance model assuming equal weights on the mean and variance and a mean-variance model estimated using each subject's choices. Our model is able to correctly predict 73% of the choices with an MSE of 0.026. In comparison, the mean-variance model that assumes equal weights on the mean and variance predicts 64% of the choices with an MSE of 0.025, while the mean-variance model based on each subject's choices correctly predicts 73% of the choices with an MSE of 0.010. The ability of our model (which is based on subjects' valuation of outcomes) to predict choice as accurately as a mean-variance model estimated using the choices

themselves suggests that subjects anticipated feelings of disappointment and regret at the time of choice.

5. Limitations and Future Research

These results suggest that both disappointment, through the difference between the realized (chosen) and the anticipated outcome, and regret, through the difference between the chosen and the forgone outcome, can play a strong role in determining post-choice valuation. However, this experiment involved simple lotteries, leaving open the issue of the generalizability of the results to applications involving actual products. While the purpose of this paper was to introduce the post-choice valuation model and empirically test it, it is important to replicate these results to contexts involving products and/or services in future experiments. As mentioned earlier, it is easy to imagine how the situation described by the model will obtain - specifically, any instance in which a consumer chooses between alternatives and later discovers the performance of the forgone alternative. For example, when dining in a restaurant, someone else in the party may order a forgone alternative (this is often the case with one of the authors and his wife). Alternatively, a consumer may purchase a product, only to subsequently see the product and the forgone alternatives rated by Consumers Reports.

As mentioned earlier, an important difference between our model and the BKSZ model is that we do not posit that the effect of forgone alternatives is mediated by *should* expectations. In other words, we predict that forgone alternatives can affect post-choice valuation without affecting updated *should* expectations. In contrast, BKSZ argue that the effect of forgone alternatives is mediated by *should* expectations because consumers update their expectations of a given alternative's performance based on the expected performance of competitors. This lack of mediation by *should* expectations is an important point of differentiation between our model versus BKSZ's model and could occur in situations where consumers choose between "noncomparable" alternatives (e.g., Bettman and Sujan 1987, Corfman 1991, Johnson 1984, 1988, 1989), an issue not addressed by BKSZ. For example, if

a person chooses to go to the movies over going to a baseball game and the baseball game is an extra-innings thriller, should the person adjust her *should* expectations for the movies? Probably not. However, might she feel worse about her choice of attending the movies? According to our model, she should. In fact, exploratory research that we have conducted along these lines is suggestive that mediation by *should* expectations does not occur under these conditions. We feel that measuring the effect of the constructs of disappointment and regret versus *will* and *should* expectations across contexts is an exciting direction for future research.

The role of anticipatory disappointment and regret in choice should be expected to vary across contexts and individuals. In terms of context variation, Simonson (1992) and Inman and McAlister (1994) have demonstrated the role of anticipatory regret in choices involving taking advantage of promotions and soon-to-expire coupons, respectively, while Hardie, Johnson, and Fader (1993) have modeled the influence of anticipatory disappointment on consumers' choice of orange juice. Future research is necessary to examine the contexts in which anticipatory disappointment and regret affect choice between members of a product category. One possibility might be the context of a new product category, where the risk of early adoption might be decomposed into the adopted product's performance and the performance of possibly superior later entrants.

Of equal or greater importance is the examination of the heterogeneity of anticipating disappointment and regret across individuals. Development of a scale to measure propensity for regret would be useful in developing methods to increase the effect of anticipatory disappointment and regret on choice, with obvious implications for programs to curtail drug use, increase retirement savings, etc. through early identification of high-risk individuals. Individuals who do not anticipate feelings of regret are arguably more likely to be at risk of engaging in deleterious behavior. Work in this regard would also help marketers effectively target anticipatory disappointment and regret oriented messages.

There are several interesting directions along which our model could be extended. First, the relationship between the prior probabilities of the realized outcomes and post-choice

valuation may be more complex than previously supposed. We set the probability of the realized outcomes *a posteriori* to one in our model, but it is possible that less likely outcomes (in terms of prior probability) could have a different effect on post-choice valuation and satisfaction than more likely outcomes.[9] Second, if there are multiple forgone options, the regret comparison could be formed in several fashions (e.g., the best forgone alternative, the average, alternatives in the consideration set versus the category in general). A choice experiment framework could be used to explore this issue. Third, the extent to which consumers seek information about the performance of forgone alternatives is an issue worthy of examination. Consumers may be more likely to seek information about forgone alternatives when their chosen option performs poorly in the hope of compensating for the disappointment in the chosen brand. Alternatively, the area of "counterfactual reasoning" whereby consumers mentally construct forgone outcomes is an area ripe for research (e.g., Adendorth and Shiv 1997). Finally, our theory might be extended to consider situations where information about unconsidered alternatives becomes available subsequent to the choice. Information such as this might indeed influence post-choice valuation, although not by inducing regret.

[9] We thank an anonymous reviewer for this suggestion.

Appendix

Let **X** be defined as the nonempty set of outcomes or performance measures. In the case that product performance is evaluated on multiple dimensions, **X** could be a set of vectors. Also, let P be a convex set of simple probability distributions or risky alternatives {*X, Y, Z,* ...} on **X**.[10] Jia and Dyer (1996a, 1996b) decompose an alternative *X* into a value attribute $\overline{X}$ (i.e., the expected value or anticipated performance) and a disappointment (or standard risk) attribute (X-$\overline{X}$) Note that when this measure is positive, it means elation rather than disappointment. An alternative *X* will then be evaluated by a two-attribute utility model E[$U(\overline{X}, X$-$\overline{X})$], where E is an expectation operator over a von Neumann-Morgenstern utility function *U*. When choosing an alternative *X* involves regret for a forgone alternative, say *Y*, then we can incorporate this effect into the choice model in order to obtain richer descriptive power. Following Bell (1982), we use (*X*-*Y)* to measure regret. Note that when this measure is positive, it implies rejoicing for the choice *X*. We then have a three-attribute structure ($\overline{X}$, X-$\overline{X}$, X-Y) for describing consumer choice behavior under uncertain information.

Let **P** be the convex set of all simple probability distributions, including degenerate distributions, on a nonempty product set, $\mathbf{X_1}\times\mathbf{X_2}\times\mathbf{X_3}$, of outcomes. For this special case, the outcome of an alternative *X* on $\mathbf{X_1}$ is fixed, which is its expected value $\overline{X}$; thus, the marginal distribution on $\mathbf{X_1}$ is a degenerate one with a singleton outcome $\overline{X}$ ¸ $\mathbf{X_1}$. For the second attribute (i.e., disappointment), the marginal distribution on $\mathbf{X_2}$ is X' ¸ P', where P' is the set of normalized probability distributions defined by $X' = X - \overline{X}$, X ¸ P. For the third attribute (i.e., regret), the marginal distribution on $\mathbf{X_3}$ is X'' ¸ P", where P" is the set of probability distributions defined by $X'' = X - Y$, X, Y ¸ P. We assume alternatives *X* and *Y* are statistically independent. Therefore, ($\overline{X}$, X', X'') denotes the distribution in **P** that yields $\overline{X}$ with probability 1, D_X ¸ $\mathbf{X_2}$ with probability X' or equivalently $D_X = X_r - \overline{X}$ ¸ $\mathbf{X_2}$ with probability *X*, where D_X is the realization on the disappointment attribute, and $R_X = X_r - Y_r$

[10] We use *X, Y,* and *Z* to refer to probability distributions and random variables interchangeably.

$\in \mathbf{X_3}$ with probability XY, where R_X the realization on the regret attribute, X_r and Y_r are the realizations on the alternatives X and Y, respectively.

Let $>_\mathbf{p}$ be a strict binary preference relation on **P**. We shall assume throughout that the von Neumann and Morgenstern utility axioms hold for $>_\mathbf{p}$ on **P**. Thus, by expected utility theory, there exists a function U: $\mathbf{X_1}\times\mathbf{X_2}\times\mathbf{X_3} \rightarrow$ Re (a set of real numbers), such that for all $(\bar{X}, X', X'')$, $(\bar{Y}, Y', Y'') \in \mathbf{P}$,

$$(\bar{X}, X', X'') >_\mathbf{p} (\bar{Y}, Y', Y'') \Leftrightarrow E^Y E^X[U(\bar{X}, X', X'')] > E^Y E^X[U(\bar{Y}, Y', Y'')]$$

where E^X represents the expectation operator taken over the probability distribution of alternative X, E^Y is the expectation operator taken over the probability distribution of alternative Y, and U is unique up to a positive linear transformation.

Although we have assumed the von Neumann and Morgenstern utility axioms for the three-attribute consumer preference model, this model can still be classified as a generalized utility model since it will not generally result in a model that is "linear in probability" with respect to the alternatives $X, Y \in$ P. This is because the underlying probabilities of alternatives are also implied in the means, which can enter both the expected performance attribute and the disappointment attribute in some nonlinear and asymmetric fashions, and because of the interactions between the chosen alternative X and the forgone alternative Y in the regret attribute.

To obtain a separable consumer preference model, some independence conditions are needed.

> Assumption 1. The consumer's preferences for expected performance and risk (measured by both disappointment and regret) are independent of one another.

More formally, we assume that the attribute subsets $\{\mathbf{X_1}\}$ and $\{\mathbf{X_2}\times\mathbf{X_3}\}$ are additive independent of one another, that is, a consumer's preferences over risky alternatives depend only on the marginal probability distributions on $\mathbf{X_1}$ and the marginal probability distributions on $\mathbf{X_2}\times\mathbf{X_3}$, and not on their joint probability distributions on $\mathbf{X_1}\times\mathbf{X_2}\times\mathbf{X_3}$ (see Keeney and

Raiffa 1976). For example, if we assume $\bar{X} > \bar{Y}$, $D_X = D_Y$ (i.e., the same level of disappointment or elation), $R_X > 0$ (rejoicing) and $R_Y < 0$ (regret), then the additive independence condition implies that a consumer would be indifferent between receiving an even-chance lottery between ($\bar{X}$, D_X, R_X) (i.e., high expected performance combined with rejoicing) and ($\bar{Y}$, D_Y, R_Y) (i.e., low expected performance combined with regret), and receiving an even-chance lottery between ($\bar{X}$, D_Y, R_Y) (i.e., high expected performance combined with regret) and ($\bar{Y}$, D_X, R_X) (i.e., low expected performance combined with rejoicing). This condition leads to a simple additive structure between expected performance and the risk of disappointment and regret, which can be easily assessed.

> Assumption 2. The consumer's preferences for uncertain levels of regret do not depend on fixed levels of performance and disappointment, and vice versa.

More formally, we assume that the attribute subsets $\{\mathbf{X_1}\times\mathbf{X_2}\}$ and $\{\mathbf{X_3}\}$ are mutually utility independent (see Keeney and Raiffa 1976). Intuitively, this assumption has the interpretation that a consumer's preferences regarding only the risk of regret, which involves comparisons of the performance of his or her chosen product with some other products, do not depend on the levels at which the expected performance and the realized performance of the chosen product are held fixed. Also, for a fixed level of regret for all product choices, the consumer's preference order over these choices regarding expected performance and the risk of disappointment will not be changed when the fixed common level of regret alters. In other words, it should be reasonable to ignore the regret attribute in preference considerations if all product choices would involve the same level of regret (or rejoicing). This seems to be an appealing proposition.

If Assumptions 1 and 2 are satisfied, then our consumer preference model has the following form:

$$E^Y E^X[U(\bar{X}, X', X'')] =$$
$$u_1(\bar{X}) + E^X[u_2(X')] + E^Y E^X[u_3(X'')] + kE^Y E^X[u_2(X')*u_3(X'')] \qquad [A1]$$

where u_1, u_2, and u_3 are utility measures for expected performance, disappointment (or elation), and regret (or rejoicing), respectively, and k is a scaling constant. The proof of this result is straightforward by using Keeney and Raiffa's (1976) results.

An alternative assumption somewhat stronger than the combination of Assumptions 1 and 2 would result in an additive model of consumer preference, eliminating the cross-product term in [A1].

> Assumption 3. The consumer's preferences for performance, disappointment, and regret are mutually independent of one another.

Formally, Assumption 3 is the additivity assumption for three attributes, which implies that preferences for risky alternatives depend only on the marginal probability distributions of the attribute outcomes, and not on their joint probabilities. If Assumption 3 is satisfied, then our consumer preference model has the following form:

$$E^{Y}E^{X}[U(\overline{X}, X', X'')] = u_1(\overline{X}) + E^{X}[u_2(X')] + E^{Y}E^{X}[u_3(X'')] \qquad [A2]$$

Note that models [A1] and [A2] can be used for both pre-choice evaluation and post-choice valuation. For product choice decisions under uncertain information, the preference measure is constructed based on expected performance, anticipatory disappointment/elation, and anticipatory regret/rejoicing as provided in models [A1] and [A2]. After uncertainties have been resolved (e.g., the products have been consumed), the latter two will be replaced by realized disappointment/elation, and realized regret/rejoicing, respectively. Then model [A2] reduces to model [1] in Section 2 for post-purchase valuation. In our experimental studies, we focus on the additive model.

6. References

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Table 1

Outcomes, Probabilities, Expected Outcomes, and Variances of Lottery Pairs Used in Experiment 1

Choice	|---------- Lottery 1----------|						|----------Lottery 2 ----------|					
Pair	High	P	Low	1-P	ExpV	Var	High	P	Low	1-P	ExpV	Var
1	250	.4	50	.6	130	98	250	.2	100	.8	130	60
	Proportion choosing 1=.28						Proportion choosing 2=.72					
2	200	.2	75	.8	100	50	500	.2	0	.8	100	200
	Proportion choosing 1=.86						Proportion choosing 2=.14					
3	500	.4	100	.6	260	196	400	.7	100	.3	310	137
	Proportion choosing 1=.13						Proportion choosing 2=.87					
4	150	.9	50	.1	140	30	200	.4	125	.6	155	57
	Proportion choosing 1=.37						Proportion choosing 2=.63					
5	500	.4	100	.6	260	196	400	.6	50	.4	260	171
	Proportion choosing 1=.60						Proportion choosing 2=.40					
6	500	.6	100	.4	340	147	300	.6	250	.4	280	25
	Proportion choosing 1=.55						Proportion choosing 2=.45					
7	500	.3	100	.7	220	183	300	.5	200	.5	250	75
	Proportion choosing 1=.12						Proportion choosing 2=.88					
8	250	.6	0	.4	150	127	500	.3	0	.7	150	229
	Proportion choosing 1=.85						Proportion choosing 2=.15					

Table 2
Experiment Parameter Estimates
for Post-Choice Valuation Model
and BKSZ Model
(Standard Errors in Parentheses)

	Model [1b] No Asymmetries	BKSZ	Model [1a] Asymmetries	F to Enter	Model [1a] with Interaction
Intercept	9.127*** (0.871)	9.127*** (0.871)	9.563*** (0.847)		9.327*** (0.862)
WE		-0.0020 (0.0012)			
Performance		0.0109*** (0.0006)			
SE (Forgone)		-0.0079*** (0.0005)			
Expected Performance	0.0011 (0.0011)		0.0037** (0.0011)		0.0033** (0.0011)
Overall Disappointment	0.0031*** (0.0008)				
Overall Regret	0.0079*** (0.0005)				
Asymmetric Disappointment					
Elation (Chosen>Expected)			0.0007 (0.0014)		0.0020 (0.0017)
Disappointment (Chosen<Expected)			0.0091*** (0.0014)	25.55***	0.0068* (0.0021)
Asymmetric Regret					
Rejoicing (Chosen>Forgone)			0.0036** (0.0010)		0.0054** (0.0016)
Regret (Chosen<Forgone)			0.0102*** (0.0007)	21.76***	0.0093*** (0.0009)
Disappointment x Regret					-0.0008 (0.0006)
R^2	0.56	0.56	0.59		0.59

* p<.05
** p<.01
*** p<.001
All tests are two-tailed.