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That's What I Thought I Wanted? Miswanting and Regret for a Standard Good in a Mass-Customized World

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How can a standardized product survive in a mass-customized world? This requires understanding that consumers often experience problems predicting their future hedonic reactions to new experiences (such as custom products), leading to feelings of regret. This form of regret occurs not because the custom product differs from specifications, but because consumers miswanted the design they ordered. Our analytic model shows that regret aversion induces consumers to design custom products to reflect the attributes of the available standard products. Consequently, regret-averse consumers may choose the standard product rather than place a custom order. The number of available standard products, however, moderates both these effects. Two experiments empirically substantiate the key predictions of the analytical model: (a) the custom product's resemblance to the standard product grows with regret aversion associated with miswanting, (b) there exists a segment of "regretfully loyal consumers" for the standard product in a mass-customized world and it expands with regret aversion, (c) both the above effects are weakened by the presence of a second standard product, and (d) the custom product can increase its market share when the number of standard products increases.

Key words: customization; standard goods; preference uncertainty; regret

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In the world there are only two tragedies. One is not getting what one wants and the other is getting it (Oscar Wilde 1892).

1. Introduction

1.1. Miswanting and Regret in the Choice Between Custom and Standard Products

Nowadays consumers can customize a variety of products such as furniture, clothing, housewares, and other items according to their individual tastes. Although marketers have always sought to provide consumers with appropriate products, it is only recently that they have been increasingly able to do so, thanks to technological advances in electronic communication that allows them to capture customer preferences and to advances in flexible manufacturing that allows them to create the custom product. The trade press states that many firms have some kind of customized product program underway currently, if they have not launched one already (Agin 2004, Brady et al. 2000, Creamer 2004, Fletcher and Wolfe 2004, Haskell 2004, Pollack 2004).¹

Faced with this onslaught from customized products, what can the manufacturer of a single standard product do? Attacking not at just one point in a perceptual map (Hauser and Shugan 1983) but at all points simultaneously will a mass customizer kill off a standard product unless the standard product substantially lowers its price? Before ringing the death knell for single product brands, we ought to explore the psychological processes that come into play when consumers choose between an available standard product and designing a custom product.

Satisfaction with customization requires that consumers know precisely what they want and can

empirical side, Leichty et al. (2001) studied consumers' preferences and price sensitivities for a variety of features and options on the choice menu for customization. Dellaert and Stremersch (2005) identified the extent of customization as a factor that determines the complexity of the customization decision, and studied how it relates to the utility that consumers obtain from customization. Huffman and Kahn (1998) investigated the complexity of processing information about a wide product assortment. Bendapudi and Leone (2003) explored self-serving biases when consumers participate in co-production. On the analytical side, researchers have recently investigated strategic issues by modeling competitive interactions among firms selling custom products (Dewan et al. 2003, Syam et al. 2005, Syam and Kumar 2006).

¹ Although the trade press scrutinizes customization intensely, the academic marketing literature on customization is sparse. On the

clearly articulate their preferences to sellers. “Wanting” a product is a forecast that it will be “liked” when it is consumed. Do consumers have wants consistent with what they eventually like? There is considerable evidence that consumers’ preferences are often uncertain and imprecise, and their wants at the time of choice can have low correlations with their likes at the time of consumption (Brown and Krishna 2004, Gilbert 2006, Loewenstein et al. 2003, Patrick et al. 2007, Prelec et al. 1997, Rabin 2002, Simonson 1993). In other words, consumers often end up “miswanting” their purchases, forecasting that a product will be liked but subsequently discovering it is not (Gilbert and Wilson 2000). This is especially important when the attributes of the product are novel, as when they have been custom designed. “Not everyone’s a designer, as Rob Wells discovered . . . His design sense took a stray turn in his living room, where he tried matching a ‘real sexy’ faux malachite coffee table with a white leather couch. ‘It was retro meets modern-eclectic. It’s sweet,’ he says. ‘But no one sits on it’” (Fletcher and Wolfe 2004).

If the consumer does not customize, there is always the option of buying a standard product whose attributes were determined by the tastes of the masses. Given that the consumer could have easily purchased such a standard product, miswanting suggests he or she might end up regretting the decision to buy the custom product. Researchers have noted that the basis of regret is cognitive in that one needs to think about both the chosen option and the rejected option (Inman et al. 1997, Tsiros and Mittal 2000). Behavioral decision theorists have argued that regret can affect many decisions even when it is not yet experienced; people sometimes anticipate future regret and make trade-offs in their decisions to avoid or minimize it (Bell 1982, 1983; Loomes and Sugden 1982, 1986; Simonson 1992). In answering the question of how a standard product may fare against an attack by a customizer that offers a clearly superior assortment, we must first ask how consumers with uncertain preferences choose between standard and customized products when they anticipate regret from making incorrect decisions.

When the market contains more than one standard product, there are multiple sources of regret. It is not clear whether potential regret from rejecting standardization will be amplified, thereby detracting from the attractiveness of the custom product, or whether the multiple sources of regret will cancel each other out, thus enhancing the custom product’s attractiveness. Since the custom product itself can be redesigned optimally to take into account the different sources of regret, a more sophisticated analysis is called for.

Our model of consumer choice allows us to answer the following research questions: (1) How do regret

and miswanting affect the way consumers design their optimal custom products? (2) What is the effect of increasing regret aversion on a consumer’s choice between a standard and a custom product? (3) Why would a consumer choose a standard product rather than an equally priced custom product designed to his specification? (4) How is the choice between standard and custom products affected by the number of available standard products?

1.2. Summary of Results and Intuition

We find that the anticipated regret from miswanting works to the advantage of the standard product manufacturer, even when the standard product can be miswanted, too, and when the intensity of regret aversion is the same regardless of whether the standard or customized product is miswanted. This implies that there always exists a segment of consumers who prefer a standard product to the custom product, *even though* the customizer offers every possible product design at the same price (we call these “regretfully loyal consumers”). Moreover, as the level of regret aversion increases, the share of these regretfully loyal consumers of the standard product increases and, therefore, the market share of the custom product decreases. However, this decrease in the market share of the custom product with increasing regret is moderated by the presence of more standard products. Said differently, the custom product loses share when regret aversion increases but, surprisingly, it loses less share when there are more standard products. In two experimental studies reported below, we find empirical support for these theoretical predictions from our analytical model.

A surprising implication of our model is that the presence of additional standard products can work to the *benefit* of the custom product: We show that the preference for the custom product can be higher when there are two standard products compared to when there is only one. This finding is counterintuitive in light of the traditional expectation that increasing the number of standard products should increasingly cover the preference spectrum and squeeze the market for custom products. This theoretical prediction is seen in the pattern of choices in our experiment, although it is not statistically significant. Gourville and Soman (2005) show experimentally that when an existing brand adds more variety along different, noncompensatory attributes, it can lose market share (*vis-à-vis* other brands). Our analytical model shows that when competing against a customized product that can be optimally designed, a standard brand that adds variety can suffer a decrease in its market share *even when* variety is added along the same attribute.

A critical precursor to the above choice and share effects is a theoretical prediction about how the optimal custom product is designed in the presence of

uncertain preferences and regret aversion. Specifically, in the absence of regret aversion, the customer with uncertain preferences will design the customized product to coincide with her expected ideal attribute level. With regret aversion, the optimal custom product design will lie between the expected ideal and the standard product's design, forced toward the standard product in order to reduce expected regret. The more deeply felt the regret aversion, the more similar the optimal custom product is to the standard product. In addition, there is a predicted interaction effect: the regret-generated adjustment of the custom design toward the closest standard product is weaker when there are other standard products.

Our research makes the following contributions. First, it shows that a standard product can retain some share when attacked by a vastly superior customizer without having to cut its price. Second, this result requires us to model consumers' uncertain preferences and anticipated regret in the context of choosing between customized and standard products. We thus incorporate and analytically model a more nuanced consumer psychology in a marketing setting, as asked for by Rabin (2002) and done recently by others (Amaldoss and Jain 2005). Third, while modeling regret is not new, the source of regret in our model is novel compared to most studies of regret. Here, regret springs from miswanting: Consumers may regret the customization decision not because of mistakes by the sellers, product breakdown, or other random external performance issues but because their own preferences are uncertain. Fourth, we experimentally test the implications of our analytical model. One such implication is that there should be a positive interaction effect between the number of standard products and the level of regret aversion in determining the design and, consequently, the demand for custom products. These are not obvious and would be hard to justify without the formal analytic model. Thus, an important contribution of this paper is to demonstrate that analytical models of psychological phenomena can generate precise and useful empirical predictions.

2. A Model of Consumer Miswanting

The traditional model of expected utility assumes that consumers know precisely what they like, although they may be uncertain about what they will get (Roberts and Urban 1988, Ratchford 2001). However, there is considerable psychological evidence that consumers are uncertain about what they want (Gilbert 2006, Gilbert and Wilson 2000, Wilson and Gilbert 2003). It is not uncommon for a person to miswant something. For example, a shopper might buy bright red slacks anticipating that they would look festive during the winter holidays, but when the time comes

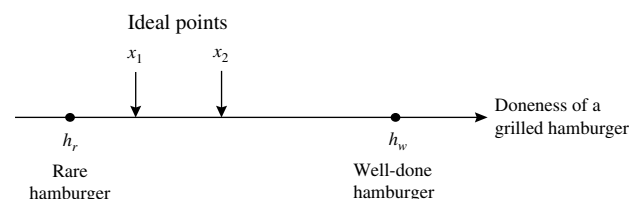
to wear them he discovers that he no longer likes such an unusual style. One can also miswant familiar products due to unanticipated situational elements such as bad health or good weather. In the context of multidimensional pairwise choice, De Soete et al. (1986) have modeled ideal points that are random variables. Though psychologists have pointed out the importance of preference uncertainty, only recently have researchers begun to investigate its marketing implications (Guo 2006).

Since the core of our model of consumer choice of custom products is "preference uncertainty," it is important to make a distinction with uncertainty in the traditional sense. Consider a grilled hamburger. On the attribute line in Figure 1, we plot the length of time the hamburger is cooked, with two distinct levels highlighted "rare" and "well-done." The location of a rare hamburger is h_r and that of a well-done hamburger is h_w . Different consumers have different ideal degrees of "doneness" for a grilled hamburger, modeled as follows. Preferences are captured by the ideal degree of completeness of the cooking of the hamburger, as denoted in Figure 1 by two potential ideal points, x_1 and x_2 . The fact that $x_1 < x_2$ indicates that a consumer with the first ideal point likes a less completely cooked hamburger than a consumer with the second.

In this ideal point model (see Roberts and Urban 1988 for an "ideal vector" model), the consumer's utility from a rare hamburger will depend on how close the hamburger's attribute h is to the consumer's ideal point x , and is measured by $|h - x|$. In the traditional model, consumers know precisely their ideal, say $x = x_1$, but do not know for certain what product will be delivered: It could be either h_r or h_w . If this uncertainty about the product's attributes is described with probabilities p_r and p_w , then the expected utility of a hamburger equals $p_r|h_r - x_1| + p_w|h_w - x_1|$.

Miswanting, on the other hand, corresponds to uncertainty about the ideal point rather than uncertainty about the product attribute. The buyer anticipates that the attribute level x is the one that he will like the best, but this value will not be known until after the product has been purchased and used. The consumer's uncertainty is whether the ideal point is x_1 or x_2 . Though one's precise ideal point is unknown at the time of purchase, it is discovered at

Figure 1



the time of consumption. If the probability of the ideal points x_1 and x_2 are p_1 and p_2 , then the expected utility of a well-done hamburger is $p_1|h_w - x_1| + p_2|h_w - x_2|$. Similar to the traditional decision models of uncertainty, we assume that consumers are cognizant of their preference uncertainty and take it into account in their decision making.

We now develop a general model of miswanting to be used throughout the paper. Prior to making the purchase, the buyer's uncertain wants are described by a probability distribution over the anticipated ideal level x . If the product is ideal, the consumer values the product an amount V . In the traditional ideal point model (Figure 2a) the consumer knows this precisely, but in this paper we assume that future preferences are not so precisely anticipated. To keep the analysis simple, we assume that prior to purchase the buyer has a "fuzzy" ideal point (Zadeh 1965) in that she believes that all values of x in a range $\mu - d/2 \leq x \leq \mu + d/2$ are equally likely to be the eventual ideal level of the attribute. The interval of potential ideal points $[\mu - d/2, \mu + d/2]$ has a midpoint μ and a width d . The expected anticipated level of the ideal attribute is μ but the attribute liked best could be as small as $\mu - d/2$ or as large as $\mu + d/2$, with all such values equally likely as seen in Figure 2b. Of course,

preferences are stable enough that the underlying distribution itself does not change in the future after purchase and experience with the product.

Consumers may have different preferences and because preferences are uncertain in this model, heterogeneity is incorporated by assuming that the expected ideal attribute μ varies within the population over the interval $[0, 1]$.² For analytic simplicity, we assume that all the consumers have identical valuation V and identical degree of preference uncertainty d about the ideal product. Throughout the paper, we assume that a standard product is available to consumers and that it has an attribute level $S \in [0, 1]$. The interval of potential ideal points is assumed wide enough that the standard product S could possibly be the ideal product for all consumers. Specifically, the standard product S falls within the support $[\mu - d/2, \mu + d/2]$ for all μ .³ As a result, it is possible that the standard product has the highest valuation V when the realized ideal attribute level x equals S . More generally, the standard product is not ideal and its utility depends upon the degree to which S differs from x . Once the consumer learns her true ideal x , the utility from the purchase of S depends upon the absolute difference between x and S as illustrated in Figure 3 and expressed algebraically as $U(x, S) = V - |S - x|$. For a fixed S , we can have $\mu > S$, $\mu < S$, or $\mu = S$. Ignoring the special case of $\mu = S$ for the moment, we will analyze the situation where $\mu > S$ as depicted in Figure 3. The case of $\mu < S$ can be analyzed in similar fashion.

Given that x is uniformly distributed, we need to calculate the "expected utility" of the standard product. A similar calculation will be used often and so we provide a detailed derivation in an online technical appendix (see Derivation D1).⁴ The expected utility of consuming the standard product is

$$EU_\mu(S) = V - \frac{(S - \mu)^2}{d} - \frac{d}{4}. \quad (1)$$

Expected utility is written as dependent on the expected ideal attribute μ because we assume that μ varies within the population; other parameters in Equation (1) are common to all consumers. For analytic simplicity, we do not incorporate risk aversion into the consumer model.

² More generally, we could assume that the expected ideal is in an interval $[A, B]$. To reduce the number of parameters in the algebraic derivations and without loss of generality, we rescale this to the unit interval $[0, 1]$. A scaled ideal x below 0 means only that the unscaled ideal was below A , not that the ideal is in some way "bad." We thank an anonymous reviewer for encouraging us to reflect on this issue.

³ This will be true so long as $d \geq 2$.

⁴ The Technical Appendix can be found at <http://mktsci.journal.informs.org>.

Figure 2

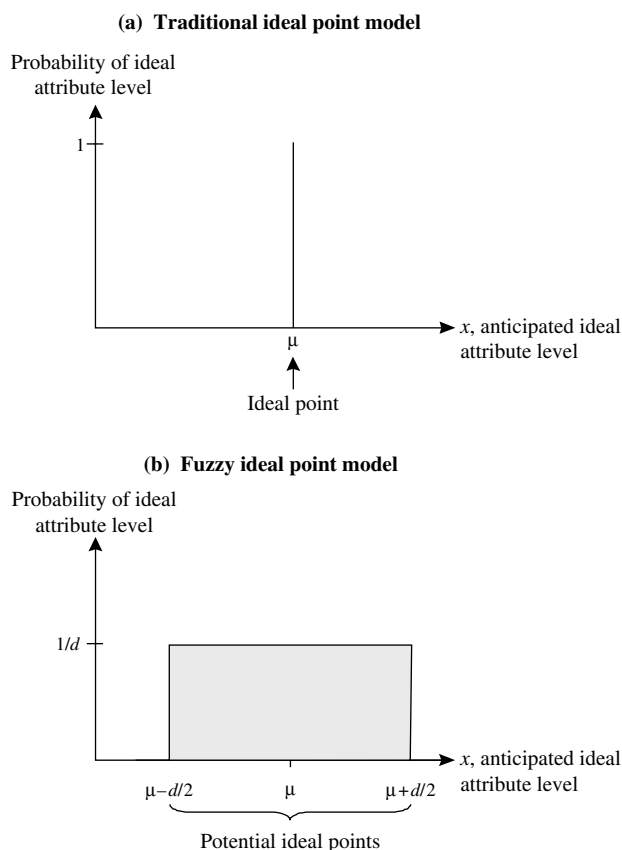
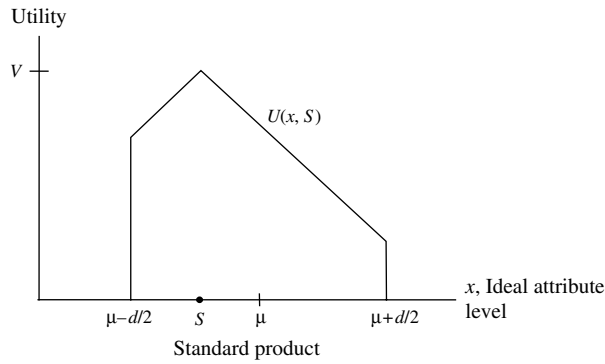


Figure 3



Now, consider a seller who offers to customize the attribute to any level the consumer selects, where the customized attribute level for the typical consumer is denoted C . As above, the utility associated with the custom product is $U(x, C) = V - |C - x|$ and expected utility, following a derivation similar to that for the standard product, is

$$EU_{\mu}(C) = V - \frac{(C - \mu)^2}{d} - \frac{d}{4}. \quad (2)$$

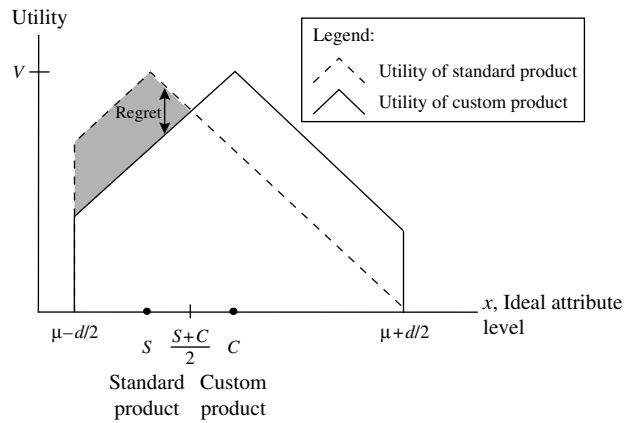
We assume for analytic convenience that the standard and custom products have identical prices P . More generally, we would expect that higher costs of production and higher consumer demand would lead to higher prices for the custom product. The “consumer surplus” that a typical consumer gains from buying a product is his expected utility minus the price: $CS_{\mu}(S) = EU_{\mu}(S) - P$ and $CS_{\mu}(C) = EU_{\mu}(C) - P$.

3. Anticipated Regret of Miswanted Custom Products

If consumers face a choice between the standard product and a custom product, they may regret their decision. Regret exists when buyers attend to the value of foregone alternatives (Inman et al. 1997). For example, if the custom product C was chosen but the realized ideal attribute level was $x = S$, the consumer could have had the highest possible utility V from the standard product but instead gets a smaller utility $V - |C - x|$ from the custom product. To capture the regret from buying the custom product, for each level of x we need to calculate the loss in utility, if any, from buying the custom product compared to what the standard product would have provided. Recall that in this paper the two products have identical prices, so the regret calculation need not consider price.

In Figure 4, regret from buying the custom product with attribute level above that of the standard product $C > S$ only exists when the realized ideal attribute level is small. Regret will kick in only when the realized ideal attribute level is closer to S than to C (x is

Figure 4



smaller than $(S + C)/2$).⁵ For such small values of x , the utility from the custom product is lower than the utility of the standard product. For all x 's above the midpoint between S and C , $(S + C)/2$, there are no regrets from buying the custom product.

We assume that consumers are aware of their preference uncertainties and, therefore, anticipate the future feelings of regret. Given the uniform distribution of x , the expected regret anticipated from buying the custom product rather than the standard product is the area of the shaded portion of Figure 4 times $1/d$. Because a similar calculation will have to be done for the expected regret anticipated from buying the standard rather than the custom product, we provide a sketch of the regret calculation in the online technical appendix in Derivation D2 (the Technical Appendix can be found at <http://mktsci.journal.informs.org>).

The expected regret anticipated from buying the custom product rather than the standard product is:

$$ER_{\mu}(C) = \left[(C - S) \left(S - \mu + \frac{d}{2} \right) + \frac{(C - S)^2}{4} \right] \frac{1}{d}. \quad (3)$$

In a similar manner, we can obtain the expected regret anticipated from buying the standard product rather than the custom product, and it turns out to be:

$$ER_{\mu}(S) = \left[(C - S) \left(\mu + \frac{d}{2} - C \right) + \frac{(C - S)^2}{4} \right] \frac{1}{d}. \quad (4)$$

Consumers must weigh the benefit of consuming a custom product that provides greater expected utility with the cost associated with feelings of regret. To integrate utility and regret, we assume that the

⁵ Without loss of generality, we analyze the case where $\mu > S$. Given this, we also assume that the custom product is to the right of the standard product, i.e., $C > S$. The other case, $C < S$, is clearly suboptimal for the consumer since moving C below S both creates regrets and lowers expected utility.

“net utility” associated with buying the custom product is a weighted average of consumer surplus and expected regret:

$$NU_{\mu}(C) = (1 - r)CS_{\mu}(C) - rER_{\mu}(C), \quad (5)$$

where the weight r is a “coefficient of regret aversion.” A negative sign precedes the regret term because the consumer dislikes more regret. In the limiting case $r = 0$, the consumer only attends to the consumer surplus they can have from the custom product while if $r = 1$, then only regret enters their calculations of well-being. This definition of net utility is consistent with the general formulation of Inman et al. (1997, p. 100).⁶

Some behavioral researchers have argued that there is greater regret aversion from active decisions than from passive decisions (Inman and Zeelenberg 2002, Zeelenberg et al. 2001). For analytic simplicity, however, we assume that regret aversion is equally intense for standard products as for customized products, but we will discuss this issue in the conclusions.

4. Consumer’s Design of a Custom Product

A consumer can buy a standard product or design a custom product. The choice of standard versus custom assumes that the custom product has first been designed to maximize the net utility that accounts both for the uncertainty about preferences and for the anticipated regret that is faced when the custom product is chosen and a standard product is rejected. Maximizing $NU_{\mu}(C)$ specified in Equation (5) gives the optimal design C^* of the custom product for a consumer whose preference uncertainty is centered on μ . It is also important to study how this custom design is influenced by second-best standard products when more than one standard product is available.

4.1. Optimal Design of a Custom Product When There Is One Standard Product

Let us begin by assuming there is only one standard product available and, as in Figure 3, without loss of

generality it has an attribute level S smaller than the expected ideal μ . For the custom product, substituting the expected utility (2) and the expected regret (3) into net utility (5) gives net utility as a function of the customized design C and parameters:

$$NU_{\mu}(C) = (1 - r) \left(V - \frac{(C - \mu)^2}{d} - \frac{d}{4} - p \right) - \frac{r}{d} (C - S) \left[S - \mu + \frac{d}{2} + \frac{1}{4} (C - S) \right]. \quad (6)$$

Solving the first-order condition for maximum net utility (6) with respect to C , the interior solution is:

$$C^* = \mu - \frac{r}{4 - 3r} (S + d - \mu). \quad (7)$$

The second-order condition for net utility maximization is satisfied but the implicit boundary condition $C^* \geq S$ must be checked (see §6.1). Backsubstituting Equation (7) into Equation (6) gives the consumer’s maximized net utility from the custom product:

$$NU_{\mu}(C^*) = (1 - r) \left(V - \frac{d}{4} - p \right) - \frac{r(3 - 2r)}{d(4 - 3r)} \left[\frac{d(2 - r)}{3 - 2r} (\mu - S) - (\mu - S)^2 - \frac{rd^2}{4(3 - 2r)} \right]. \quad (8)$$

How does regret aversion influence the consumer’s design of a custom product? First, observe that in the absence of regret, it is optimal for the consumer to order a custom product that equals his expected ideal attribute level. Specifically, when the consumer feels no aversion to regret ($r = 0$), then the optimal customized product in Equation (7) coincides with the expected ideal attribute level $C^* = \mu$. Second, the presence of regret shifts the optimally designed custom product away from the consumer’s expected ideal attribute level μ and toward the standard product S : $S < C^* < \mu$. This is a consequence of the attempt to mitigate the regret of not choosing the standard product.⁷

THEOREM 1. *Suppose there is one standard product. As consumers’ regret aversion r increases, the optimal custom product C^* of the typical consumer adjusts toward the standard product S and away from the expected ideal attribute level μ .*

4.2. Optimal Design of a Custom Product When There Are Two Standard Products

How is the custom product designed when there are two standard products instead of one, and what is the effect of regret in this design? Consider two standard

⁶ When C^* is chosen, other custom designs are rejected and these might be the basis for a different form of regret. A more general model could have two parameters: r_s for the regret associated with not choosing S and r_f for the regret associated with not choosing the ideal point x . Since S is a “real alternative,” available off the shelf, and any other x is a “fictional alternative,” we would assume that $r_s > r_f$. We analyze only the extreme case where $r_f = 0$, since we are mainly interested in the choice between standard and custom products. Even so, our results will remain qualitatively unchanged in the more general model, since with $r_s = 0$ we would have $C^* = \mu$ and, as our model shows, with $r_f = 0$ we have $C^* < \mu$. Thus, a model with nonzero r_s and r_f will still have $C^* < \mu$, and it is this fact that leads to the interesting implications on choices in our model. We thank the AE and two anonymous reviewers for pointing out this alternative source of regret.

⁷ To keep the text uncluttered, detailed proofs of all theorems are in the appendix at the end of this paper.

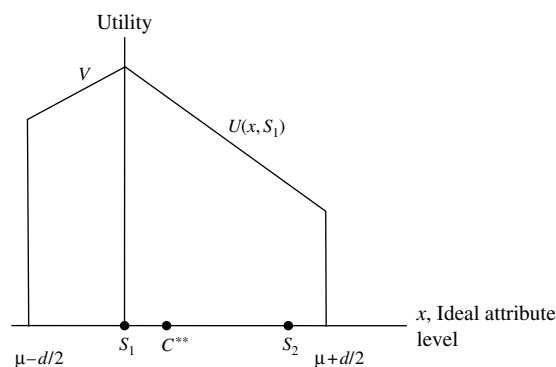
products labeled S_1 and S_2 , with $0 \leq S_1 < S_2 \leq 1$. To facilitate comparison with the one standard product case, we assume that the left-most standard product is identical to the single standard product that was analyzed in the previous subsection: $S = S_1$. To analyze the two-standard product case completely, three subcases must be considered: The expected ideal μ could lie between the two standard products or to the left of both or to the right of both. We analyze each subcase in sequence.

Case i: $S_1 < \mu < S_2$. Let the expected ideal μ lie between S_1 and S_2 . We will present analysis of the case where μ is closer to S_1 than to S_2 , $\mu < (S_1 + S_2)/2$ (see Figure 5) and use symmetry to make conclusions about the complement. If $0 < \mu < (S_1 + S_2)/2$, then the only relevant choice is between the standard product S_1 and the optimally designed custom product.

We must determine the optimal location C^{**} of the custom product (two asterisks denote the situation with two available standard products) and, analogous to Equation (6), this requires us to calculate the net utility $NU_\mu^2(C)$ from buying the custom product (we use the superscript 2 to denote the situation with two standard products). To do this, we calculate the expected utility $EU_\mu^2(C)$ from consuming the custom product and the anticipated regret $ER_\mu^2(C)$ from buying the custom product. These will then be substituted into $NU_\mu^2(C) = (1 - r)CS_\mu^2(C) - rER_\mu^2(C)$. The expected utility from consuming the custom product is exactly the same as in Equation (2) because that calculation is unaffected by whether there are one or two standard products in the market. The derivation of the anticipated regret from buying the custom product when there are two standard products is given in the online technical appendix at <http://mktsci.journal.informs.org> (Derivation D3) and results in:

$$ER_\mu^2(C) = \frac{1}{d} \left\{ (C - S_1) \left[S_1 - \mu + \frac{d}{2} + \frac{1}{4}(C - S_1) \right] + (C - S_2) \left[S_2 - \mu - \frac{d}{2} + \frac{1}{4}(C - S_2) \right] \right\}. \quad (9)$$

Figure 5



Making the appropriate substitutions, the net utility of the custom product is:

$$NU_\mu^2(C) = (1 - r) \left(v - \frac{(C - \mu)^2}{d} - \frac{d}{4} - p \right) - \frac{r}{d} \left\{ (C - S_1) \left[S_1 - \mu + \frac{d}{2} + \frac{1}{4}(C - S_1) \right] + (C - S_2) \left[S_2 - \mu - \frac{d}{2} + \frac{1}{4}(C - S_2) \right] \right\}. \quad (10)$$

Solving the first-order condition for optimal C and checking the second-order condition, the consumer maximizes expected net utility with the custom product:

$$C^{**} = \mu - \frac{r}{2 - r} \left[\frac{S_1 + S_2}{2} - \mu \right]. \quad (11)$$

It is easily seen from Equation (11) that the consumer's optimal custom product is below the expected ideal attribute μ and, as regret aversion increases, the custom product becomes more similar to the standard product S_1 .

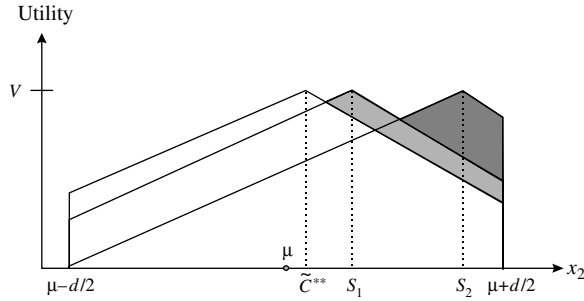
THEOREM 2. *As regret aversion r increases, the optimal custom product of the typical consumer whose expected ideal μ lies between two standard products adjusts toward the best standard product and away from the expected ideal.*

Suppose that the consumer has been customizing when there was only one standard product located at S_1 and then a second standard product becomes available at a location S_2 (farther from the expected ideal than the first one): The optimal customized product changes from C^* to C^{**} . Using Equations (7) and (11), one can show that the additional regret from the second standard product located to the right draws the custom product to the right: $C^{**} > C^*$. As the regret aversion increases, both C^{**} and C^* adjust toward the best standard product S_1 , but C^* adjusts faster, so the gap $C^{**} - C^*$ grows with increases in r .

THEOREM 3. *As regret aversion r increases, the optimal custom product adjusts less noticeably toward a standard product when there are standard products on either side of the expected ideal than when there is only one standard product.*

The intuition for Theorem 3 is that the regret associated with the second standard product acts as a countervailing force on the tendency to adjust the optimal customized product toward the best standard product. With standard products on either side of the expected ideal attribute, the custom product is pulled in opposite directions so its adjustment toward the closest standard product is dampened. In this manner, the optimal custom product locates closer to the consumer's mean preference when there are two, compared to one, standard products.

Figure 6



Case ii: $\mu < S_1 < S_2$. In this case, the expected ideal μ lies to the left of both S_1 and S_2 (see Figure 6). Determining the optimal custom product requires the anticipated regret $ER_\mu^2(C)$ from buying the custom product when both standard products are on the same side of μ ; this is the sum of the light gray and dark gray shaded regions in Figure 6. Again, the expected utility from consuming the custom product, $EU_\mu^2(C)$, is exactly the same as in Equation (2). The derivation of the anticipated regret from buying the custom product when the two standard products are on the same side of μ is in the online technical appendix at <http://mktsci.journal.informs.org> (Derivation D4) and is:

$$ER_\mu^2(C) = \frac{1}{d} \left\{ (S_1 - C) \left[\mu + \frac{d}{2} - S_1 + \frac{1}{4}(S_1 - C) \right] + (S_2 - S_1) \left[\mu + \frac{d}{2} - S_2 + \frac{1}{4}(S_2 - S_1) \right] \right\}. \quad (12)$$

Making the appropriate substitutions, the net utility from the custom product when both standard products lie to the right of the expected ideal is:

$$NU_\mu^2(C) = (1-r) \left(V - \frac{(C-\mu)^2}{d} - \frac{d}{4} - P \right) - \frac{r}{d} \left\{ (S_1 - C) \left[\mu + \frac{d}{2} - S_1 + \frac{1}{4}(S_1 - C) \right] + (S_2 - S_1) \left[\mu + \frac{d}{2} - S_2 + \frac{1}{4}(S_2 - S_1) \right] \right\}. \quad (13)$$

Notice that C does not interact with S_2 in Equation (13). This has the following geometric meaning. If the value of C is changed in Figure 6, the regret associated with standard product S_1 adjusts (the gray region changes). However, the regret associated with standard product S_2 (the cross-hatched region in Figure 6) is not changed by an adjustment of C because the regret associated with S_2 is based upon the foregone standard product S_1 ; this regret is a fixed cost with respect to the custom product.

Consequently, the optimal custom design is independent of the second-best standard product S_2 and

is designed exactly as if *only* the proximal standard product S_1 were present in the market. It is given by:

$$\tilde{C}^{**} = \mu + \frac{r}{4-3r}(d + \mu - S_1). \quad (14)$$

Subject to being below the standard product, this optimal custom design is identical to that with only one standard product (Equation 7). That is, consumers whose expected ideal μ is below both standard products behave as though there is only one standard product—the more proximal of the two.

Case iii: $S_1 < S_2 < \mu$. This is the mirror image of Case ii and will be left to the reader.

4.3. Empirical Hypotheses

Several empirical hypotheses flow from Theorems 1–3. For all hypotheses, we assume that consumers are regret averse and the statement “become more regret averse” means that the regret aversion coefficient r is larger.

First, from Equations (7) and (11) we know that the custom design equals the expected ideal attribute if the consumer is regret neutral. Theorems 1 and 2 state that as regret aversion subsequently becomes positive, the optimal design of the custom product shifts toward the best of the standard products. This implies the following hypothesis:

HYPOTHESIS 1 (H₁). *If a consumer becomes more regretful, she redesigns the custom product to more closely resemble the best standard product.*

Second, suppose that we go from one to two standard products, where the new standard product is “second best” in the sense that it is located further from the expected ideal than the initial standard product. The expected regret associated with the second-best standard product acts as a force pulling the custom design toward it and, therefore, away from the best standard product.

HYPOTHESIS 2 (H₂). *If a second-best standard product becomes available, the consumer increases her custom product's dissimilarity to the best standard product.*

Third, when a consumer becomes more regret averse, the regret-driven increase in similarity between the custom and standard product is mitigated by the presence of a countervailing source of regret, namely another standard product. Equivalently, the increased dissimilarity of custom and standard product when another standard product enters the market is based upon feelings of regret. As a result, if the consumer develops greater aversion to regret, this accentuates the dissimilarity. Hypothetically, there is a positive interaction of the number of standard products and regret aversion in determining the optimal design of the custom product.

HYPOTHESIS 3 (H_3). *The degree to which a more regretful consumer designs a custom product to resemble the best standard product is diminished by the presence of a second-best standard product.*

5. Experimental Study 1: The Design of the Custom Product

The results of the theoretical model were tested in an experimental study. Forty-three undergraduate students from a large urban university participated in exchange for partial course credit as well as an opportunity to “win” \$25 based on their performance in a prediction exercise described below.

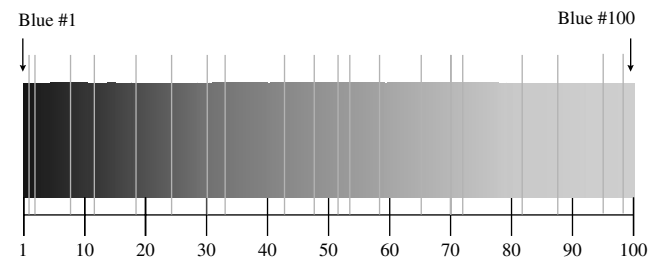
5.1. Context, Procedure, and Design

Participants were asked to act as shopping agents for clients whose preferences they did not know. Their goal was to buy a product from the standard versus custom options such that their pick would come as close as possible to that of their clients. We created this shopping agent scenario and made the client’s preferences unknown to induce and control preference uncertainty, a key requirement of the analytical model. Thus, the context was one in which the participants were to make choices on behalf of others when they do not know the others’ preferences. There were two phases in the study. In the first phase, common to all participants, we reinforced the preference uncertainty through a bogus feedback session. In the second phase, we manipulated the levels of regret aversion and number of standard products to assess the impact on the design of the customized product as outlined in the hypotheses above.

In phase one, we informed the participants that this study involves making predictions about others’ preferences for the color of automobiles, specifically shades of blue that ranged from 1 (darkest) to 100 (lightest). We told the participants that 200 other students had already indicated their preference for their shade from among the 100 shades (this was an experimental fiction). After being shown 100 shades seen in the shaded box of Figure 7, participants were asked to predict the average preferred shade and the most popular range of shades. People on average tended to predict that others would prefer the darker shades (average predicted shade was #35), and this reflected in their prediction of the distribution of the most popular shades (2% thought all shades were equally likely).

To induce preference uncertainty, we gave bogus feedback in which we displayed the “preferences” of a random selection of 20 of the 200 participants. We told the participants that each vertical line represented the preference of one of the 20 participants (Figure 7 shows each of the 20 vertical lines). The

Figure 7



feedback was calculated to suggest that there was a uniform distribution of preferences over the range of available colors, consistent with the requirements of the model.

Having induced preference uncertainty, we proceeded to phase two which comprised manipulation of the independent variables and assessment of preference, as detailed below.

5.2. Independent and Dependent Variables

Regret was manipulated within subjects such that people made the choice in the low regret decision first and then moved to the high regret decision. The number of standard products that people were exposed to was manipulated between subjects. This resulted in a 2 (regret: low/high) \times 2 (number of standard products: one/two) mixed design.

Regret Manipulation. Recall that the participants at this stage only know that they stand to win \$25. In phase two, they were told that they will be making decisions on behalf of two clients drawn from the same population of 200 whose preferences ranged the entire spectrum. They were further told for every shade of blue their predicted shade differs from the shade picked by the other person, they will be assessed penalty points. They were also explicitly told that this meant (a) the further off they are, the greater the penalty points, and (b) the penalty is not affected by whether they pick a darker shade or lighter shade and that the only determinant is the distance from the actual shade. This satisfies the regret computations in the analytical model which requires graduated and symmetric regrets.

The participants were further informed that they will be making two decisions, a small penalty decision and a large penalty decision. This meant that for the same magnitude of error, the penalties will be small for some decisions and large for other decisions. Finally, they were told that their performance depends on the total penalties they accumulate, and three persons with the lowest total penalties will be awarded \$25 each. Thus, the low versus high penalty decision represented the low versus high regret manipulation.

The first decision the participants faced was always the low regret decision. The actual decision was preceded by a page featuring statements to the effect that

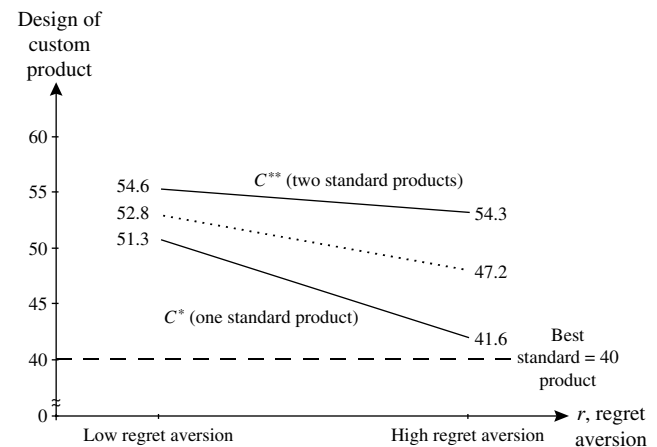
the first decision involves “small penalties” and that, even in the worst case, they will accumulate only a few penalty points and their chance of getting \$25 is only *slightly affected* by the mistakes they make in their choice. The second decision was always the high regret decision, preceded by an admonition that the decision they were about to make involved “large penalties,” and that they could wind up with a lot of penalty points. Their chance of winning \$25 is *significantly adversely affected* by the mistakes they make in their choice. By sequencing the first and second decision as low and high regret decisions, we created a within-subjects’ manipulation of regret. While this is not a balanced design, we found it difficult to manipulate regret from high to low.

Number of Standard Products. The eventual choice faced by the participant was whether to pick the standard product or the custom product. The standard product was shade #40 in the one standard product condition and shades #40 and #70 in the two standard products condition. Notice that the analytical model requires the second standard product to be situated further from the mean preferred shade (#50) compared to the first. These standard product locations satisfy the requirements of the analytical model.

Regret Manipulation Check. Following the declaration of whether the upcoming decision was a small or large penalty decision and before the actual choice decision, participants were asked to indicate the extent to which they might regret their predictions considering the amount of penalty involved. This served as a manipulation check for regret. The results revealed a significant effect of regret, $F(1, 41) = 17.5$, $p < 0.01$; the mean regret in the small versus large penalties decisions were 3.47 and 4.86, respectively. Number of standard products (neither alone nor as interaction with size of penalty, understandably) had an impact on the perception of regret (both F s, n.s.). This is to be expected because the manipulation of the number of standard products came after the regret manipulation check was assessed.

Dependent Measure. To assess the principal dependent measure (the design of the custom product), we informed participants that the manager of the paint store can customize any of the remaining shades of blue from the 100, and asked whether they would elect to customize (yes/no) and, if yes, what shade they would pick to customize. For those electing to customize, their pick of shade was designated as the “designed product.” For those not electing to customize, their pick of standard shade (#40 for one and one of #40 or #70, depending on their earlier pick) was designated as the “designed product.” This designed product was then subjected to a repeated-measures ANOVA with regret as a within-subjects factor and number of products as a between-subjects factor.

Figure 8



Note. Dotted line is the main effect of regret aversion.

5.3. Results

Figure 8 summarizes the empirical findings. Note that the mean preference suggested in the training phase was $\mu = 50$ and the best standard product was $S_1 = 40$. Hence, support for H_1 – H_3 should be understood in terms of the how the custom designed color relates to shade #40.

First, H_1 states that there should be a main effect of increasing regret aversion to adjust the custom design to a lower shade of blue. Indeed, the custom product tended to become more proximal to the standard product (shade #40) as the level of regret increased: 52.8 under low regret and 47.2 under high regret. In a one-tailed test of H_1 , this is significantly negative ($t = -1.86$, $p < 0.04$), confirming H_1 . The corresponding within-subjects effect from the mixed model ANOVA is $F(1, 41) = 3.46$, $p < 0.07$.

Second, H_2 says that the main effect of larger numbers of standard products is to move the custom product away from the best of the standard products, that is, to a higher number shade of blue in our experiment. The average custom color chosen by participants with $N = 1$ standard color (shade #40) was 46.5 but when a second standard color was added (shade #70), the average custom color of participants increased to 54.5 and this increase is marginally significant ($t = 1.32$, $p < 0.096$ one tailed); in effect, it is directionally consistent. The corresponding between-subjects effect from the mixed model ANOVA is $F(1, 41) = 1.76$, $p < 0.19$. This is primarily driven by the one simple effect when regret aversion is high, where the difference 12.7 has $t = 1.99$, $p < 0.03$. The simple effect of number of standard products when regret aversion is low (3.25) is insignificant ($t = 0.48$, $p < 0.32$).

Third, according to H_3 , there should be a positive interaction between the number of standard products and regret aversion. As seen in Figure 8, the slope of

the simple effect of regret aversion changes from -9.7 in the case $N = 1$ to -0.3 when $N = 2$. This increase in slope with respect to regret aversion (decrease in slope magnitude) corresponds to the hypothesized direction and is significant in a one-tailed test ($t = 1.76$, $p < 0.04$). As seen in Figure 8, this is primarily driven by the strong negative simple main effect associated with $N = 1$ standard product ($t = -2.20$, $p < 0.02$). When two standard products are on either side of the expected ideal point, the increase in regret aversion does not significantly change the custom design ($t = -0.04$, $p < 0.48$). The corresponding interaction effect of the number of standard products and regret on the design of the custom product from the mixed model ANOVA is $F(1, 41) = 3.11$, $p < 0.09$.

In summary, the model of the design of customized products, in the presence of standard product(s) and when consumers anticipate the regret associated with miswanting the custom product, is generally supported by the evidence in this experiment.

6. Why Buy a Standard Product Instead of a Custom-Designed Product?

We next discuss the implications of our model of custom design on the choice to buy either the standard or the custom product. As before, we begin with the case of only one standard product and then consider a model with a second-best standard product.

6.1. One Standard Product

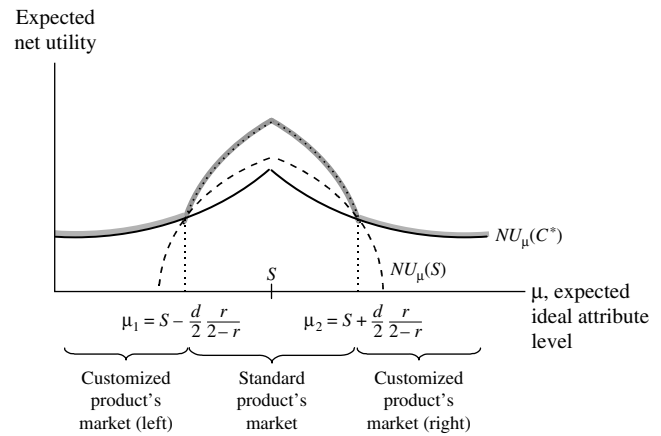
Had the consumer bought the standard product, regret would be based on the foregone opportunity to buy the customized design C^* . Assuming the coefficient of regret aversion is the same for either choice, the net utility formula for the standard product is obtained by substituting the expected utility (1) and expected regret (4) into $NU_\mu(S) = (1 - r)CS_\mu(S) - rER_\mu(S)$. We then obtain the standard product's net utility formula as a function of C^* . Further substituting the custom design C^* from Equation (7) gives the net utility of the standard product as a function of parameters (the expression for which is recorded in Equation 20, Derivation D, in the appendix at the end of the paper). If the expected ideal attribute μ is close to the standard product S , the net utility for the custom product (8) falls below the net utility for the standard product. See the graphs of net utilities of the custom (solid line) and standard (dashed line) in Figure 9.

At $\mu = S$, the net utility formulas for the custom and standard products reduce to:

$$NU_S(C^*) = (1 - r) \left(V - \frac{d}{4} - P \right) + \left[r \frac{r}{4 - 3r} \frac{d}{4} \right] \quad \text{and}$$

$$NU_S(S) = (1 - r) \left(V - \frac{d}{4} - P \right) + \left[r \frac{r}{4 - 3r} \frac{d}{4} \right] \frac{4}{4 - 3r}.$$

Figure 9



Thus, the standard product's net utility always exceeds the custom product's net utility by an amount $(3r^3/(4 - 3r^2))(d/4)$ for a consumer whose expected ideal product matches the standard product ($\mu = S$). In general, the difference between $NU_\mu(C^*)$ and $NU_\mu(S)$ is a function of the discrepancy between the consumer's expected ideal and the standard product's attribute $\mu - S$:

$$NU_\mu(C^*) - NU_\mu(S) = ((S - \mu)^2 - (C^* - \mu)^2)/d. \quad (15)$$

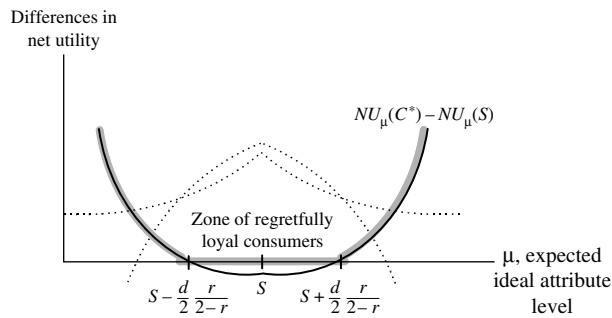
There exists a consumer with expected ideal μ_2 located to the right of S that finds custom and standard products equally desirable. To determine the individual that is indifferent between the standard product and the optimally designed custom product, we solve the equation $NU_\mu(C^*) - NU_\mu(S) = 0$ for μ (details are in Derivation D in the appendix). This defines a zone between μ_1 and μ_2 in Figure 9 where the standard product can compete successfully with the custom product, *even though* both have equal regret intensity r .

Consequently, Equation (7) is the appropriate solution for C^* when $\mu < \mu_1$ and $\mu > \mu_2$, but for $\mu \in [\mu_1, \mu_2]$ the optimal designed custom product is identical to the standard product $C^* = S$. In the latter, the consumer can avoid regret entirely and achieve a net utility of:

$$NU_\mu(C^*) = (1 - r) \left[V - \frac{d}{4} - P - \frac{(\mu - S)^2}{d} \right]. \quad (16)$$

In Figure 9, the net utility from the custom product is the shaded upper envelope of the two curves defined by Equations (8) and (16). Notice that the net utility of Equation (16) (the dotted line in Figure 9) exceeds the net utility $NU_\mu(S)$ recorded in Derivation D in the appendix (the dashed line in Figure 9) because there are no regrets.

Figure 10



In Figure 10, we plot three curves: the net utility from the custom product, the net utility from the standard product, and the difference in net utilities between the custom and standard product. Because the consumers whose μ 's are close to S choose a custom product designed to be exactly the same as the standard product, the difference in net utilities is zero. As a tie breaker, we assume that such consumers avoid the hassle of articulating their needs and buy the standard product even though it is unlikely to be ideal for them. These customers are loyal to the standard product because they want to avoid feelings of regret so we call the interval of μ 's,

$$\left[S - \frac{d}{2} \frac{r}{2-r}, S + \frac{d}{2} \frac{r}{2-r} \right], \quad (17)$$

the zone of “regretfully loyal consumers” for the standard product. We formally state the above discussion as a theorem.

THEOREM 4. *A standard product always has a segment of “regretfully loyal consumers” despite facing competition from a customizer that offers every possible variant of a product at the same price as the standard product.*

It is important to note that the above is true even though the standard product is regretted with equal intensity as the custom product.

If common regret aversion increases in the population, the zone of regretfully loyal consumers of the standard product grows and fewer consumers choose to customize a product.

THEOREM 5. *As the consumers’ regret aversion r increases, the net utility premium of the custom product over the single standard product is reduced and, therefore, the zone of regretfully loyal consumers of the standard product increases.*

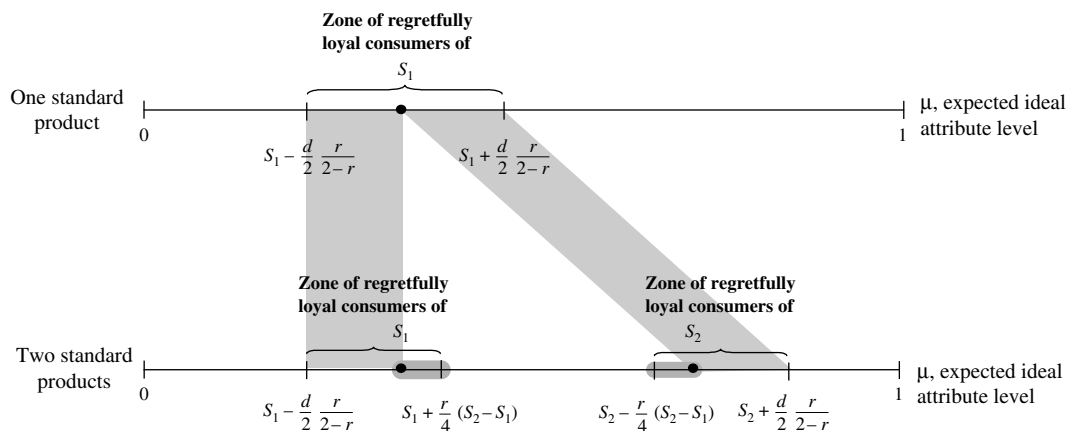
6.2. Two Standard Products

As above, consider two standard products labeled S_1 and S_2 , with $0 \leq S_1 < S_2 \leq 1$ and $S_1 = S$. We will analyze the decision to buy custom versus standard for values of μ in the four regions $[0, S_1]$, $[S_1, (S_1 + S_2)/2]$, $[(S_1 + S_2)/2, S_2]$, and $[S_2, 1]$.

Case a. To begin, suppose that a consumer has an expected ideal $\mu < S_1 < S_2$. The analysis of Case ii in §4.2 shows that the optimal custom product and, therefore, the choice between the custom product and S_1 remains as described in §4.1. The boundary consumer who is indifferent between the custom design and the proximal standard product has an expected ideal $S_1 - (d/2)(r/(2-r))$, as seen in Figure 11. All the consumers in the interval $[S_1 - (d/2) \cdot (r/(2-r)), S_1]$ are in S_1 's zone of regretfully loyal customers whether or not this is the only standard product.

Case b. Suppose that μ is between the standard products but nearer to S_1 : $S_1 < \mu < (S_1 + S_2)/2 < S_2$. As in the one standard product case, the choice of custom versus standard product depends on the expected net utility of choosing the optimal customized product over the standardized product that is closest to the mean preference (which is S_1 in this case). If the consumer chooses the standard product S_1 , the net utility can be obtained by making appropriate substitutions and is recorded in Derivation D in the appendix. The relative attractiveness of the proximal standard prod-

Figure 11



uct S_1 compared to the custom product is:

$$NU_{\mu}^2(S_1) - NU_{\mu}^2(C^{**}) = [(C^{**} - \mu)^2 - (S_1 - \mu)^2]/d. \quad (18)$$

Substituting C^{**} from Equation (11) and solving $NU_{\mu}^2(S_1) - NU_{\mu}^2(C^{**}) = 0$ for μ gives the marginal consumer who is indifferent between buying the standard product S_1 and the custom product. From Derivation D in the appendix, this value of μ is $S_1 + (r/4)(S_2 - S_1)$ and so all the consumers with μ in the interval $[S_1, S_1 + (r/4)(S_2 - S_1)]$ are in the zone of regretfully loyal customers of standard product S_1 , as seen in the dark gray shaded region immediately to the right of S_1 in Figure 11.

Case c. When μ lies in $[(S_1 + S_2)/2, S_2]$, a comparable analysis to the above gives the zone below the standard product S_2 .

Case d. At the other extreme, there is a cluster of customers whose value expected ideal satisfies $S_1 < S_2 < \mu$ who are regretfully loyal to standard product S_2 . The size of that cluster precisely equals the size of the cluster of consumers whose expected ideal is below S_1 but are regretfully loyal to S_1 , as seen in Figure 11.⁸

Combining the above, the total zone of regretfully loyal customers for S_1 is the interval of expected ideal values $[S_1 - (d/2)(r/(2-r)), S_1 + (r/4)(S_2 - S_1)]$. The market share of the standard product S_1 equals $(d/2)(r/(2-r)) + (r/4)(S_2 - S_1)$. The above discussion leads directly to the following:

THEOREM 6. *Suppose there are two standard products. Each standard product always has a segment of “regretfully loyal consumers” despite facing competition from a customizer that offers every possible variant of a product at the same price as the standard product.*

How does product choice relate to the regret aversion of the consumers?

THEOREM 7. *Suppose there are two standard products. As the consumers’ regret aversion r increases, the net utility premium of the custom product over the standard products is reduced and therefore the zone of regretfully loyal consumers of each standard product increases.*

In conclusion, the simple effect of regret aversion on the choice of a standard product is positive for both one and two standard products.

As the number of standard products goes from one to two, the size of the zone of regretfully loyal customers of standard product S_1 changes from $2(d/2) \cdot (r/(2-r))$ to $(d/2)(r/(2-r)) + (r/4)(S_2 - S_1)$. Under the assumption used throughout that $d \geq 2$ (see footnote 3), one can easily see that the zone of regretfully loyal customers of S_1 has shrunk.

⁸ This, of course, assumes that S_1 and S_2 are sufficiently interior that the entire zone of regretfully loyal consumers of standard products lies in $[0, 1]$.

THEOREM 8. *If we hold regret aversion constant and standard product S_2 is added to standard product S_1 in the market, then the zone of regretfully loyal consumers of standard product S_1 decreases.*

Are the magnitudes of these simple effects identical or is there a “regret aversion” \times “number of standard products” interaction in determining product choice? Theorem 3 hints at this: The optimal customized product is more responsive to regret aversion when there is one versus two standard products that straddle the expected ideal. This finding about product design translates into a theorem about product choice.

THEOREM 9. *The zone of regretfully loyal consumers of a standard product expands less dramatically in response to a given increase in consumers’ regret aversion r when there is a second standard product than when there is one.*

In Case b, where $S_1 < \mu < (S_2 + S_2)/2$, even though the other standard product (S_2) is a dominated alternative and is not chosen, it affects the redesign of the optimal custom product in such a way that the custom product becomes a more attractive alternative than it would be when there is only one standard product. This suggests the possibility that the addition of new standard products in the market might actually work to the clear *advantage* of the custom product. This surprising result turns out to be true for a large set of parameter values: when the standard products are far apart and regret aversion r is high. When the standard products are far apart, one or both of the standard products are close to the nearest boundary and lose some of the regretfully loyal customers. Then, when r is large enough (larger than the value \hat{r} given in Equation 29 in the appendix) the custom product can benefit from more standard products.⁹

THEOREM 10. (a) *Suppose S_1 is the incumbent standard product and S_2 enters the market. For sufficiently high regret aversion ($r > \hat{r}$), the market share of the custom product increases after the entry of S_2 . (b) This increase is greater for larger regret aversion.*

For example, when $S_1 = 0.4$, $S_2 = 0.7$, $d = 2$, then for $r = 0.6$ the market share of the custom product with one standard product is 18%, but when the second standard product is added the customized market share rises to 21%.

Theorem 10a can be understood by noting that with the standard products sufficiently distant from each other, the custom product has the maximum room to

⁹ In the extreme case ($S_1 \rightarrow 0$, $S_2 \rightarrow 1$), we find that for all degrees of regret aversion, the sales of custom goods rise when the second standard product enters the market. Theorem 10a is driven primarily by the behavior of consumers for whom both standard products are viable alternatives, i.e., μ 's that lie between S_1 , S_2 .

occupy between them. This, and the fact that standard products at the extremities have fewer customers than they would have if they were in the middle of the market explains this finding. Note that the redesign of the optimal custom product when the number of standard products increases, as predicted by our analytical model, is crucial for this result. If the custom product's design remained unchanged in going from one to two standard products, then a particular standard product would have the same market segment regardless of the number of standard products, and this result would not hold. Also, we have already shown that as the regret aversion increases, both C^{**} and C^* are reduced from μ but C^* is reduced faster, so the gap $C^{**} - C^*$ grows with increases in r . In terms of distortions from the desirable design (which is the expected ideal μ), the difference in distortions between the one and two standard product cases is most stark when regret is high. Therefore, the higher attractiveness of the custom product in the presence of two standard products compared to one is most pronounced when regret aversion is higher. This explains Theorem 10b.

6.3. Empirical Hypotheses

How is the choice between buying the standard versus custom product influenced by regret aversion of the consumers and the number of standard products? As Theorems 4 and 6 state, there will be some regret averse consumers who will buy the standard product. This is a nontrivial hypothesis because there is no reason to expect any share for the standard product when there is a customizer who can provide every possible variant, including the standard product, for the same terms. A utility maximizing customer ought to pick a custom product at the mean of the preference interval when their preferences are uncertain. Thus, an "intuitive" model predicts that a standard product would have zero market share. In contrast, our analytical model of miswanting and regret predicts a positive share for the standard product.

HYPOTHESIS 4 (H_4). *If consumers are regretful, then some of them will choose to buy a standard product rather than a custom product.*

As Theorems 5 and 7 suggest, the number of consumers that regretfully choose the standard product rather than buying an optimally designed custom product increases with the regret aversion of the consumers.

HYPOTHESIS 5 (H_5). *If consumers become more regretful, it is more likely that they will buy a standard product.*

Suppose that we go from one to two standard products. The expected regret associated with the new standard product acts as a force pulling the custom

design toward it and, therefore, toward the expected ideal attribute. As Theorem 8 establishes, this makes the optimal custom product more attractive relative to the existing standard product.

HYPOTHESIS 6 (H_6). *If a second standard product becomes available, fewer consumers choose to buy the existing standard product.*

When a consumer becomes more regret averse, this makes the standard product more attractive as a regret minimizing choice, but this regret is mitigated by the presence of a countervailing source of regret, namely another standard product. As a result, if the consumer develops greater aversion to regret, fewer will switch to the standard product when there is a second standard product also available.

HYPOTHESIS 7 (H_7). *Suppose that consumers become more regret averse. The presence of a second standard product lessens the increase in consumers that regretfully choose the incumbent standard product.*

Finally, when regret aversion is large the demand for the custom product can increase when a second standard product enters the market.

HYPOTHESIS 8 (H_8). *If consumers are very regret averse, the addition of a second standard product to the market can increase the proportion of consumers that choose the custom product.*

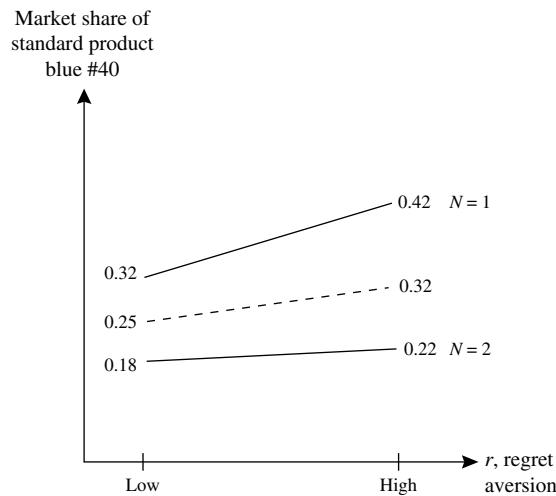
7. Experimental Study 2: Choice Between Standard and Custom Products

7.1. Experimental Design

Study 2 basically duplicates Study 1 as described in §5, with the following changes. First, when the 102 participants were given the option to buy the standard product or buy a custom product, the customized designs were limited to the 11 values $\{0, 10, 20, \dots, 100\}$ rather than 100 values. This was done to increase the proportion of participants who might find the standard blue #40 attractive (versus a custom color #41 which is visually indistinguishable). Second, the study was conducted in person rather than online. Third, while participants were asked to set aside their own preferences for colors while playing the role of a buyer's agent, there is an issue of how well they accepted this role. We measured their personal color preference and corrected for it in the statistical analysis.¹⁰

¹⁰ Individual color preferences were coded as central values = $[34, 65]$ or extreme values = $[0, 33] \cup [66, 100]$ and controlled for using the POPULATION statement in the CATMOD procedure (SAS 1990, p. 429).

Figure 12



Note. Dotted line is the main effect of regret aversion.

7.2. Results

The results of manipulation of regret aversion and number of standard products on the proportion of participants that chose the standard blue color #40 are displayed in Figure 12.

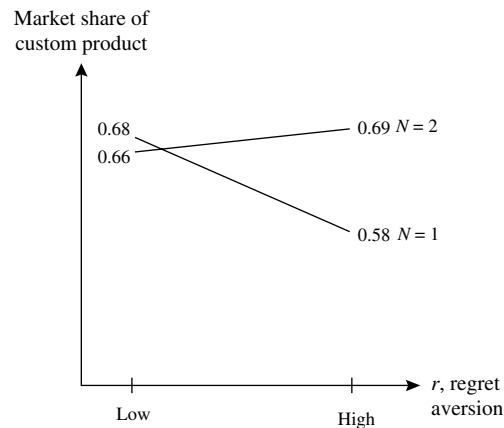
First, consider H_4 that states that the standard product will have a positive market share even though a custom product is available (that allows them to choose any color, including the standard one). As can be seen in Figure 12, 29% of the participants chose the standard blue #40 in the 204 choice situations and this is significantly positive ($p < 0.01$). Incidentally, this proportion is also significantly greater than one eleventh—the share for the standard product of each design is equally likely.

Hypotheses H_5 , H_6 , and H_7 were tested using a log-linear model (PROC CATMOD). Hypothesis H_5 states there should be a positive main effect of increasing regret aversion on the choice of the standard product. The proportion that chose the standard product (blue #40) increased from 0.25 to 0.31 at higher levels of regret, $\chi^2(1) = 1.93$, $p < 0.08$ (one tailed), consistent with H_5 .

Hypothesis H_6 says there should be a negative main effect of number of standard products on the likelihood of consumers choosing the incumbent standard product. As seen in Figure 12, 37% of the participants chose blue #40 when only it was available, while 19% chose it when there was a blue #70 as well as a custom product available. This is a statistically significant drop ($\chi^2(1) = 6.28$, $p < 0.01$ one tailed).

Hypothesis H_7 says that the effect of regret aversion is negatively moderated by the presence of a second standard product. As seen in Figure 12, the slope of the line for $N = 2$ is considerably smaller than that

Figure 13



of $N = 1$, and this difference in slopes is statistically significant ($\chi^2(1) = 3.69$, $p < 0.03$ one tailed).

Finally, H_8 suggests that there exists a level of regret at which the demand for the custom product can be higher when there are two standard products compared to just one. We found directional support (see Figure 13) for this hypothesis using a preplanned simple effect contrast of number of standard products within the high regret conditions; the proportion choosing to customize was directionally higher when there were two standard products, 69%, than when there was one, 58% ($\chi^2(1) = 1.29$, $p < 0.11$ one tailed).

In summary, the model of the choice between standard and customized products is generally supported by the evidence from this experiment.

8. General Discussion

A central contribution of this paper is a novel model of consumers' uncertain preferences and anticipated regret in the context of customization. Behavioral researchers have argued that consumers' preferences are often fuzzy and imprecise (Simonson 1993). Not only do we formally incorporate the psychology of this consumer miswanting in an analytic model, but we also provide a model of anticipated regret due to customizing decisions. In sum, this paper integrates important psychological processes into models of economic phenomena as have been called for by economists (Rabin 2002).

In our model, consumers rationally incorporate their miswanting and anticipated regret in designing their custom products, and compare the aggregate utility from an appropriately designed custom product with that of standard product. With regard to the optimal choice of the custom product, we show that if consumers do not face any regrets from incorrect decisions, it is optimal for them to order the custom product that exactly coincides with their mean preferences. This is consistent with the intuition that, absent

other factors affecting their decisions, consumers with uncertain preferences who make a choice before their preferences are realized can do no better than to choose the custom product at their mean preferences. However, if they anticipate regret from incorrect decisions, the optimal location of the custom product is shifted away from their mean preference and toward the pre-existing standard product. This is, of course, a regret-minimizing strategy. As the level of regret aversion increases, consumers tend to prefer the standard product to the custom product even though they associate the *same* level of regret aversion with the standard and custom products.

Interestingly, we find that the tendency to favor the standard product under conditions of higher regret aversion is diminished if consumers have more standard products in their preference intervals. Thus, counter to intuition, the presence of more standard products can work to the advantage of the custom product. Regret aversion makes the design of the custom product move closer to preexisting standard products and away from a consumer's mean preference. However, with two standard products on either side of the mean preference the custom product is pulled in opposite directions and its movement toward the preferred standard product is impeded. This may be to the advantage of the custom product, as more consumers might choose it over the standard products.

Although our hypotheses spring directly from our theoretical model, it is important to discuss some of our experimental findings in the context of findings in the literature that predict preference for the norm under higher regret (Chernev 2004). The prediction that people prefer the standard product when regret level increases echoes the prediction from norm theory that as regret increases so does the preference for the norm, i.e., the standard product. It is also noted in Chernev (2004) that the prevention focus engendered by regret induces inertia and encourages preference for the norm. The more interesting part of our paper has to do with what happens when the number of standard products increases from one to two. If regret-induced preference for the norm is the sole driver, then people have two ways rather than one way of reducing regret by picking the standard product. If this is true, there should be an even greater decrease in the preference for the customized product under higher regret when there are two standard products compared to one. Our model, in contrast, predicts that the opposite can happen and the experimental results are consistent with our prediction.

Our observed behavior (the middle alternative of three is more likely to be chosen than it would be if it was one of just two alternatives) has been called the "compromise effect" by Simonson (1989). It is a

specific form of the more general "context effect" that says the target product is influenced by the presence of a decoy product (Prelec et al. 1997). Wernerfelt (1995) provided a microbehavior-level explanation for the compromise effect that complements ours. In his model, there are three brands $\{1, 2, 3\}$ whose fixed attribute levels are ordered as $a_1 < a_2 < a_3$, and if all three are available, the consumer can precisely identify the attribute levels. However, if presented with just two brands from this set, the consumer can only identify the relative positioning of the attributes. That is, the consumer observes a low attribute-level brand A and high attribute-level brand B , where the ordered pair of attributes (A, B) could be (a_1, a_2) , (a_1, a_3) , or (a_2, a_3) but not (a_2, a_1) , (a_3, a_1) , or (a_3, a_2) . The uncertainty about the true values of the attributes of the two brands A and B implies that realized utility is uncertain compared to the three-brand case, and Wernerfelt (1995) shows how that can lead to the compromise effect.

In our model, by contrast, consumers have precise and certain perceptions of the attribute that the brand will deliver, but are instead uncertain about what their own ideal attribute level will be when the product is consumed. In addition, the middle alternative in our model does not have a predetermined attribute level, but is customized by the consumer. If the customized level chosen when there is only one standardized brand available, C^* , could not be adjusted after the appearance of a second standardized product, our model would predict that the market share of the customized (middle) product would not increase. It is the adjustment of the customized product from attribute level C^* to C^{**} as predicted by our model that creates the increased demand for the middle alternative. Moreover, as the analysis in Case ii (§4.2) shows, if the custom product is located to the left of both standard products, $C < S_1 < S_2$, then S_1 is the middle alternative, but the custom product in our model is designed as if S_2 did not exist. The choice between C and S_1 reflects this: the market shares of the custom product and S_1 when two standard products are on the same side is exactly the same as that when there is only S_1 in the market.

Managerially, our analysis suggests that a manufacturer of a standard product facing threat from a manufacturer of custom products does not have to offer a price discount (relative to the customizer) to survive. In view of the fact that the customizer offers a clearly superior product assortment (including what is offered as the standard product), this finding is surprising. The consumer behaviors of miswanting and regret ensure that the standardizer always has a mass of regretfully loyal consumers at the same price.

It is important to note that the above result is not driven by any asymmetric regret aversion for

the standard and custom products. Some behavioral researchers have argued that there is greater regret aversion from active decisions (custom products) than from passive decisions (standard products) (Inman and Zeelenberg 2002, Zeelenberg et al. 2001). Though we do not assume differential intensity of regret between the custom and the standard product, this is easy to incorporate in our consumer model and will not affect any of our results. A major implication of our analysis is that due to consumers' feelings of regret, a standard product will be able to retain positive market share when competing with a custom product that is offered at the same price. Higher regret will only strengthen our result.

Acknowledgments

Authors' names appear in reverse alphabetical order and do not indicate any ranking of contributions to this research.

Appendix

PROOF OF THEOREM 1. From the expression for the optimal customized product given in Equation (7), for a consumer with expected ideal attribute $\mu > S$, the optimal custom product C^* is smaller than μ by $r/(4-3r)(S+d-\mu)$. This is positive since $S \geq \mu - d/2$ and $0 < r < 1$, so C^* is below μ . As regret aversion increases, the term $r/(4-3r)$ increases so C^* adjusts toward S and away from μ .

PROOF OF THEOREM 2. $\partial C^{**}/\partial r = (2\mu - S_1 - S_2)/(2-r)^2 < 0$ because $S_1 + S_2 = 1$ and we are assuming that $\mu < 0.5$.

PROOF OF THEOREM 3. Note that $\partial C^*/\partial r = 4(\mu - d - S)/(4-3r)^2 < 0$ and $\partial C^{**}/\partial r = (2\mu - S_1 - S_2)/(2-r)^2 < 0$. Let the location of the more attractive standard product be the same in both cases, i.e., $S = S_1$. Now consider the absolute values of the partial derivatives above. From $d + S_1 - \mu > S_1 + S_2 - 2\mu$ and from $4/(4-3r)^2 > 1/(2-r)^2$, it directly follows that $|\partial C^*/\partial r| > |\partial C^{**}/\partial r|$.

Derivation D: The Zones of the Regretfully Loyal Customers of the Proximal Standard Product in the Cases with One and Two Standard Products

Case 1: One Standard Product. Making appropriate substitutions, the net utility of the standard product is:

$$NU_\mu(S) = (1-r) \left[V - \frac{d}{4} - P - \frac{(\mu-S)^2}{d} \right] - \frac{r}{d} (C^* - S) \left[\mu + \frac{d}{2} - C^* + \frac{1}{4} (C^* - S) \right]. \quad (19)$$

Substituting C^* from Equation (7) gives:

$$NU_\mu(S) = (1-r) \left(V - \frac{d}{4} - P - \frac{(\mu-S)^2}{d} \right) - \frac{r}{d(4-3r)^2} [(2-r)(2-3r)(\mu-S)^2 + (4-3r+(3/2)r^2)(\mu-S)d - d^2r]. \quad (20)$$

Substituting $NU_\mu(C^*)$ from Equation (8) and $NU_\mu(S)$ from Equation (20), we have:

$$NU_\mu(C^*) - NU_\mu(S) = \frac{[2(\mu-S)(2-r) - dr][4\mu(1-r) - 4S + r(d+4S)]}{d(4-3r)^2} = 0. \quad (21)$$

Equation (21) has two roots for μ , but only one of them is greater than S . Since we are only analyzing the case $\mu > S$, this root gives the value of the expected ideal of the indifferent consumer. The specific value of this expected ideal is $\mu_2 = S + (d/2)(r/(2-r))$. By symmetry, there is also an indifferent consumer to the left of the standard product, $\mu_1 = S - (d/2)(r/(2-r))$. This can be obtained by analyzing the case where $\mu < S$ and $C < S$.

Case 2: Two Standard Products. In this case, the net utility from the proximal standard product is:

$$NU_\mu^2(S_1) = (1-r) \left(V - \frac{(S_1 - \mu)^2}{d} - \frac{d}{4} - P \right) - \frac{r}{d} \left\{ (C - S_1) \left[\mu + \frac{d}{2} - C + \frac{1}{4} (C - S_1) \right] + (C - S_2) \left[S_2 - \mu - \frac{d}{2} + \frac{1}{4} (C - S_2) \right] \right\}. \quad (22)$$

Subtracting Equation (10) from Equation (22) gives the relative attractiveness of the proximal standard product S_1 :

$$NU_\mu^2(S_1) - NU_\mu^2(C^{**}) = [(C^{**} - \mu)^2 - (S_1 - \mu)^2]/d. \quad (23)$$

Substituting C^{**} from Equation (11) and solving $NU_\mu^2(S_1) - NU_\mu^2(C^{**}) = 0$ for μ gives the marginal consumer who is indifferent between buying the standard product S_1 and the custom product. This value of μ equals $S_1 + (r/4)(S_2 - S_1)$.

PROOF OF THEOREM 5. When regret aversion is not so severe, some consumers strictly prefer the custom product and one can prove that:

$$\frac{\partial(NU_\mu(C^*) - NU_\mu(S))}{\partial r} = 2(\mu - C^*) \frac{\partial C^*}{\partial r} \leq 0,$$

given that C^* is below μ and decreases with r (Theorem 1). By the envelope theorem, it is easy to show that if the consumer has higher regret aversion r , then the optimal net utility of the custom product must fall: $\partial NU_\mu(C^*)/\partial r < 0$. That is, if the consumer feels regret more intensely, this reduces the attractiveness of the custom product. On the one hand, if $\partial NU_\mu(S)/\partial r > 0$, then increases in regret intensity make the standard product more attractive and make the custom product less attractive. On the other hand, if $\partial NU_\mu(S)/\partial r < 0$, then two inequalities above imply that $|\partial NU_\mu(C^*)/\partial r| > |\partial NU_\mu(S)/\partial r|$.

PROOF OF THEOREM 7. The boundary value of the zone of regretfully loyal consumers of S_1 is $S_1 - (d/2)(r/(2-r))$ when $\mu < S_1$, and $S_1 + r(S_2 - S_1)/4$ when $\mu > S_1$. Since $(\partial/\partial r)(S_1 + r(S_2 - S_1)/4) > 0$ and $(\partial/\partial r)(S_1 - rd/(2(2-r))) < 0$, therefore, the zone of regretfully loyal consumers of S_1 increases with higher regret. Hence, the share of the custom product must decrease.

PROOF OF THEOREM 9. First, note that the analysis so far only considers consumers whose only active choice is between S_1 and the custom product, i.e., consumers whose

μ 's are in $[0, 0.5]$. As we have already established, the effect of increasing r is to reduce the share of the custom product and to increase the share of S_1 , regardless of there being one or two standard products. The difference in the change in the share of S_1 w.r.t. r in going from one to two standard products is:

$$\begin{aligned} & \frac{\partial}{\partial r} \left(\frac{rd}{2-r} \right) - \frac{\partial}{\partial r} \left(\frac{rd}{2(2-r)} + \frac{r(S_2 - S_1)}{4} \right) \\ &= \frac{4d - (2-r)^2(S_2 - S_1)}{4(2-r)^2}. \end{aligned}$$

The last quantity is positive because $d > 2$ and $S_2 - S_1 < 1$. Thus, the increase in the zone of regretfully loyal customers of S_1 with higher regret is less when there are two standard products than when there is one standard product. Therefore, the custom product loses less market share with increasing regret when there are two standard products than when there is one standard product.

PROOF OF THEOREM 10. Without loss of generality, let us fix the location of $S_1 < \mu$. Consider the case when there is one standard product S_1 in the market. From Equation (17), the market share for the custom product is:

$$1 - \frac{rd}{2-r}. \quad (24)$$

Consider the case when there are two standard products in the market. Further let S_2 be sufficiently distant from S_1 and close to 1, such that the right boundary of the zone of regretfully loyal customers of S_2 is greater than 1. In other words, $S_2 + rd/(2(2-r)) > 1$. With $d = 2$, this inequality is satisfied for:

$$r > 2 - \frac{2}{2 - S_2}. \quad (25)$$

From Figure 11, we can see that the market share for the custom product in this case is:

$$1 - \left[\frac{r}{4}(S_2 - S_1) + \frac{rd}{2(2-r)} \right] - \left[1 - S_2 + \frac{r}{4}(S_2 - S_1) \right]. \quad (26)$$

Taking the difference of the expressions in Equations (26) and (24) and setting $d = 2$, we find that the custom product's market share will increase when there are two standard products than when there is one, if:

$$S_2 + \frac{r}{2-r} - 1 - \frac{r}{2}(S_2 - S_1) > 0. \quad (27)$$

The right hand side (RHS) of the above quadratic expression in r and the corresponding quadratic equation has only one positive root. Solving, we find that the inequality in Equation (27) is satisfied if

$$r > \frac{2S_2 - 2 - S_1 + \sqrt{4 + S_1^2 - 4S_2}}{S_2 - S_1}. \quad (28)$$

Thus, when Equation (28) holds, the custom product benefits when there are more standard products in the market. Of course, the condition $S_2 + rd/(2(2-r)) > 1$ has to be satisfied, which implies that Equation (25) has to be satisfied. Both the conditions (25) and (28) can be written as:

$$r > \hat{r} = \max \left\{ \frac{2S_2 - 2 - S_1 + \sqrt{4 + S_1^2 - 4S_2}}{S_2 - S_1}, 2 - \frac{2}{2 - S_2} \right\}. \quad (29)$$

In other words, for r satisfying Equation (29), the custom product sells more when there are two standard products. Clearly, if S_2 's location is fixed with $S_2 > \mu$, then we will require S_1 to be distant and close to 0. We will then obtain an analogous condition for $S_1 - rd/(2(2-r)) < 0$, except that the condition corresponding to Equation (25) will be expressed w.r.t. S_1 . In any case, there will be an analogous condition to Equation (29) guaranteeing that the custom product will sell more when there are two standard products.

Finally, we find that the RHS of Equation (27) increases in r because:

$$\begin{aligned} & \frac{\partial}{\partial r} \left\{ S_2 + \frac{r}{2-r} - 1 - \frac{r}{2}(S_2 - S_1) \right\} \\ &= \frac{1}{2-r} + \frac{r}{(2-r)^2} - \frac{S_2 - S_1}{2}, \end{aligned}$$

and since $\max(S_2 - S_1) = 1$, therefore substituting $(S_2 - S_1) = 1$ shows that the derivative is positive. Thus, the advantage to the custom product from an increase in the number of standard products increases in r .

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