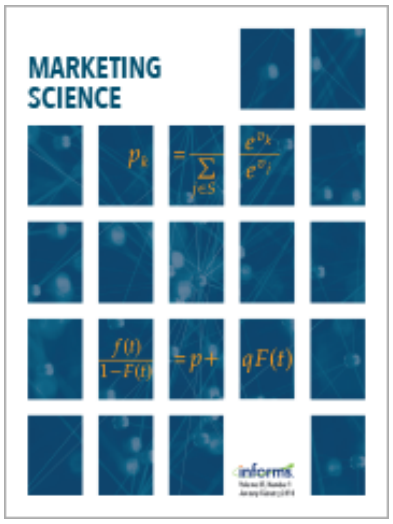
This article was downloaded by: [154.59.124.38] On: 29 June 2021, At: 02:00
Publisher: Institute for Operations Research and the Management Sciences (INFORMS)
INFORMS is located in Maryland, USA



Marketing Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Expected Firm Altruism, Quality Provision, and Brand Extensions

Julio J. Rotemberg,

To cite this article:
Julio J. Rotemberg, (2013) Expected Firm Altruism, Quality Provision, and Brand Extensions. Marketing Science 32(2):325-341. https://doi.org/10.1287/mksc.1120.0765

Full terms and conditions of use: https://pubsonline.informs.org/Publications/Librarians-Portal/PubsOnLine-Terms-and-Conditions

This article may be used only for the purposes of research, teaching, and/or private study. Commercial use or systematic downloading (by robots or other automatic processes) is prohibited without explicit Publisher approval, unless otherwise noted. For more information, contact permissions@informs.org.

The Publisher does not warrant or guarantee the article's accuracy, completeness, merchantability, fitness for a particular purpose, or non-infringement. Descriptions of, or references to, products or publications, or inclusion of an advertisement in this article, neither constitutes nor implies a guarantee, endorsement, or support of claims made of that product, publication, or service.

Copyright © 2013, INFORMS

Please scroll down for article—it is on subsequent pages

With 12,500 members from nearly 90 countries, INFORMS is the largest international association of operations research (O.R.) and analytics professionals and students. INFORMS provides unique networking and learning opportunities for individual professionals, and organizations of all types and sizes, to better understand and use O.R. and analytics tools and methods to transform strategic visions and achieve better outcomes.
For more information on INFORMS, its publications, membership, or meetings visit http://www.informs.org

MARKETING SCIENCE
Vol. 32, No. 2, March–April 2013, pp. 325–341
ISSN 0732-2399 (print) | ISSN 1526-548X (online)

http://dx.doi.org/10.1287/mksc.1120.0765
© 2013 INFORMS

Expected Firm Altruism, Quality Provision, and Brand Extensions

Julio J. Rotemberg
Harvard Business School, Boston, Massachusetts 02163, jrotemberg@hbs.edu

A setting is considered where consumers keep track of the extent to which brands care about them, which is modeled as altruism of brands toward their target consumers. Consumers who purchase an experience good of high quality reasonably deduce that the supplier of this good is relatively altruistic toward them, and they are therefore more keen to purchase a brand extension that is also directed at them. As a result, the success of brand extensions depends on the overlap between the customers of the original product and the target customers of the extension product. The quality and demand for a brand extension can be higher if the brand is perceived as caring only for its most quality-conscious consumers rather than for all possible buyers of the good.

Key words: quality provision; firm objectives; brand extensions; price signaling
History: Received: May 25, 2011; accepted: November 8, 2012; Preyas Desai served as the editor-in-chief and Ganesh Iyer served as associate editor for this article. Published online in *Articles in Advance* January 23, 2013.

1. Introduction

In many of the mission statements collected by Abrahams (2004), firms and brands claim to care for their customers. At the same time, the evidence of Fournier (1998) suggests that some customers keep track of how much brands care for them, with one customer remembering that she reacted to a design change feeling, "How could they do that to me?" (Fournier 1998, p. 355). The willingness of consumers to attribute human emotions to brands might seem absurd but for the fact that decisions about brands are made by people, and that both founders and boards of directors can delegate decisions to individuals who put weight on their own emotions. Moreover, if the pride and self-esteem of managers, designers, and engineers depend on their assessment of their and their firm's contributions to the lives of consumers, firms that sometimes act as if they sacrifice profits to let their decision makers enhance consumer welfare might be able to recruit more motivated and effective personnel (Tyler 1999). Even if decisions within firms inevitably favor the present value of profits, the tendency of consumers to anthropomorphize brands, as demonstrated by Fournier (1998), can lead firms with a reputation for "caring" to be held in higher esteem. Consumers might then use firms' actions as gauges of their caring, and firms might find themselves with an incentive to act as if they did.

This paper addresses two issues that arise in this context. First, what exactly is a "caring" firm expected to do in regard to product quality, such that not doing it demonstrates a lack of caring? Second, what are the benefits of acting in such a caring manner?

This paper analyzes these questions by developing the simplest possible model of caring—namely, one where firms internalize consumer utility to a small extent. This can be thought of as a simplification of a more complex process in which decision makers within firms put more weight on consumer emotions than seems warranted by their apparent impact on the present value of profits, with the ultimate result that long-run profits can be higher. In Isaacson (2011), Steve Jobs makes the related claim that Apple's success under his leadership was due to it being more motivated by making great products than by the resulting profits, whereas it was less successful under John Sculley, who "flipped these priorities to where the goal was to make money" (p. 567).

In my simplification, a caring firm (or brand) acts as if its objective function were equal to the sum of its profits and, with a weight $0 < a < 1$, the utility of its customers. This weighted utility has been called "altruistic," and I use the term here as well. This altruism can lead firms to make donations to causes that their customers value highly, because that would increase their utility, but such donations are not guaranteed because $a < 1$. What this altruism ensures is that firms somewhat moderate those actions that raise profits while hurting consumers. For example, Rotemberg (2011) shows that it can prevent firms from "price gouging" consumers in emergencies. In the experience goods context considered here, this altruism leads firms to provide higher-quality goods than those provided by selfish firms whose a equals 0.

An important aspect of altruism comes into play here—namely, that altruism is typically directed, so that people are more altruistic toward certain individuals and less altruistic toward others. Krebs (1975), for example, presents evidence that individuals are more likely to feel empathy and be generous toward people who are similar to themselves. This extra empathy may help explain the high quality and corresponding success of companies such as UnderArmour that are founded by individuals who used to belong to the group the firm intends to target.

Thus, an individual who has purchased a high-quality good might be justified in inferring that the brand has a special affinity for people like him. Such an individual should then expect high quality from a brand extension aimed at him, whether or not the high quality of the original product was in fact due to firm altruism. By contrast, individuals who have not been interested in the existing products of a brand have much less reason to expect altruism of the brand toward themselves, even if the brand's existing customers are extremely satisfied. Their expectation of the quality of an extension aimed at them is correspondingly lower.

Initial sales of a brand extension thus rationally depend on the extent to which the customers of the brand's original product are also being targeted by the extension. For sales to rise, the two products have to "fit" in the sense of being targeted at similar consumer segments. Some of the empirical evidence on brand extensions conforms to this pattern, although this does not rule out alternative interpretations. As an example, Smith & Wesson failed in the mass market for bicycles, which it entered in 2002, even though it had been successful in the market for bicycles aimed at law enforcement, which it entered in 1997.[1] More generally, Keller (1998) shows that several successful extensions can be used together with the brand's original product, so they would naturally seem to target the same customers. A good example of this is provided by the successful extension of Aunt Jemima, a brand focused initially on dry pancake mixes, into pancake syrup. Another is the extension of the toothpaste brand Colgate into toothbrushes.

Broniarczyk and Alba (1994) propose a different theory for the dependence of an extension's success on the fit between a brand's original product and its extension. According to this theory, an extension's success depends on whether the unique brand associations of the original product are "relevant in the extension category" (Broniarczyk and Alba 1994, p. 227). The most prescient finding of their study concerns Crest. Their survey respondents associated Close-Up with breath freshening, which they deemed more relevant for breath mints, whereas they associated Crest with dental protection, which they deemed more relevant for toothbrushes. Consistent with this, their respondents preferred a Crest extension into toothbrushes (before Crest introduced this extension) and preferred a Close-Up extension into breath mints. This particular finding seems consistent with the model presented here as well. The reason is that Close-Up was directed at people such as smokers who were particularly concerned with the smell of their breath (and could be the target market for breath mints), whereas the target market for Crest seemed more concerned with health and hygiene.

The model that captures these intuitions formally is one where a firm makes a costly "vertical" quality choice concerning a product and where consumers are initially uncertain about this choice. Consumers use three pieces of information to help them estimate this quality. The first is the price of the good, so that price can be a signal of quality as in Bagwell and Riordan (1991) and Judd and Riordan (1994).[2] The second is the customer segment to which the good is addressed. Finally, they know the segment, if any exists, to which the brand has provided a high-quality good in the past. If all firms were selfish, the overlap between these two segments would be of no consequence. With directed altruism, on the other hand, this overlap does more than just increase the demand for the extension by customers of the original product. It also increases the range of parameters for which an equilibrium exists in which altruistic firms provide a new good of high quality. Such equilibria are often disrupted by selfish firms who deliver low-quality goods while mimicking the prices of altruistic firms. If an existing product leads to the belief that the brand is altruistic, a brand that is truly altruistic finds it easier to provide high-quality goods.

There is also a more subtle implication of the fact that consumers evaluate the target of a brand's altruism when deciding whether its extension is likely to be good for them. This is that a new product from a brand that is expected to feel altruism only toward its most quality-conscious consumers may have higher quality, and attract more demand, than a similar product from a brand that cares for both these consumers and consumers that are somewhat less quality conscious. The reason is that the latter also welcome lower prices so that a brand that cares for them should be relatively more keen on innovations that have a large potential for cost reductions. The result is that a brand that cares for all its purchasers finds it more difficult to convince its customers that its brand

[1] See Haig (2011, p. 85), Associated Press (1997), and *Business Wire* (2003).

[2] Contrary to these papers, it turns out that, here, a *low* price can be a credible signal of high quality.

extension is of extremely high quality. A brand that cares only about its quality-conscious segment, by contrast, is not expected to care as much about potential cost reductions, so its commitment to quality is less in question.

Notice that the sources of high quality and additional demand for certain brand extensions that I have just discussed do not require that the demand for a brand's existing products fall when customers are dissatisfied with the extension. Having said this, it is worth noting that people can experience anger, and thus a desire to hurt, when a brand's observed behavior is incompatible with the altruism that people expect. Even though Isaacson (2011) quotes Steve Jobs as caring for his users, the book suggests that his empathy for Apple's customers may not have been as important as his desire to be proud of its products. Nonetheless, the delight consumers experienced with his creations may have led them to infer that he did, in fact, care for them. This could help explain why they reacted with so much anger when Apple dramatically lowered the price of the iPhone in 2007. I thus follow Rotemberg (2011) and also consider the case where some of the consumers who expect altruism from a particular brand react with anger when this firm's brand extension is of low quality. This anger then leads them to reduce their demand for the brand's original product. As a result, brands that are expected to be altruistic are afraid of losing existing sales if they provide low-quality extensions, and this can lead even selfish firms to provide high quality goods. Because this effect raises the demand for brand extensions, it turns out to have a positive effect on the quality provided by altruists as well.

A similar fear of losing existing sales plays a central role in the umbrella branding literature that includes Wernerfelt (1988), Cabral (2000), and Miklós-Thal (2012). In that literature, these losses in sales occur if and only if consumers lower their estimate of the quality of existing goods when they purchase an extension with which they are dissatisfied. As demonstrated in Choi (1998), if one modifies the Wernerfelt (1988) and Cabral (2000) models so that quality judgments of the original product are unaffected by failed extensions, the demand for new products does not depend on whether they are brand extensions or not. By contrast, the anger that is unleashed when consumers are disappointed by a firm's altruism should lead to sales reductions even if perceptions of quality are unchanged. As it happens, there is some empirical support for the idea that the perceived quality of existing products is independent of the properties of brand extensions. In Roedder-John et al. (1998), respondents did not significantly alter their judgment of the gentleness of Johnson & Johnson's Baby Shampoo upon learning that the company had introduced other bath products that were deemed to be low in gentleness. Summarizing their study, Roedder-John et al. (1998, p. 25) say, "Overall, these findings provide support for our view that beliefs about flagship products are highly resistant to change."

Perceptions of quality are likely to have been particularly stable in the product examined by Swaminathan et al. (2001, pp. 11–13), as this was a food product that had a 53% market share in its category before its manufacturer introduced an unrelated extension. In spite of this, Swaminathan et al. (2001, pp. 12–13) show that individuals who purchased the extension, which ultimately failed, were significantly less likely to repeat their purchases of the original product.

Firms in Wernerfelt (1988), Choi (1998), and Cabral (2000) seek to maintain a reputation for "high quality" rather than one for altruism. The notion of high quality can be applied narrowly, covering, for example, the consistency of a particular product, or broadly, covering everything the firm does. Neither approach seems helpful in explaining why fit matters for the success of brand extensions. On the other hand, altruism toward customers would presumably lead to consistent products, because inconsistent ones can be very disappointing. Thus, the reputation considered here may subsume other valuable reputations.

The rest of this paper is organized as follows. Section 2 introduces the structure of the model and analyzes the market for an existing good, which can act as a hostage when a new good is introduced by an existing brand. Section 3 studies the introduction of a new good by a new firm. It demonstrates that a more altruistic firm is more prone to offer a high-quality good, particularly if consumers believe it is altruistic. Section 4 turns its attention to the new product introductions of a brand that has already sold a successful product to the consumers targeted by the extension and supposes that some consumers react with anger when their expectations of altruism are disappointed. Consumers' perception that a brand is altruistic is shown to increase both the demand for the extension and the likelihood that this extension is of high quality. Section 5 demonstrates that the demand for a new good can be lower if it is sold by a brand that is expected to be altruistic toward all its consumers rather than by one whose altruism is targeted only toward its most quality-conscious segment. Section 6 presents some concluding remarks.

2. The Setup

The temporal structure of the model is close to Choi (1998) and Cabral (2000). There are three periods: 0, 1, and 2. In Periods 0 and 2, an incumbent brand is

the monopoly provider of an "old" good with known quality. In Period 1, either the incumbent or another brand can start producing a new good. Before they produce, entrants determine the quality of this good. For the moment, both the high- and the low-quality versions have the same marginal cost $\bar{c}$, which is also the marginal cost of the old good.[3] In addition, a positive setup cost κ is required to produce high-quality goods. Consumers do not learn the new good's quality until Period 2, when it is available for sale once again. This timing is illustrated in Table 1.[4]

As in Rotemberg (2008, 2011), consumer j's utility U_j depends on his material payoffs x_j, on the material payoffs π of the brand he purchases from, on his altruism a_j toward the brand, and on his assessment of the extent to which the brand acts altruistically toward him. In particular,

$$U_j = x_j + \left(a_j - \xi(\bar{a}_j, \hat{a})\right)\pi, \quad a_j, \bar{a}_j, \hat{a} \geq 0, \tag{1}$$

where a_j denotes his direct altruism toward the brand, and the function ξ takes a value of 0 if given the information set $\hat{a}$, consumers cannot reject the hypothesis that the brand acts as if it had an altruism parameter greater than or equal to $\bar{a}_j$. Otherwise, ξ equals $\bar{\xi} > 0$. For simplicity, a_j is set equal to 0.[5] A fraction γ of consumers is "altruism-sensitive" and has $\bar{a}_j = \bar{a} > 0$. For the rest, $\bar{a}_j = 0$. The standard case in which consumers are never angry obtains when γ is 0, and considerable attention is devoted to this case below.

The population consists of H consumers, not all of whom value particular goods or qualities. There are h^o potential consumers for the old good. For these h^o consumers, the incremental material payoff from consuming one unit of the good rather than none equals ψ, where this is drawn from a distribution with cumulative distribution function (cdf) F_ψ. The variable ψ can be interpreted as measuring the extent to which individuals value the "quality" embedded in the good. This interpretation turns out to be useful when the focus shifts to the h^n individuals that are potential customers for the new good introduced in Period 1, as shown below. As is true also of this new good, consumers do not obtain any incremental benefit from purchasing a second unit of the old good in any given period.

[3] Because some equilibria involve a price that is slightly below marginal cost, it is important that $\bar{c}$ be positive. On the other hand, the assumption that the old and new goods have the same marginal cost is made only for simplicity.

[4] It may seem odd not to let the old good be available in Period 1 as well. This is done only for simplicity. Because no information about the new good is available at this point, the market for the old good would be identical in Period 1 to the Period 2 market without new goods.

[5] It could be positive if, for instance, the firm donated a fraction of its profits to a charity that the consumer wished to support.

Table 1 Model Sequence

Period	Firm action	Consumer information	Consumer action
Period 0	Set price for o	Quality of o	Purchase o
Between 0 and 1	Set quality for n Pay development costs		
Period 1	Set price for n	Quality of o Target customers for o and n	Purchase n
Period 2	Set price for o and n	Quality of o and n	Purchase o and n

Let π_t^i and B_t^i denote, respectively, the profits and consumer surplus from the sale of the good of type i in period t, and $a < 1$ is a parameter giving a firm's altruism toward its consumers. The distribution of a across new firms is given by the cdf G_a. For simplicity, discounting is ignored in this section. A firm that produces only the old good then has a level of welfare given by

$$W^o = W_0^o + W_2^o, \quad \text{where } W_t^o = \pi_t^o + aB_t^o \text{ and } t = 0, 2,$$

whereas a new entrant that produces only the new good has a welfare level equal to

$$W^n = W_1^n + W_2^n, \quad \text{where } W_t^n = \pi_t^n + aB_t^n \text{ and } t = 1, 2.$$

In both these formulas, a firm values a unit of consumer surplus a times as much as it values a unit of profits. An incumbent firm that produces both the old good and the new good has a welfare level W, which equals $W^o + W^n$.

Consider now the market for the old good in Period 2. Because the quality of this good is known, its supplier only needs to determine its price. Because the new and old goods are treated symmetrically in many respects, this analysis sets the stage for the study of equilibrium quality that follows.

Suppose for the moment that all consumers base their purchases exclusively on their material payoffs. If the seller charges p_2^o, all consumers with $\psi \geq p_2^o$ buy the good, and sales equal $h^o(1 - F_\psi(p_2^o))$. To simplify the analysis, let ψ be uniform between 0 and Y, so $F_\psi(\psi) = \psi/Y$ and sales equal $h^o(1 - (p_2^o/Y))$. Total consumer surplus is then

$$h^o \int_{p_2^o}^{Y} \frac{\psi - p_2^o}{Y}\, d\psi = \frac{h^o(Y - p_2^o)^2}{2Y}. \tag{2}$$

A firm that acts as if its altruism parameter were a would then set the price p_2^o to maximize

$$W_2^o(a, p_2^o) = h^o\left\{\left(1 - \frac{p_2^o}{Y}\right)(p_2^o - \bar{c}) + \frac{a(Y - p_2^o)^2}{2Y}\right\}. \tag{3}$$

The first-order condition for this problem is

$$2p_2^o - Y + a(Y - p_2^o) = \bar{c}, \tag{4}$$

so that its optimal price equals

$$p^*(a) = \frac{\bar{c} + (1-a)Y}{2-a}. \tag{5}$$

The derivative of this price with respect to a equals $(\bar{c} - Y)/(2-a)^2$, which is negative because the maximum willingness to pay Y must exceed marginal cost.

A high price can thus lead altruism-sensitive consumers to reject the hypothesis that a firm's altruism equals at least $\bar{a}$. Rotemberg (2011) studies the resulting Nash equilibrium and shows that, regardless of the distribution of types G_a, there is a unique equilibrium where firms whose actual altruism equals $\bar{a}$ charge $p^*(\bar{a})$. His demonstration relies on the assumption that a fraction greater than or equal to α of firms whose altruism truly equals $\bar{a}$ are naive in the sense that they neglect the effect of their price on consumers' inference regarding their altruism. The fraction α is the size of the test that altruism-sensitive consumers use to test the hypothesis that firms' altruism equals at least $\bar{a}$. Neglecting these details, it is reasonable to imagine that the price $p^*(\bar{a})$ should not lead any consumer to reject the hypothesis that their supplier has an altruism parameter equal to $\bar{a}$, so that firms with this altruism level find it optimal to charge this price. Whether selfish firms also charge this price has no bearing on the result of this testing procedure and thus no effect on altruistic firms.

Firms that do charge a higher price cause the hypothesis that their altruism is at least $\bar{a}$ to be rejected, and altruism-sensitive consumers respond by setting $\xi = \bar{\xi}$. If $\bar{\xi}$ is large enough, and price exceeds marginal cost so that firms make profits from incremental sales, these consumers stop purchasing. The excess of price over marginal cost is ensured by the assumption that a is smaller than 1, so that firms care more about profits than consumer welfare. It follows that, for large enough $\bar{\xi}$, a firm that charges more than $p^*(\bar{a})$ loses a fraction γ of its customers and faces a demand equal to $(1-\gamma)h^o(1 - p_2^o/Y)$. Its objective function is then $(1-\gamma)W_2^o(a, p_2^o)$ so that its welfare-maximizing value of p_2^o is $p^*(a)$. For a firm with $a < \bar{a}$, the only pertinent choices are thus $p^*(\bar{a})$ and $p^*(a)$, with the former being more attractive if and only if $\Delta(a) > 0$, where

$$\begin{aligned}\Delta(a) &= W_2^o(a, p^*(\bar{a})) - (1-\gamma)W_2^o(a, p^*(a)) \\ &= \frac{h^o(Y-\bar{c})^2}{Y}\left\{\frac{1-\bar{a}+a/2}{(2-\bar{a})^2}\right. \\ &\qquad \left. - (1-\gamma)\frac{1-a/2}{(2-a)^2}\right\} > 0, \end{aligned} \tag{6}$$

and the second equality is established in the appendix.

Consider the simple case where firms are either selfish so that $a = 0$ or have an altruism parameter a equal to $\bar{a} > 0$, the level expected by altruism-sensitive consumers. Selfish firms then face the choice between the selfish price $(Y + \bar{c})/2$ and the altruistic price $(Y(1-\bar{a}) + \bar{c})/(2-\bar{a})$. Since W is equal to profits for these firms,

$$\Delta(0) = \frac{h^o(Y-\bar{c})^2}{Y}\left[\frac{1-\bar{a}}{(2-\bar{a})^2} - \frac{1-\gamma}{4}\right].$$

This is declining in $\bar{a}$. For any $\gamma > 0$, there is thus a critical value of $\bar{a} > 0$ such that $\Delta(0) > 0$ for any $\bar{a}$ smaller than this critical value. Rotemberg (2011) shows numerically that fairly modest levels of γ lead to $\Delta(0) > 0$ for nontrivial levels of $\bar{a}$. In other words, small numbers of anger-prone consumers are sufficient to lead even selfish firms to behave like altruistic ones.

To close this section, consider the case where the evidence from earlier periods leads to the rejection of the hypothesis that a firm's altruism level was greater than or equal to $\bar{a}$. Altruism-sensitive consumers then set ξ equal to $\bar{\xi}$ in the second period regardless of the firm's current price, so the firm's demand is $(1-\gamma)h^o \cdot (1 - p_2^o/Y)$. The cost in this market from taking an earlier action that allows altruism-sensitive consumers to reject the hypothesis that a firm is altruistic thus equals $\Delta(a)$. As we shall see below, this cost of being seen as selfish contributes to the provision of high-quality new goods.

For the moment, notice that when $\Delta(0) > 0$, both selfish firms and firms with $a = \bar{a}$ find it optimal to charge $p^*(\bar{a})$ in period 0 also. The reason is that higher prices lead to losses even larger than $\Delta(0)$ itself.

3. The Introduction of a New Good by an Unrelated Brand

In this section, a firm without an old good decides whether or not to spend the setup cost κ so that its new good is of high quality. This section shows that altruistic firms are more likely to provide high-quality goods than selfish firms. Moreover, an increase in the extent to which consumers expect firms to be altruistic increases the range of parameters for which altruistic firms produce high-quality goods. This result is crucial for the analysis that follows. Consumers' expectation of altruism thus matters also.

There are h^n potential consumers for the new good. If the good is of high quality, a fraction $F_\theta(\theta)$ of the h^n consumers values it at θ or less so that θ can be interpreted again as an individual's valuation of the quality embodied in the new good. For simplicity, I consider a situation in which low-quality goods would not be produced under full information. I thus suppose that consumers value them at L, which can

be negative and is definitely below the marginal cost of their production $\bar{c}$. To express the utility received by an individual consumer belonging to h^n, let I^h and I^l be indicator functions. These take a value of 1 if the consumer buys a high-quality new good or a low-quality new good, respectively, and take a value of 0 otherwise. Because the consumer does not buy more than one unit of the new good, $I^h + I^l$ is, at most, equal to 1. Supposing that the consumer pays p_1^n for a newly introduced good, his actual material payoffs are

$$I^h\theta + I^l L - p_1^n. \tag{7}$$

A different indicator variable, σ_H, equals 1 with probability β and equals 0 otherwise. When it equals 0, the firm is unable to introduce the new good. By contrast, when it equals 1, it can introduce either a low- or a high-quality new good. The reason to set $\beta < 1$ is to ensure that, as in real-world markets, new goods are not introduced in every period. From a modeling point of view, it implies that the nonintroduction of a good by a firm is not informative about the firm's altruism. Even so, most of the analysis is concerned with situations where $\sigma_H = 1$ so that firms have a nontrivial product introduction decision. Before analyzing the product introduction decision of Period 1, I study its effects on Period 2.

3.1. Period 2

If the new good is known in Period 2 to be of high quality, purchasing the good raises the material payoffs of people with $\theta \geq p_2^n$. If no one is angry, the quantity demanded d_2^n equals

$$d_2^n = h^n(1 - F_\theta(p_2^n)). \tag{8}$$

Using the same simplification as in the previous section, let θ also be uniform between 0 and Y. The analysis is then the same as that for the old good in Period 2, so that consumer surplus B_2^n is given by the expression in (2) with p_2^o replaced by p_2^n and h^o by h^n.

The Period 2 welfare from selling a new good of high quality is thus

$$W_2^n(a, p_2^n) = h^n\left\{\left(1 - \frac{p_2^n}{Y}\right)(p_2^n - \bar{c}) + \frac{a(Y - p_2^n)^2}{2Y}\right\}, \tag{9}$$

which equals $h^n W_2^o(a, p_2^n)/h^o$.

As a result, the optimal price p_2^n for a firm with altruism parameter $\bar{a}$ equals $p^*(\bar{a})$ in (5). Its resulting level of Period 2 welfare is $W_2^n(\bar{a}, p^*(\bar{a}))$, which is denoted by $W_2^n(\bar{a})$. For a selfish firm, the equilibrium value of p_2^n also equals $p^*(\bar{a})$ if $\Delta(0) \geq 0$, whereas it equals $p^*(0)$ if $\Delta(0) < 0$. In the former case, its Period 2 welfare $W_2^n(0)$ equals $W_2^n(0, p^*(\bar{a}))$, whereas it equals $(1 - \gamma)W_2^n(0, p^*(0))$ in the latter. In either case, $W_2^n(\bar{a}) > W_2^n(0)$. One reason this occurs is that when $\gamma > 0$, the altruistic firm is able to charge its optimal price without fear of punishment. Even when $\gamma = 0$ and there are no punishments, the altruistic firm obtains more welfare because it enjoys vicariously the welfare of its consumers.

3.2. Period 1

This is the period in which the new firm must make a quality choice. Although consumers do not know the quality of the good they buy, firms do. A firm's assessment of consumer surplus therefore depends on this quality. Consumer surplus also depends on the price consumers pay and the quantity they purchase, although these two variables are linked via the consumer's equilibrium demand curve. Consumer surplus as seen by the firm can thus be written as a function of only price and quality. Let $B_1^n(p_1^n, \text{high})$ denote this surplus when quality is high, and let $B_1^n(p_1^n, \text{low})$ denote it when quality is low. Most of the analysis of this subsection is carried out under the assumption that $\gamma = 0$ so that no firm is punished for providing low quality. In this case, an entrant with altruism parameter a (equal to either $\bar{a}$ or 0) prefers to produce a high-quality good rather than a low-quality good in Period 1 if

$$W_2^n(a) + a\big(B_1^n(p_1^n, \text{high}) - B_1^n(p_1^n, \text{low})\big) \geq \kappa. \tag{10}$$

The entrant also has the option of not producing any goods at all, and this also avoids saddling consumers with a low-quality good. By not producing, the firm forgoes the profits $q_1^n(p_1^n - \bar{c})$ where q_1^n is the quantity sold. Therefore, the entrant prefers to produce a high-quality good rather than not producing the new good if

$$W_2^n(a) + aB_1^n(p_1^n, \text{high}) + q_1^n(p_1^n - \bar{c}) \geq \kappa. \tag{11}$$

Finally, the entrant prefers to produce a low-quality good to not producing the new good if

$$aB_1^n(p_1^n, \text{low}) + q_1^n(p_1^n - \bar{c}) > 0. \tag{12}$$

A Nash equilibrium where all entrants supply high-quality products exists if a price p_1^n can be found such that when demand is given by (8), the entering firm does not wish to deviate from this price while both (10) and (11) are satisfied. This equilibrium involves some coordination between the actions of producers and the beliefs of consumers, because demand is only given by (8) if consumers believe that high quality is forthcoming.

Consider first the benchmark case in which all entrants are selfish and $\gamma = 0$, so that brands are not punished for their selfishness. In this case,

Proposition 1. *If $\gamma = 0$ and all firms have $a = 0$, entrants provide high-quality goods if and only if*

$$W_2^n(0, p^*(0)) \geq \kappa. \tag{13}$$

If this condition is satisfied, the equilibrium price is $p^*(0)$.

Proofs are in the appendix.

The quantity $W_2^n(0)$ equals the profits in the second period for a firm charging the (selfish) monopoly price. High quality is thus provided only when these future profits, which would disappear if quality were low, cover the firm's setup costs.[6] When consumers know this to be true, they expect high quality so that the firm finds it optimal to set the resulting monopoly price.

I now proceed to show that altruistic firms may provide high-quality goods even when (13) is violated. Because altruistic firms obtain vicarious utility from providing high quality, they have less to gain from failing to do so. This is reflected in the fact that the expressions on the left-hand side of (10) and (11) are increasing in a for any combination of p_1^n and q_1^n. As a result, these constraints can be satisfied for $a = \bar{a} > 0$ even if (13) is violated. A simple case where this occurs is when $W_2^n(0) < \kappa < W_2^n(\bar{a})$. Since B_1^n is nonnegative and $B_1^n(p_1^n, \text{high})$ is no smaller than $B_1^n(p_1^n, \text{low})$, this is enough to ensure that both conditions are satisfied for a firm with altruism $\bar{a}$. For the analysis below, it is helpful to obtain weaker conditions for a high-quality product to be offered. Proposition 2 provides such conditions for the case in which consumers expect all firms to be altruistic and use the price to rationally infer whether firms will provide high-quality goods.

Proposition 2. *Let ϵ denote $(\bar{c} - L)$ while*

$$\tilde{p}_1^n = \bar{c} + \frac{a}{1-a}\epsilon. \tag{14}$$

Suppose, moreover, that ϵ is small enough that

$$\tilde{p}_1^n < p^*(\bar{a}). \tag{15}$$

Suppose that consumers believe that all firms have an altruism parameter $\bar{a}$ and believe that high quality is forthcoming only if altruistic firms have no incentive to deviate from this. A necessary and sufficient condition for there to be an equilibrium in which firms with an altruism parameter $\bar{a}$ provide high-quality goods is then

$$W_2^n(\bar{a}) + \frac{h^n}{Y}\left\{\bar{a}\frac{(Y-\tilde{p}_1^n)^2}{2} + (Y-\tilde{p}_1^n)(\tilde{p}_1^n - \bar{c})\right\} \geq \kappa. \tag{16}$$

Unless

$$W_2^n(\bar{a}) + \frac{h^n}{Y}\left\{\bar{a}\frac{(Y-p^*(\bar{a}))^2}{2} + (Y-p^*(\bar{a}))(p^*(\bar{a}) - \bar{c})\right\} \geq \kappa$$

holds also, which is a stronger condition, altruistic firms charge a price below $p^*(\bar{a})$.

[6] Here, quality provision is helped by patience. Because employees eventually leave, it may be harder to obtain "patient employees" than ones that intrinsically like customers. Even leaving aside whether customers would be as happy with a patient firm as with a caring one, it may thus be difficult to convincingly build a reputation for patience.

Because (16) is substantially weaker than (13), this proposition shows that high quality can be sustained by altruistic firms more easily than by selfish ones. Interestingly, however, altruistic brands may be forced to charge less than their preferred price $p^*(\bar{a})$ to sustain high quality. By cutting the price below $p^*(\bar{a})$, sales increase, and the vicarious losses from selling low rather than high quality increase. This deters the firm from selling low quality and thereby convinces customers that high quality is forthcoming.

Proposition 2 requires consumers to believe that all firms are altruistic, and these beliefs are rational only if, indeed, all firms are. It is presumably more common for consumers to be less confident about firms' altruism. Suppose, then, that consumers believe that the probability that a firm has an altruism parameter $\bar{a}$ equals $\mu \leq 1$, whereas they expect the firm to be selfish with probability $1 - \mu$. If (13) is satisfied, all firms provide high-quality goods, so the more interesting case arises when this condition is violated. The issue, then, is how altruistic firms are affected by a decline of μ (from the value of 1). It turns out that, for certain changes in μ, altruistic firms continue to provide high-quality goods. For others, high quality is unsustainable even if the conditions of Proposition 2 are satisfied.

There are two different types of equilibria in which altruistic firms provide high-quality goods. In the first, the equilibrium price is above $\bar{c}$ so that selfish firms also charge this price and sell goods of low quality. In the second, the equilibrium price is below $\bar{c}$ so that selfish firms produce nothing. First consider the former. Because customers expect high quality only from a fraction μ of firms, their expected utility from a purchase of the new good is $\mu\theta + (1-\mu)L$. As a result, only those consumers for whom this is greater than or equal to p_1^n buy, and demand is

$$d_1^n = h^n\left(1 - \frac{p_1^n - (1-\mu)L}{\mu Y}\right). \tag{17}$$

This is increasing in μ, and the resulting increase in demand turns out to raise altruists' desire to provide high-quality goods. It does so by raising both the vicarious benefit from selling high-quality goods and the vicarious loss from providing low quality. Proposition 3 demonstrates this formally.

Proposition 3. *Suppose that ϵ is small enough that*

$$\tilde{p}_1^n < p^\mu(\bar{a}) \equiv \frac{\mu Y(1-\bar{a}) + \bar{c} + (1-\mu)L[1-\bar{a}(1-1/\mu)]}{2-\bar{a}(2-1/\mu)}. \tag{18}$$

Suppose that consumers believe that a fraction μ of firms has an altruism parameter $\bar{a}$ whereas the rest have an altruism parameter of 0. Suppose further that they believe that

high quality is forthcoming from altruistic firms if these have no incentive to deviate from this. A necessary and sufficient condition for there to be an equilibrium in which firms with an altruism parameter $\bar{a}$ provide high-quality goods at a price above $\bar{c}$ is

$$W_2^n(\bar{a}) + \frac{h^n}{Y}\left\{\bar{a}\int_{(\tilde{p}_1^n-(1-\mu)L)/\mu}^{Y}(\theta-\tilde{p}_1^n)\,d\theta + \left(Y-\frac{\tilde{p}_1^n-(1-\mu)L}{\mu}\right)(\tilde{p}_1^n-\bar{c})\right\} \geq \kappa. \quad (19)$$

Moreover, reductions in μ lower the left-hand side of (19)*, so they make high quality harder to sustain.*

This proposition shows that altruists find it easier to supply high-quality products as consumers expect more firms to be altruistic. In the limit where they expect all firms to be altruistic, (19) coincides with (16) so that Proposition 2 applies. If (16) holds as a strict inequality, small reductions in μ below 1 still lead (19) to hold so that altruistic firms provide high-quality goods whereas selfish firms do not. Notice that although Proposition 3 does not require consumer beliefs regarding μ to be correct, it is consistent with this form of rationality.

Proposition 3 covers the case where the price is above $\bar{c}$ so that selfish firms enter with low quality. Now consider the possibility of an equilibrium with a price below $\bar{c}$. Because selfish firms stay out, this low price lets altruists signal their quality.[7]

To set the stage for this case, note that there exist values of μ small enough that demand disappears even at a price equal to $\bar{c}$. At these values of μ, the right-hand side of (17) is nonpositive when p_1^n equals $\bar{c}$. Using (17), these values of μ satisfy

$$\mu(Y+\epsilon-\bar{c}) \leq \epsilon. \quad (20)$$

If (20) is satisfied, there is no equilibrium where firms provide high-quality goods at a price p_1^n greater than or equal to $\bar{c}$. However, any firm selling the new good at a price slightly below $\bar{c}$ must be altruistic and must be providing high quality; otherwise, they would make losses in period 1 and sell nothing in period 2. An altruistic firm charging less than $\bar{c}$ thus has a demand given by (8). It thus provides high quality if (10) and (11) are satisfied. The proof of Proposition 2 shows that, in this case, (11) is tighter than (10) because $\bar{c}$ is smaller than $\tilde{p}_1^n$. Still, (11) is easier to meet than the condition (13) that leads selfish firms to provide high-quality goods, so equilibria of this sort exist.

[7] One reason this signaling equilibrium with low prices is interesting is that it provides a contrast with signaling models such as Bagwell and Riordan (1991) and Judd and Riordan (1994), where high quality is signaled with high prices.

To this point, the discussion in this section has been carried out setting $\gamma = 0$ so that consumers do not become angry if firms are insufficiently altruistic. Positive values of γ have no effect on altruistic firms, because these are already acting in accord with the expectations of altruism-sensitive consumers. They do, however, reduce selfish entrants' incentive to provide high-quality goods. More specifically, they lower the period 2 profits $W_2^n(0)$ that accrue to selfish firms that provide high-quality goods. The reason is that a positive γ requires them to either charge a price they regard as suboptimal or lose a fraction $(1-\gamma)$ of their customers. The effect of this is to tighten the condition (13), which is needed according to Proposition 1 to yield high quality from selfish firms.

The analysis so far has assumed that brands are altruistic either toward all h^n potential consumers of the new good or toward none. It is worth noting, however, that altruism toward customers who do not buy the good is immaterial for equilibrium behavior. Thus, the analysis would have been the same if the parameter a for altruistic firms was positive only for individuals with a valuation θ larger than θ^-, where θ^- represents the smallest θ that leads to an equilibrium purchase.

4. The Introduction of a New Good by a Related Brand

If all firms were known to be selfish and γ were 0 so that this was acceptable, Proposition 1 would determine quality choice whether or not the old good was sold under the same brand as the new one. The match between goods would play no role. On the other hand, the analysis in the previous section has established that brands that are more altruistic toward a particular group of customers are more likely to introduce high-quality goods aimed at this group. The result is that customers who find themselves buying a high-quality good should adjust upward their expectation of this brand's altruism toward themselves. This would be particularly true if consumers knew that selfish firms would have offered a low-quality good but should extend also to settings in which consumers are ex ante uncertain about the quality sold by selfish firms. With this as the background, consider the introduction of the new good n by the brand that sells the old high-quality good o.

Imagine first that there is no overlap between h^o and h^n or, equivalently, that there is no overlap between the $h^o(1-\psi^-/Y)$ people who purchased the old good (where ψ^- is the smallest ψ that leads to a purchase) and the $h^n(1-\theta^-/Y)$ individuals that might purchase the new good. In this case, the purchasers of the new good have no reason to expect altruism toward them from the brand selling good n. Their

subjective probability of altruism μ should thus be quite low.

Contrast this with the extreme opposite case, where the two customer segments overlap perfectly, so that the $h^o(1-\psi^-/Y)$ purchasers of the old good coincide with the $h^n(1-\theta^-/Y)$ purchasers of the new one. These purchasers would seem justified in assuming that μ is higher, so that they should regard this brand as more likely to be altruistic. This belief in the altruism of the brand would obviously be reinforced if the old good was sold at the price that altruistic firms would wish to charge. Once consumers believe that μ is larger, Proposition 3 implies that an equilibrium where altruistic firms provide high-quality goods is more likely to be possible. In some cases, the increase in μ makes an equilibrium with high quality possible when it was impossible before. The demand for the brand extension at this high-quality equilibrium is then much larger than the demand for an equivalent product from a new brand. Even if an equilibrium where altruistic firms provide high-quality goods exists also for new entrants, (17) implies that an increase in μ raises the demand for the brand extension relative to the demand for a product with a new brand.

This shows that the extra demand for brand extensions from brands that have successful incumbent products directed at the same customers does not require customer anger at brands whose extensions have low quality. Moreover, this extra demand is rational insofar as many firms with a high-quality incumbent good are, in fact, altruistic toward the customers of this good. In spite of this, I now turn to an analysis of the effects of setting $\gamma > 0$ on quality and demand.

It might at first be thought that this modification has no effect on altruistic firms, because these never do anything that triggers anger. In fact, they are affected, albeit indirectly. The possibility of angering customers has a direct effect on selfish firms, because these firms now fear the consequences of providing low quality. Because this increases equilibrium demand, it turns out that altruistic firms also face an increased incentive to provide high-quality goods.

Consumer anger has a much more limited role if an existing brand provides an extension aimed at a group of customers that does not purchase its original product. In this case, buyers of good n cannot reduce their purchases of the old good if the new good is of low quality. Furthermore, purchasers of the old good have little reason for anger in this case. Thus, angry reactions to defective brand extensions would seem to be more important if the brand extension fits with the brand's original product. The evidence in Ohbuchi et al. (2004) that a high level of expected altruism inclines people to be more angry at selfish acts is also more relevant in this case.[8] Although this evidence comes from a quite different domain, it seems reasonable to suppose that it could also apply to brands. It would then be the case that a successful brand that introduces an extension aimed at its existing customers risks angering them if the extension is deemed to be of low quality.

I thus focus on a situation in which the customers for the old and the new good coincide, and these customers expect the brand to *act* as if it were altruistic. In other words, the fraction γ of altruism-sensitive consumers reacts with anger if the firm fails to act in the way that an altruistic firm would. The first issue, then, is the choice of quality by selfish firms. If altruism-sensitive customers become angry at the provision of low quality, firms that introduce a low-quality good lose $\Delta(0)$ in the second period, where γ is now assumed to be large enough that this is positive.

Thus, the condition under which selfish firms prefer producing high quality rather than low quality ceases to be (10) and becomes

$$W_2^n(0, p^*(\bar{a})) + \Delta(0) \geq \kappa. \tag{21}$$

The first term in (21) is smaller than the left-hand side of (13) because the existence of altruism-sensitive consumers forces selfish firms to charge $p^*(\bar{a})$ instead of their optimal price $p^*(0)$. Still, for a value of $\bar{a}$ sufficiently small (so that $W_2^n(0, p^*(0))$ is not much larger than $W_2^n(0, p^*(\bar{a}))$) and a value of γ sufficiently large (so $\Delta(0)$ is large), (21) is easier to meet than (13). In this case, selfish firms now find it more attractive to provide high quality rather than low. Similarly, the condition under which such a firm prefers to produce a low-quality good rather than not producing the new good at all is no longer (12) and is instead

$$q_1^n(p_1^n - \bar{c}) - \Delta(0) > 0. \tag{22}$$

Finally, condition (11), which ensures that selfish firms prefer producing a high-quality good to not producing the new good, can now be written as

$$W_2^n(0, p^*(\bar{a})) + q_1^n(p_1^n - \bar{c}) \geq \kappa. \tag{23}$$

The changes in these conditions make it easier for equilibria to exist where high-quality goods are produced, even by altruistic firms. This is demonstrated in Propositions 4 and 5.

Proposition 4. *Consider a price $p_1^n = \bar{p}$, which leads altruistic firms to provide high-quality goods when consumers expect $\mu = 1$. Even if the actual probability that*

[8] They show that people are angered when, for example, people who are close to them engage in actions that do not take proper account of their feelings, whereas anger is less likely to be triggered in response to such behavior from people who are less close.

firms are altruistic is less than 1, *there exists an equilibrium in which all incumbent firms provide high-quality new products at this price as long as* (a) (21) *is satisfied and* (b) (23) *is satisfied when* q_1^n *is given by* $F^n(1-\bar{p}/Y)$. *At this equilibrium, consumer beliefs regarding quality are rational*.

The earlier discussion implies that if $\bar{a}$ is sufficiently small, (23) with a price p_1^n equal to $\bar{p}$ is easier to satisfy than (13). When (21) is weaker than (13) as well, the proposition says that an equilibrium where selfish firms provide high-quality goods is more easily achieved when these firms have an incumbent high-quality product than when they do not. This proposition thus covers a case where some firms provide high-quality goods not because they are altruistic but because they are expected to be, and they are better off acting as if they were.[9]

In Proposition 5, (23) is violated so that selfish firms are not induced to supply high-quality products. Nonetheless, consumer anger continues to play a role in expanding the provision of high-quality goods by altruistic incumbents. The reason is that it deters selfish firms from introducing the good at all. In particular,

Proposition 5. *Let* $\hat{p}_1^n$ *denote the minimum of the critical price* $\tilde{p}_1^n$, *and the price that makes* (22) *hold as an equality when* q_1^n *is given by* $F^n(1-p_1^n/Y)$. *Then, if* (10) *and* (11) *are satisfied for* $a=\bar{a}$ *at this price and* (23) *is not, there exists an equilibrium in which consumers rationally expect high quality at this price, altruistic firms provide this high-quality good, and selfish firms do not sell the new good*.

What occurs here is that the fear of losing customers for its old good is sufficient to ensure that selfish firms do not provide low quality, although it is not enough to actually lead them to produce high-quality new goods. Nonetheless, the lack of low quality provision by selfish firms raises the demand for altruistic firms and thus helps them produce high-quality goods.

Recall that when new goods were provided by new entrants, altruists had to charge a price below $\bar{c}$ to prevent selfish firms from selling low-quality goods in the case where (13) was violated. When the new good is sold by incumbent firms, selfish firms require a price premium above $\bar{c}$ to sell a low-quality good (because doing so leads to a loss in period 2). The fact that selfish firms are now deterred even with a price above $\bar{c}$ helps altruistic firms provide high-quality goods because condition (11) becomes easier to meet as the price rises from $\bar{c}$ to the critical price $\tilde{p}_1^n$.

5. High-End vs. Broad Brands

The previous section showed that incumbent brands have an advantage over new entrants as long as the perception that an incumbent is altruistic toward her existing customers leads people to expect altruism toward the customers of the new good. Being perceived as altruistic can thus be regarded as an asset, a form of brand equity. This raises the question of whether the demand for a brand's new products is strictly increasing in the number of people that the brand is perceived as being altruistic toward, or whether it can be more valuable for a brand to be regarded as being altruistic *only* toward a limited set of customers. This section shows that the latter can be true.

Suppose that there are two types of firms. Firms of type b are altruistic toward all their potential customers, whereas firms of type x are altruistic only toward the most quality-sensitive subset of these customers. Consumers know the firms' types as a result of earlier purchases, and for this reason, I neglect both the existence of selfish firms and the possibility that consumers will be angry at firms that provide insufficient quality. Because both types of firms are, in fact, altruistic toward their more quality-conscious customers, actions that are consistent with altruism toward this narrow group of customers would not induce anger, according to (1). Actions that demonstrate altruism only toward this group, and not toward less quality-conscious customers, have the potential for inducing anger among the latter. This provides an additional incentive for firms whose altruism is broader to act differently from those whose altruism is narrower. The section demonstrates that these two kinds of firms can act differently even without this additional incentive.

Consider again the situation depicted in Table 1, where firms can introduce goods between Periods 0 and 1 whose value to consumers depends on the consumer's realized value of θ. Now, however, the level of quality of the new good is given by a parameter m so that the value of these goods to consumers equals $m\theta$.[10] All consumers prefer goods with a higher value of m, and this preference is particularly strong for people whose realized θ is large. The key choice faced by firms in this section is whether to choose a high or low value for m. A second difference between the analysis in this section and that in the previous

[9] There is an interesting contrast between Proposition 4 and the result at the end of §3 that selfish entrants are less likely to provide high-quality goods if they get punished for being insufficiently altruistic *in their pricing*. The production of a high-quality good as a result of pretending to be an altruist is thus operative only for firms who have already become established as high-quality producers.

[10] The earlier analysis corresponds to the case where m could effectively equal only 0 or 1.

one is that the evolution of the marginal cost of production depends on the choice of m. In particular, marginal cost drops faster from Period 1 to Period 2 if m is lower.

Because consumers with higher values of θ are more quality sensitive, it is appealing to suppose that "high-end" firms care only about consumers with relatively high values of θ. To capture this, let the altruism parameter of firms of type x equal $\bar{a}$ for consumers whose θ lies between X and Y, and let it equal 0 for consumers with lower values of θ. By contrast, firms of type b have an altruism parameter equal to $\bar{a}$ for all their potential customers.

The demonstration that firms of type x can have more demand for brand extensions than firms of type b proceeds in two steps. The next subsection focuses on Period 2 and shows that, relative to firms of type b, firms of type x prefer higher-quality innovations even if they have a higher marginal cost of production. The following subsection then shows that, under certain circumstances, firms of type x can credibly convince their customers in Period 1 that their good is of the highest possible quality in situations where firms of type b cannot. The difficulty for firms of type b is that customers suspect that their good has been designed primarily with an eye toward future cost reductions.

5.1. Period 2

In Period 2, customers know that the good is worth $m\theta$ to them. Because customers pursue only their material rewards in this section, they purchase the good if $m\theta$ exceeds the price p_2^n. Demand is thus equal to $h^n(1-p_2^n/mY)$. Adapting the analysis of §2, the logic of (2) implies that total consumer welfare is $h^n(mY-p_2^n)^2/2mY$, whereas that of (5) implies that the optimal price for firms that care about all their consumers is

$$p_2^b = \frac{mY(1-\bar{a})+c}{2-\bar{a}}, \tag{24}$$

where c is marginal cost and the superscript b denotes the firm's type. For future reference, it is worth recording θ^-, the lowest θ that still leads customers to buy. Since this equals p_2^n/m, it is given by

$$\theta^- = \frac{(1-\bar{a})Y + c/m}{2-\bar{a}}. \tag{25}$$

Firm welfare for a firm of type b that charges the price in (24) equals

$$W_2^b(m,c) = h^n\left\{\left(1-\frac{p_2^b}{mY}\right)(p_2^b-c)+\frac{\bar{a}(mY-p_2^b)^2}{2mY}\right\}$$
$$= \frac{h^n}{mY}\left(\frac{mY-c}{2-\bar{a}}\right)^2\left(1-\frac{\bar{a}}{2}\right), \tag{26}$$

where m is an explicit determinant of W_2^b.

The restriction that some firms care only for consumers with $\theta > X$ matters only if $X \geq \theta^-$, and this fits with the idea that these firms care only about the keenest consumers. As shown momentarily, these firms then sell to all individuals with $\theta \geq X$ so that total consumer surplus for these consumers equals

$$h^n\int_X^Y (m\theta - p_2^n)\,dF_\theta(\theta)$$
$$= h^n\left(1-\frac{X}{Y}\right)\left(\frac{m(X+Y)}{2}-p_2^n\right). \tag{27}$$

This surplus thus equals the product of the number of buyers with θ between X and Y, which is $h^n(1-X/Y)$, and their average surplus, which is $[m(X+Y)/2-p_n^2]$.

Given this value of consumer surplus, a firm of type x maximizes

$$W_2^x(m,c,X) = h^n\left\{\left(1-\frac{p_2^n}{mY}\right)(p_2^n-c)+\bar{a}\left(1-\frac{X}{Y}\right)\cdot\left(\frac{m(X+Y)}{2}-p_2^n\right)\right\} \tag{28}$$

in Period 2. Therefore, its optimal price is

$$p_2^x = \frac{mY+c-\bar{a}m(Y-X)}{2}. \tag{29}$$

Any consumer whose θ is greater than or equal to p_2^x/m buys the good, and it is immediately verified that $p_2^x/m < X$ if $X > \theta^-$, so that, indeed, all individuals with $\theta \geq X$ buy the good. The price p_2^x rises with X because increases in X lead firms to care about fewer customers so that their vicarious gain from lowering their price is reduced. A firm with $X = Y$ cares about no customers so that it acts as if its altruism parameter $\bar{a}$ were equal to 0. At the opposite extreme, a firm that cares for all its customers acts as if X were equal to θ^-, and its optimal price is (24).

One clear and unsurprising implication of (28) is that all firms are better off if either their quality m rises (which raises demand) or their marginal cost c declines. This can be verified by differentiating this equation and obtaining

$$\frac{dW_2^x(m,c,X)}{dm}$$
$$= h^n\left\{\frac{p_2^x}{m^2Y}(p_2^x-c)+\frac{\bar{a}Y}{2}\left[1-\left(\frac{X}{Y}\right)^2\right]\right\} \tag{30}$$

$$\frac{dW_2^x(m,c,X)}{dc} = -h^n\left(1-\frac{p_2^x}{mY}\right). \tag{31}$$

The first of these expressions is positive because p_2^n exceeds marginal cost, whereas the second is negative because demand is positive only if p_2^n is smaller than mY. These signs imply that one can always find

a combination of an increase in c and an increase in m that leaves overall firm welfare constant.

The sign of the derivatives in (30) and (31) is independent of the size of the parameters $\bar{a}$ and X. It is immediately apparent, however, that the size of these derivatives depends on X both directly and indirectly through the dependence of the price p_2^x on X. This is the basis of the finding that increases in X starting from its lowest possible value of p_2^x/m raise the desirability of increasing c and m simultaneously. This is demonstrated in Proposition 6.

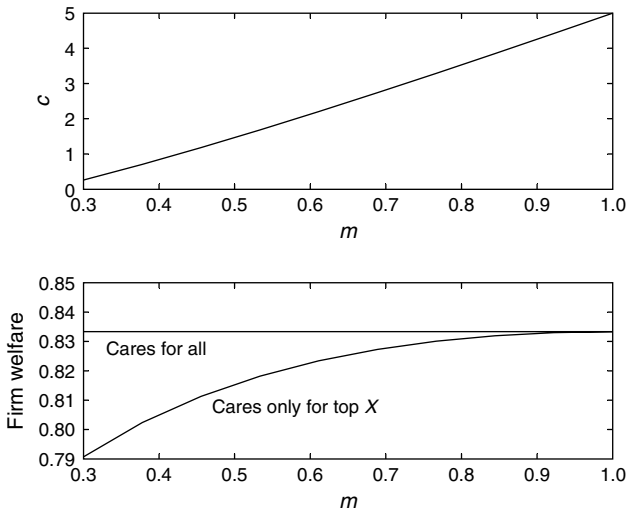
Proposition 6. *Consider a combination of infinitesimal increases in c and m that leaves W_2^b unchanged when $X = \theta^-$. Then, this combination increases $W_2^x(X)$ when X is strictly above θ^-.*

Reductions in c (combined with reductions in m) tend to be relatively more attractive to firms that care for all their customers for two main reasons. The first is that such firms charge lower prices and sell correspondingly more, so they obtain the savings from cost reductions on more units. Second, all consumers benefit equally from a cost reduction (through its effect on the price that they pay), whereas the benefits of an increase in m accrues disproportionately to consumers with high values of θ. This means that even though a firm that cares about all its consumers receives a larger total vicarious benefit from an increase in m than a firm that cares only for a subset (because all consumers gain something), its vicarious benefits from a reduction in c are relatively larger.

Although Proposition 6 deals only with marginal changes, its validity for all $X > \theta^-$ implies that it has global implications. Suppose, in particular, that we consider any two combinations of c and m that give the same welfare to a firm that cares about all its customers equally. One can then reach the higher $\{c, m\}$ combination from the lower one by a series of infinitesimal changes, each of which leaves the broadly altruistic firm indifferent and each of which makes the narrowly altruistic firm better off. This latter firm thus strictly prefers the combination with the higher m.

Figure 1 shows this graphically for $Y = 10$ and $\bar{a} = 0.5$. For each m between 0.3 and 1, the top panel depicts the level of c such that the combination $\{c, m\}$ makes the value of W_2^b the same as when $m = 1$ and $c = 5$. The bottom panel then depicts both W^b (which is a constant) and W^x for a particular X when c varies with m as it does in the top panel. The value of X is chosen so that the narrowly altruistic firm cares only for those consumers that buy when $m = 1$ and $c = 5$ and the price is set according to (24). At this point, both types of firms care about the same customers, so the two welfare levels are identical. For the combinations with lower m and c, the firm that

Figure 1 Variations in m and c That Keep W^b Constant

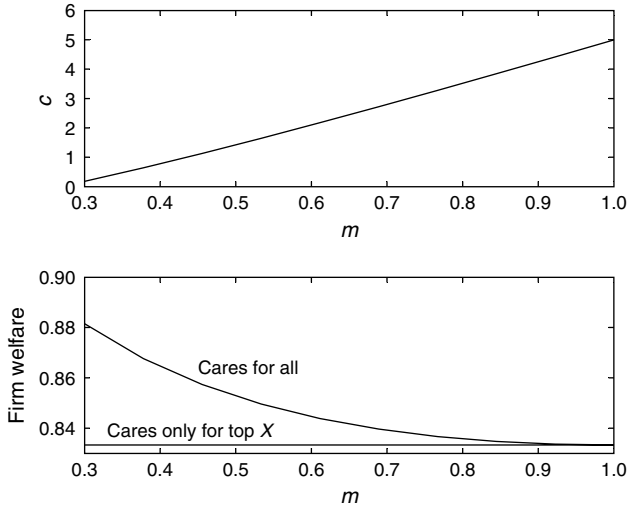


cares about the most quality-conscious consumers is worse off. It should be noted, however, that the reductions in firm welfare are modest even though the changes in cost and quality considered in Figure 1 are substantial.

Figure 2 depicts the converse situation. For the same Y and $\bar{a}$, it lets c vary with m so that W^x is unaffected. Again, X is chosen so that both firms get the same welfare when m and c are at the highest values under consideration. Now, however, reductions in m are matched by reductions in c that keep W^x constant. This means that W^b rises with c, because a firm that cares for all its consumers benefits more from simultaneous reductions in c and m.

This subsection has thus demonstrated that it is possible to find two $\{c, m\}$ combinations such that firms of type b derive more welfare in Period 2 from the one with lower m, whereas those of type x derive

Figure 2 Variations in m and c That Keep W^x Constant



more Period 2 welfare from the one with higher m. This is not a general result, and there are, of course, numerous pairs of $\{c, m\}$ combinations that lead both types of firms to prefer the same one. The model does make testable predictions, however, as to when the two kinds of firms have the same preferences and when they do not.

5.2. Period 1

The purpose of this section is to show that under some circumstances, firms of type x introduce extensions with a value of m, m^H, that exceeds the value of m, m^L, embodied in the extensions of firms of type b. This results in a higher demand for the extension of firms of type x. This is an equilibrium result that is driven by the customer's expectation of altruism, where this expectation is influenced by both by the firm's previous offering and by its current price. These expectations are central because, by assumption, both types of firms are equally capable of producing either of these goods. The marginal cost of the goods with quality m^L and m^H in Period 2 are, respectively, c^L and c^H, where $c^L < c^H$. For illustration, suppose that both goods have a marginal cost of c^H in the first period, although this is not essential for the results. Finally, the Period 1 setup costs for these two goods are κ^L and κ^H.

The previous subsection established that there exist combinations of parameters such that, once the welfare functions $W_2^b(m, c)$ and $W_2^x(m, c, X)$ have been maximized with respect to their respective prices, they satisfy

$$\begin{aligned} W_2^b(m^L, c^L) &> W_2^b(m^H, c^H), \\ W_2^x(m^L, c^L, X) &< W_2^x(m^H, c^H, X). \end{aligned} \tag{32}$$

For the numerical example considered above, these inequalities are satisfied when $c^H = 5$, $c^L = 1.43$, $m^H = 1$, and $m^L = 0.5$. With these parameters, welfare is about 2% higher for the broadly altruistic firm when it has low costs and low quality rather than high costs and high quality. For a firm that cares only about the equilibrium purchasers of the good with high cost and high quality, welfare is about one-third of 1% lower when it has low costs and low quality instead.

In the analysis so far, Periods 1 and 2 have been treated as having the same demand, and discounting between the periods has been neglected. However, the length of time during which the quality of a good is relatively uncertain might well be different from the length of time during which this quality is relatively well understood and the good continues to be sold. Indeed, one can imagine that for many products the uncertainty dissolves quickly relative to the life of the product. In this case, the present value of the welfare the firm obtains from the new product can be written as

$$W^i = W_1^i + \rho W_2^i \quad i = b, x.$$

The parameter ρ captures both discounting and the relative sales, or length, of Periods 1 and 2.[11]

One difference between Periods 1 and 2 is that consumers do not know m in the former. Letting m^e denote consumers' expectation of m, consumer demand is $h^n(1 - p_1^n/(m^e Y))$. The welfare in Period 1 of a broadly altruistic firm that introduces a good of quality m at a price p_1^n is then

$$\begin{aligned} &W_1^b(m, m^e, p_1^n) \\ &\quad = h^n\left\{\left(1 - \frac{p_1^n}{m^e Y}\right)(p_1^n - c^H) + a\int_{p_1^n/m^e}^{Y} \frac{\theta m - p_1^n}{Y} d\theta\right\} \\ &\quad = h^n\left\{\left(1 - \frac{p_1^n}{m^e Y}\right)(p_1^n - c^H)\right. \\ &\qquad \left. + a\left[\frac{mY}{2} + \frac{(2m^e - m)(p_1^n)^2}{2Y(m^e)^2} - p_1^n\right]\right\}. \end{aligned} \tag{33}$$

The price that maximizes this is

$$p_1^b(m, m^e) = \frac{m^e Y(1 - \bar{a}) + c^H}{2(1 - \bar{a}) + \bar{a}m/m^e}. \tag{34}$$

This price rises with perceived quality because this increases demand. It is declining in actual quality, however, because an increase in quality leads altruistic firms to obtain more vicarious benefits from each sale. They thus lower their prices to increase total sales. Notice that, by contrast, an increase in actual quality would have no effect on the price of selfish firms because it affects neither cost nor demand.

Differentiating (33) with respect to m^e yields

$$\frac{dW_1^b}{dm^e} = h^n\left\{\frac{p_1^n}{(m^e)^2 Y}\left[p_1^n - c^H + a p_1^n\left(\frac{m}{m^e} - 1\right)\right]\right\}. \tag{35}$$

Optimal pricing by firms ensures that $p_1^n > c^H$, so that this expression is positive for m^e smaller than a value exceeding m. A reduction in m^e (for given m) leads consumers to lower their purchases. This has only a second-order effect on consumer welfare when $m = m^e$ because consumers are then receiving zero surplus from marginal purchases. For firms, by contrast, the reduction in purchases represents a first-order reduction in profits. The result is that, as long as m^L and m^H are not too far apart, both firms supplying quality m^H and firms supplying quality m^L prefer to be seen as supplying quality m^H.

[11] Suppose Period 2 consists of τ segments, each of which has the same demand as Period 1. Further, let $\tilde{\rho}$ denote the discount rate between consecutive segments as well as between Period 1 and the first segment of Period 2. Then $\rho = \tilde{\rho}(1 - \tilde{\rho}^\tau)/(1 - \tilde{\rho})$, which rises with τ and $\tilde{\rho}$.

Supposing that all consumers with $\theta \geq X$ buy the good, the Period 1 welfare of a narrowly altruistic equals

$$\begin{aligned} W_1^x(m, m^e, p_1^n, X) &= h^n\left\{\left(1-\frac{p_1^n}{m^e Y}\right)(p_1^n - c^H) + \bar{a}\int_X^Y \frac{\theta m - p_1^n}{Y}\, d\theta\right\} \\ &= h^n\left\{\left(1-\frac{p_1^n}{m^e Y}\right)(p_1^n - c^H) \right. \\ &\qquad \left. + \bar{a}\left(1-\frac{X}{Y}\right)\left(\frac{m(X+Y)}{2} - p_1^n\right)\right\}. \end{aligned} \tag{36}$$

Differentiating with respect to p_1^n, the optimal price $p_1^x(m, m^e)$ depends only on m^e and is given by the expression in (29) with m replaced by m^e. The earlier analysis leads again to the conclusion that all consumers with $\theta \geq X$ buy the good if $X \geq \theta^-$. Inspection of (36) also shows that the derivative of W_1^x with respect to m^e is positive.

Because firms have nothing to gain by pretending to be offering quality m^L, a firm that offers this quality can charge the price that maximizes $W^i(m^L, m^L, p)$ with respect to p, where i equals either b or x. Let p_L^i denote this price, which equals either $p_1^b(m^L, m^L)$ or $p_1^x(m^L, m^L)$. By contrast, consumers would only believe that a firm is offering a good of quality m^H at a price p_H^i if they are certain that the firm has no incentive to deviate and offer quality m^L instead. Thus, provision of quality m^H is possible only if

$$\begin{aligned} &W_1^i(m^H, m^H, p_H^i) - W_1^i(m^L, m^L, p_L^i) \\ &\quad + \rho(W_2^i(m^H, c^H) - W_2^i(m^L, c^L)) \geq \kappa^H - \kappa^L, \end{aligned} \tag{37}$$

$$\begin{aligned} &W_1^i(m^H, m^H, p_H^i) - W_1^i(m^L, m^H, p_H^i) \\ &\quad + \rho(W_2^i(m^H, c^H) - W_2^i(m^L, c^L)) \geq \kappa^H - \kappa^L, \end{aligned} \tag{38}$$

where i equals either b or x. The first of these conditions says that the firm prefers to provide high-quality good at p_H^i, with consumers believing that quality is m^H, to providing low quality at p_L^i when this price leads consumers to believe that quality is m^L. This can be thought of as ensuring that the firm does not want to deviate in an overt way from providing high quality. The second of these conditions requires the firm to suffer a loss when it sells low rather than high quality at the price p_H^i even if the fact that it keeps the price constant at p_H^i leads consumers to believe that the firm provides high quality. This condition prevents the firm from making a covert deviation in the quality it provides.

When these conditions are met, it is possible to sustain an outcome with high quality if the price is p_H^i. Among all outcomes with this level of quality, firms of type i prefer the one that makes the left-hand side of (37) as large as possible, and this is a natural choice for an equilibrium price (because firms have no incentive to deviate from this price). It is also worth noting that these conditions imply that firms of type i prefer all the outcomes with prices that lead quality to be equal to m^H to the feasible outcomes where quality equals m^L so that, again, it seems reasonable to suppose that the equilibrium will take this form.

Proposition 7. *When* (32) *is satisfied, one can always find values of* ρ *and* $\kappa^H - \kappa^L$ *such that there exists no price that induces a rational expectations equilibrium in which firms of type b supply a good of quality* m^H. *At the same time, there does exist a rational expectations equilibrium in which firms of type x do so and charge* $p_1^x(m^H, m^H)$.

This proposition captures the idea that demand for new products from narrowly altruistic firms can be higher than demand for new products from broadly altruistic ones. In particular, it shows that, for certain model parameters, there exists an equilibrium price p_H^x such that narrowly altruistic firms sell $h^n(1 - p_H^x/(m^H Y))$ units. Because broadly altruistic firms would be expected to sell a good of quality m^L, they would sell $h^n(1 - p_H^x/(m^L Y))$ units, which is fewer, if they (counterfactually) charged this price.

6. Conclusions

This paper has sought to show that the association of a brand with altruism for a particular group of consumers can explain some consumer attitudes for branded products. It can explain why consumers are quick to accept certain new product offerings from particular brands while meeting others with suspicion. The model also suggests a reason for why brands may find it more difficult to "move up" and acquire associations with higher quality than to "move down" and generate demand by consumers with limited quality sensitivity. The reason is that people expect high quality not so much from brands that they regard as having a particular affection for themselves, but rather from brands that they regard as devoted to the most quality-sensitive purchasers.

In a sense, the model offers a formalization of the idea of "brand image," which is captured here by the expectations that consumers have about the groups of people toward whom the brand is altruistic. Whether this particular definition of brand image fully captures a brand's extensibility remains an open empirical question. The importance of the brand associations stressed in Aaker and Keller (1990) might suggest that it does not. They show, for example, that their survey respondents expect a potential Vidal Sassoon extension into perfume to be of relatively low quality, with some saying that "it smells like shampoo." Still, skepticism about this extension might be rationalizable along the lines of this paper if the group of customers that purchases Vidal Sassoon shampoo does not overlap neatly with any group of consumers

that has common objectives when it comes to perfume. If no group of people with common perfume desires expects Vidal Sassoon to particularly care for them, the forces discussed in the current paper could keep the demand for Vidal Sassoon perfume modest and subject the brand to only weak pressure to produce a high-quality perfume. To study this issue more formally, however, the model would have to be extended so that it covers a richer pattern of partial overlaps between the consumer segments targeted by brand extensions and the purchasers of the brand's original products.

The paper draws a sharp distinction between extensions that are not received warmly and extensions that elicit anger. The latter are more likely when consumers flock to an extension thinking the brand cares for them and then find the product disappointing. Because this anger can hurt the sales of the brand's original products, this outcome may well be more costly than a failure of the extension to catch on. It would thus seem important to develop survey methods that can detect the potential for such anger.

Although not asking directly about this anger, Milberg et al. (1997) provide some evidence suggesting that the sensitivity of consumers to the quality of brand extensions depends on the relationship between the extension and the brand's original product. They collect data on attitudes toward brands after people read articles describing these extensions. Not surprisingly, their data show that people who read a neutral description of an extension report more favorable views about the brand than people who read that the extension was of bad quality. What is more interesting, and more closely related to the current paper, is that this impact of quality on brand perceptions is much larger when the extension is "similar" than when it is not. In their paper, similarity is related but not identical to overlap between the groups being targeted by the brand's products, so it would be worthwhile to extend their method of analysis so that it speaks more directly to the model presented here.

Acknowledgments

The author thanks Mary Burke, Stephan Meier, and Christina Wang for conversations; Zhaoning Wang for research assistance; Ganesh Iyer, the editor Preyas Desai, and the review team for comments; and the Harvard Business School Division of Research for support.

Appendix. Derivations and Proofs

Derivation of $\Delta(a)$. Using the formula in (5) to substitute for both $p^*(\bar{a})$ and $p^*(a)$ in (6), one obtains

$$\frac{\Delta(a)}{h^o} = \left(1-\frac{\bar{c}+(1-\bar{a})Y}{(2-\bar{a})Y}\right)\left(\frac{\bar{c}+(1-\bar{a})Y}{2-\bar{a}}-\bar{c}\right) + \frac{a}{2Y}\left(Y-\frac{\bar{c}+(1-\bar{a})Y}{2-\bar{a}}\right)^2 - (1-\gamma)\left\{\left(1-\frac{\bar{c}+(1-a)Y}{(2-a)Y}\right)\left(\frac{\bar{c}+(1-a)Y}{2-a}-\bar{c}\right) + \frac{a}{2Y}\left(Y-\frac{\bar{c}+(1-a)Y}{2-a}\right)^2\right\}.$$

After rearranging, this becomes

$$\frac{\Delta(a)}{h^o} = \frac{(1-\bar{a})(Y-\bar{c})^2}{(2-\bar{a})^2Y} + \frac{a}{2Y}\left(\frac{Y-\bar{c}}{2-\bar{a}}\right)^2 - (1-\gamma)\left\{\frac{(1-a)(Y-\bar{c})^2}{(2-a)^2Y} + \frac{a}{2Y}\left(\frac{Y-\bar{c}}{2-a}\right)^2\right\},$$

and the expression in the text follows.

Proof of Proposition 1. Suppose first that (13) is satisfied. Because selfish firms are not punished for charging $p^*(0)$, they would charge this price in period 2 if their good were of good quality. Condition (10) follows. Moreover, regardless of consumer beliefs concerning quality, sales are nonnegative at prices above $\bar{c}$. This leads (11) to be satisfied for all such prices. Therefore, the entrant prefers entering with high quality and a price above $\bar{c}$ to any alternative course of action. Knowing this, consumers expect high quality at any price above $\bar{c}$, so the equilibrium price is $p^*(0)$ also in period 1.

Conversely, the violation of (13) implies that (10) is violated as well, so the firm prefers low quality to high quality at any price.

Proof of Proposition 2. First note that the utility function (7) implies that consumers lose $L-p_1^n=\bar{c}-\epsilon-p_1^n$ for each low-quality unit that they buy at a price of p_1^n. We thus have

$$B_1^n(p_1^n, \text{low}) = (\bar{c}-\epsilon-p_1^n)q_1^n. \tag{39}$$

Conditions (11) and (10) are thus identical when p_1^n satisfies

$$a(p_1^n-\bar{c}+\epsilon)q_1^n = (p_1^n-\bar{c})q_1^n,$$

which is true when p_1^n is given by $\tilde{p}_1^n$. As a result, the violation of (16) implies that both (10) and (11) are violated at $\tilde{p}_1^n$ if demand is given by (8). Thus, high quality is not provided even if consumers expect new goods to be of high quality. I now show that when (16) is violated, high quality cannot be provided at any other price either.

For high quality to be provided at a price $p_1^n > \tilde{p}_1^n$, (10) would have to be true when demand is given by (8) so that

$$W_2^n(\bar{a}) + \bar{a}\frac{h^n(Y-p_1^n)^2}{2Y} - \bar{a}\left[h^n\left(1-\frac{p_1^n}{Y}\right)(\bar{c}-\epsilon-p_1^n)\right] \geq \kappa. \tag{40}$$

The derivative of the left-hand side of (40) with respect to the price p_1^n is

$$\bar{a}h^n\left[-\frac{Y-p_1^n}{Y}+\frac{1}{Y}(\bar{c}-\epsilon-p_1^n)+\left(1-\frac{p_1^n}{Y}\right)\right] = \frac{\bar{a}h^n}{Y}[\bar{c}-\epsilon-p_1^n].$$

This is negative as long as firms do not charge prices below $\bar{c}-\epsilon$. Since $\bar{c}-\epsilon$ is below the critical price, increasing the price above $\tilde{p}_1^n$ does not lead high quality to be sustainable when (16) is violated.

For high quality to be provided at a price $p_1^n < \tilde{p}_1^n$, (11) would have to be satisfied when demand is given by (8) so that

$$W_2^n(\bar{a}) + \bar{a}\frac{h^n(Y-p_1^n)^2}{2Y} + h^n\left(1-\frac{p_1^n}{Y}\right)(p_1^n-\bar{c}) \geq \kappa. \qquad (41)$$

The left-hand side of this inequality is maximized when p_1^n equals $p^*(\bar{a})$. Moreover, because the expression is quadratic in the price, it declines monotonically as the price is lowered below this. This means that lowering the price below $\tilde{p}_1^n$ does not make it possible to sustain high quality when (16) is violated.

The analysis above shows that when the price is raised above $\tilde{p}_1^n$, (11) is satisfied whenever (10) is. As the price is raised, the left-hand side of (10) declines. Let $\bar{p}$ be equal to $p^*(\bar{a})$ if (10) is satisfied for $p^*(\bar{a})$ when demand is given by (8). If (10) is not satisfied in this case, let $\bar{p}$ be the highest price consistent with (40), and thus with (10).

I now show that when (16) is satisfied, there is an equilibrium in which firms provide high-quality goods and charge $\bar{p}$. First, if consumers expect high quality at $\bar{p}$, their demand is given by (8), and both (10) and (11) are satisfied, so the firm wishes to provide a high-quality good. The only remaining issue is whether the firm wishes to charge a different price. When $\bar{p}$ equals $p^*(\bar{a})$, all other prices give lower welfare to firms. When it is not, lowering p_1^n below $\bar{p}$ lowers the firm's welfare (since $p^*(\bar{a})$ is above $\bar{p}$). Raising p_1^n above $\bar{p}$ leads consumers to expect low quality (because (10) would be violated if demand were given by (8)). This too lowers firm welfare because it implies a W_1^n of 0.

Proof of Proposition 3. Note first that $B_1^n(p_1^n, \text{low})$ is still given by (39) so that $\tilde{p}_1^n$ still gives the price at which the left-hand sides of (10) and (11) are equal. Furthermore, the willingness of consumers to buy only if $\mu\theta + (1-\mu)L$ is greater than or equal to p_1^n implies that

$$B_1^n(p_1^n, \text{high}) = \frac{h^n}{Y}\left\{\int_{(p_1^n-(1-\mu)L)/\mu}^{Y}(\theta - p_1^n)\,d\theta\right\}.$$

Taking into account the demand function (17), it follows that (19) represents condition (11) at the price $\tilde{p}_1^n$. Thus, if (19) is violated, high quality cannot be provided at this price. The left-hand side of (19) is quadratic in $\tilde{p}_1^n$ and reaches a maximum at $p^\mu(\bar{a})$. To see this, replace $\tilde{p}_1^n$ by p in (19) and differentiate with respect to p, which yields

$$\frac{h^n}{Y}\left\{\frac{-\bar{a}}{\mu}\left(\frac{p-(1-\mu)L}{\mu}-p\right)-\bar{a}\left(Y-\frac{p-(1-\mu)L}{\mu}\right) + Y - \frac{p-(1-\mu)L}{\mu} - \frac{p-\bar{c}}{\mu}\right\}.$$

Setting this to 0 implies that p equals to $p^\mu(\bar{a})$. Because this is above $\tilde{p}_1^n$, lowering p_1^n below $\tilde{p}_1^n$ does not make it possible to satisfy (11) when (19) is violated.

When (19) is violated, raising the price above $\tilde{p}_1^n$ leads to a failure of (10). To see this, note that (39) and the expression for $B_1^n(p_1^n, \text{high})$ above imply that (10) is given by

$$W_2^n(\bar{a}) + \frac{\bar{a}h^n}{Y}\left\{\int_{(p_1^n-(1-\mu)L)/\mu}^{Y}(\theta-p_1^n)d\theta - (\bar{c}-\epsilon-p_1^n)\cdot\left(Y-\frac{\tilde{p}_1^n-(1-\mu)L}{\mu}\right)\right\} \geq \kappa.$$

The derivative of the left-hand side of this equation with respect to p_1^n simplifies so that it equals

$$\frac{\bar{a}h^n}{\mu^2 Y}(\mu(\bar{c}-\epsilon)-p_1^n),$$

which is negative for any price above $\mu(\bar{c}-\epsilon)$. Because this is below $\tilde{p}_1^n$, it follows that raising the price above $\tilde{p}_1^n$ leads (10) to continue to be violated when (19) is violated.

When (19) does hold, consumers rationally expect high quality from altruistic firms if firms charge this price. Using the same steps as in the proof of Proposition 2, it follows that the equilibrium price is either the highest price that leads (10) to hold or $p^\mu(\bar{a})$, whichever is lower. At this price, consumers continue to expect high quality from altruistic firms, and altruistic firms find it in their interest to supply this.

Finally, the derivative of (19) with respect to μ is

$$\frac{\tilde{p}_1^n-L}{\mu^2}\left[\frac{\bar{a}}{Y}\left(\frac{\tilde{p}_1^n-(1-\mu)L}{\mu}-\tilde{p}_1^n\right)+\tilde{p}_1^n-\bar{c}\right]h^n = \frac{\tilde{p}_1^n-L}{\mu^2}\left[\frac{\bar{a}}{Y}\frac{(1-\mu)(\tilde{p}_1^n-L)}{\mu}+\tilde{p}_1^n-\bar{c}\right]h^n.$$

Because $\tilde{p}_1^n$ exceeds both $\bar{c}$ and L, this is positive.

Proof of Proposition 4. At the proposed equilibrium, consumers expect high quality at p_1^n, so the quantity demanded is $F^n(1-p_1^n/Y)$. Proposition 2 then implies that altruistic firms provide high-quality goods at this price. Because altruistic firms provide high-quality goods, incumbent firms that provide low-quality new goods do indeed lose $\Delta(0)$ in Period 2. Thus, if (21) and (23) are satisfied at this price–quantity combination, selfish firms produce high-quality goods as well because they prefer this to producing a low-quality good and to producing no new good at all. There is thus an equilibrium where consumers expect high quality and both types of firms supply it.

Proof of Proposition 5. Given an expectation that selfish firms will not produce the new good, altruistic firms produce high-quality goods since (10) and (11) are satisfied. This implies that firms who deviate from the equilibrium and sell a new good of low quality would indeed lose $\Delta(0)$ in the second period. The failure of (23) and the definition of $\hat{p}_1^n$ implies that selfish firms are strictly worse off if they deviate in this way.

Proof of Proposition 6. For clarity, I neglect most superscripts and subscripts of W, a, and p in this proof. Using (26), the cost c that leads firms who care equally for all their customers to obtain a particular welfare level W satisfies

$$c = mY - \sqrt{2(2-a)mYW/h^n}. \qquad (42)$$

Using (42) to substitute for c in (28), one obtains

$$W^x(X) = \frac{2-a}{2}W - \frac{a(2-a)mh^n(Y-X)^2}{4Y} + \frac{a(Y-X)}{2Y}\sqrt{2(2-a)mh^nYW}.$$

The derivative of this welfare with respect to m is then

$$\frac{dW^x(X)}{dm} = -\frac{a(2-a)h^n(Y-X)^2}{4Y} + \frac{a(Y-X)}{4}\sqrt{\frac{2(2-a)h^nW}{mY}}.$$

When marginal cost is given by (42), the smallest possible value of X (namely, θ^-) is

$$\theta^- = Y - \sqrt{\frac{2YW}{(2-a)mh^n}}.$$

Given this relationship, it turns out to be convenient to write X as

$$X = Y - (1-\zeta)\sqrt{\frac{2YW}{(2-a)mh^n}},$$

so that X equals θ^- when ζ is 0, whereas it is strictly greater than θ^- when $\zeta > 0$. Note that ζ is at most equal to 1 if the firm feels any altruism at all. Using this value of X in the derivative above yields

$$\frac{dW^x(X)}{dm} = \frac{aW\zeta(1-\zeta)}{2m},$$

which is positive for all ζ between 0 and 1.

Proof of Proposition 7. Let

$$\chi_o^i \equiv W_1^i(m^H, m^H, p_1^i(m^H, m^H)) - W_1^i(m^L, m^L, p_L^i), \quad (43)$$

$$\chi_c^i \equiv W_1^i(m^H, m^H, p_1^i(m^H, m^H)) - W_1^i(m^L, m^H, p_1^i(m^H, m^H)). \quad (44)$$

The function $W_1^b(m^L, m^H, p)$ is quadratic in p and reaches its maximum at $p_1^b(m^L, m^H)$. According to (34), $p_1^b(m^L, m^H) > p_1^b(m^H, m^H) > p_L^b$, so that $W_1^b(m^L, m^H, p_1^b(m^H, m^H)) > W_1^b(m^L, m^H, p_L^b)$. In addition, the fact that the right-hand side of (35) is positive implies that $W_1^b(m^L, m^H, p_L^b) > W_1^b(m^L, m^L, p_L^b)$. Therefore, $\chi_o^b > \chi_c^b$. This means that, at the price $p_H^b = p_1^b(m^H, m^H)$, condition (38) is more stringent than condition (37) for firms of type b. Because the left-hand side of (37) reaches a maximum at this price, any other price makes condition (37) harder to meet. Therefore, if (37) is violated at this price for firms of type b, there is no price that leads these firms to supply quality m^H.

In the case of firms of type x, $p_1^x(m^L, m^H) = p_1^x(m^H, m^H)$. Nonetheless, the fact that (36) implies that W_1^x is strictly increasing in m^e also implies, through the envelope theorem, that $W_1^x(m^L, m^H, p_1^x(m^H, m^H)) > W_1^i(m^L, m^L, p_L^i)$. Therefore, $\chi_o^x > \chi_c^x$. This implies that condition (38) is more stringent than condition (37) for firms of type x when the price p_H^x equals $p_1^x(m^H, m^H)$. As a result, firms of type x are willing to supply quality m^H at the price $p_1^x(m^H, m^H)$ if (38) is satisfied at this price.

The expressions for W_1^b and W_1^x in (33) and (36), respectively, are linear in m with coefficients that depend only on $\bar{a}$, Y, X, h^n, and p_1^i/m_H. Therefore, χ_c^i equals the derivative of W_1^i with respect to m times $(m^H - m^L)$. Moreover, the coefficient on m is larger in the case of W_1^b as long as $p_1^b(m^H, m^H)/m^H < X$. For $X \geq \theta^-$, $p_1^b(m^H, m^H) \leq p_1^x(m^H, m^H) \leq m^H X$. Therefore, $\chi_c^b \geq \chi_c^x$, which in turn implies that $\chi_o^b > \chi_c^x$.

Now consider the equation system

$$\chi_o^b + \rho(W_2^b(m^H, c^H) - W_2^b(m^L, c^L)) = \kappa^H - \kappa^L,$$

$$\chi_c^x + \rho(W_2^x(m^H, c^H, X) - W_2^x(m^L, c^L, X)) = \kappa^H - \kappa^L.$$

The solution $\{\rho^*, (\kappa^H - \kappa^L)^*\}$ of this system satisfies $\rho^* > 0$, $(\kappa^H - \kappa^L)^* > 0$ as long as $\chi_o^b > \chi_c^x$ and $W_2^x(m^H, c^H, X) - W_2^x(m^L, c^L, X) > 0 > W_2^b(m^H, c^H) - W_2^b(m^L, c^L)$. The former is demonstrated above, and the latter is implied by (32). Therefore, $\rho > \rho^*$ and $\kappa^H - \kappa^L = (\kappa^H - \kappa^L)^*$ lead to (38) being satisfied for firms of type x at a price of $p_1^x(m^H, m^H)$, whereas (37) is not satisfied for firms of type b at a price of $p_1^b(m^H, m^H)$.

References

Aaker DA, Keller KL (1990) Consumer evaluations of brand extensions. *J. Marketing* 54:27–41.

Abrahams J (2004) *The Mission Statement Book: 301 Corporate Mission Statements from America's Top Companies* (Ten Speed Press, New York).

Associated Press (1997) Gun maker Smith & Wesson now selling bicycles to police. (December 29) http://tinyurl.com/akzaijh.

Bagwell K, Riordan MH (1991) High and declining prices signal product quality. *Amer. Econom. Rev.* 81:224–239.

Broniarczyk SM, Alba JW (1994) The importance of the brand in brand extension. *J. Marketing* 21:214–228.

Business Wire (2003) Smith & Wesson bicycles receive wide acclaim. (April 16) http://tinyurl.com/b8z6d6l.

Cabral LMB (2000) Stretching firm and brand reputation. *RAND J. Econom.* 31:658–673.

Choi JP (1998) Brand extension as informational leverage. *Rev. Econom. Stud.* 65:655–669.

Fournier S (1998) Consumers and their brands: Developing relationship theory in consumer research. *J. Consumer Res.* 24:343–373.

Haig M (2011) *Brand Failures: The Truth About the 100 Biggest Branding Mistakes of All Time* (Kogan Page, London).

Isaacson W (2011) *Steve Jobs* (Simon & Schuster, New York).

Judd KL, Riordan MH (1994) Price and quality in a product monopoly. *Rev. Econom. Stud.* 61:773–789.

Keller KL (1998) *Strategic Brand Management* (Prentice-Hall, Upper Saddle River, NJ).

Krebs D (1975) Empathy and altruism. *J. Personality Soc. Psych.* 32:1134–1146.

Miklós-Thal J (2012) Linking reputations through umbrella branding. *Quant. Marketing Econom.* 10:335–374.

Milberg SJ, Park CW, McCarthy MS (1997) Managing negative feedback effects associated with brand extensions: The impact of alternative branding strategies. *J. Consumer Psych.* 6:119–140.

Ohbuchi K-I, T. Tamura, Quigley BM, Tedeschi JT, Madi M, Bind M, Mummendey A (2004) Anger, blame, and dimensions of perceived norm violations: Culture, gender, and relationships. *J. Appl. Soc. Psych.* 34:1587–1603.

Roedder-John D, Loken B, Joiner C (1998) The negative impact of extensions: Can flagship products be diluted? *J. Marketing* 62:19–32.

Rotemberg JJ (2008) Minimally acceptable altruism and the ultimatum game. *J. Econom. Behav. Organ.* 66:457–476.

Rotemberg JJ (2011) Fair pricing. *J. Eur. Econom. Assoc.* 9:952–981.

Swaminathan V, Fox RJ, Reddy SK (2001) The impact of brand extension introduction on choice. *J. Marketing* 65:1–15.

Tyler T (1999) Why people cooperate with organizations: An identity-based perspective. Sutton RI, Staw BM, eds. *Research in Organizational Behavior*, Vol. 21 (JAI Press, Greenwich, CT), 201–246.

Wernerfelt B (1988) Umbrella branding as a signal of new product quality: An example of signaling by posting a bond. *RAND J. Econom.* 19:458–466.