Quality Provision, Expected Firm Altruism and Brand Extensions

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Abstract

Altruism by firms towards consumers, as well as consumer expectations of this altruism, affect the quality of brand extensions. This result obtains even if a brand's existing products only help consumers determine who the brand cares about. Quality is affected further if consumers react with anger when a brand acts less altruistically than consumers expect. In either case, brand extensions experience higher demand and are of higher quality when their target segments coincide with those of the brand's existing products. Quality and demand can be higher still if the brand is perceived as caring only for its most quality-conscious consumers.

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This paper studies how altruism (and perceived altruism) from firms towards consumers affects product quality, particularly in the case of brand extensions. It considers experience goods, whose quality consumers only learn after purchasing them, while firms know this quality in advance. One immediate consequence of this is that a brand that is altruistic towards its consumers has more to gain than a selfish one from providing goods of higher quality. The reason is that the former receives vicarious benefits from the additional utility obtained by its consumers.

The literature's neglect of this straightforward mechanism of quality enhancement may be due to skepticism about the relevance of firm or brand altruism towards customers.[1] Altruism does, however, provide a convenient formalization for statements made by firms and their customers. The former, in particular, often claim to care for the latter.[2] At the same time, consumers sometimes express judgments about the extent to which brands care for them. Fournier (1998, p. 355) discusses a consumer she calls "Karen" who, recollecting a design change at Mary Kay Cosmetics said: "I remember feeling, 'how could they do that to me?'."[3]

Since altruism towards customers increases the quality of goods, a consumer who is impressed by the quality of a good should update his beliefs concerning the altruism of a brand. Here, an important aspect of altruism comes into play, namely that altruism is typically directed, so that people are more altruistic towards certain individuals and less altruistic towards others. Krebs (1975), for example, presents evidence that individuals are more likely to feel empathy and be generous towards people who are similar to themselves.[4]

[1]Because the paper does not focus on multi-brand firms, the terms firm and brand are used interchangeably in the text. Consumer beliefs about altruism are more likely to be focused on brands, because these act as the personality that is behind products.

[2]This concern is often expressed in mission statements. For example, the well publicized Johnson & Johnson "credo" starts with the words "We believe our first responsibility is to the doctors, nurses and patients, to mothers and fathers and all others who use our products and services." Other examples can be found in Abrahams (2004).

[3]In discussing the attitudes of people with respect to brands more generally, Fournier (1998, p. 345) says "Another form of animism involves complete anthropomorphization of the brand object itself, with transference of the human qualities of emotionality, thought, and volition."

[4]This extra empathy may help explain the high quality and corresponding success of companies such as Under Armour that are founded by individuals who used to belong to the group the firm intends to sell to.

Thus, an individual who has purchased a high quality good can be justified in thinking that the brand is altruistic towards people like him, as opposed to people in general. More importantly individuals who have not been interested in the existing products of a brand have much less reason to expect altruism of the brand towards themselves, even if the brand's existing customers are extremely satisfied.

Beliefs about the orientation of a firm's altruism matter when people form estimates about the quality of a new product offered by an existing brand, *i.e.*, a brand extension. Individuals who have been happy with their previous purchases from a brand and who perceive its extension to be aimed at them should, in particular, expect the brand to have made a great deal of effort at improving the quality of the extension. This raises the demand for such extensions. This, in turn, raises an altruistic firm's incentive to provide high quality since its vicarious loss from delivering low quality to more customers is larger.

Initial sales of a brand extension thus depend somewhat rationally 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.[5] This is consistent with at least some evidence regarding the attractiveness and success of those brand extensions that do not rely on inputs or technologies that resemble those of the brand's original products.[6] Keller (1998) shows that several of these 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.

Target customers seem to be similar also in less straightforward cases. Broniarczyk and Alba (1993) show that their undergraduate survey respondents regard a potential extension of the Close-Up brand of toothpaste into breath mints as more attractive than a similar

[5]There is considerable discussion in the branding literature concerning the importance of fit between a brand's extension and its original product. At the same time, Klink and Smith (2001) point out that the concept of "fit" is not very precisely defined in this literature.

[6]When such similarities are present, customers might be attracted to the extension by the belief that the brand has relevant technical expertise.

extension by Crest.[7] By contrast, an extension by Crest into toothbrushes was regarded more favorably than a similar extension by Close-Up.[8] This pattern seems consistent with the target markets for the two existing products. Close-Up seems directed at people who are particularly concerned with the smell of their breath (who should be the target market for breath mints) while the target market for Crest seems 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 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).[9] The second is the customer segment to which the good is addressed.[10] Lastly, 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. In the presence of directed altruism, on the other hand, a strong overlap between these two segments 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.

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 towards its

[7]Interestingly, these survey respondents regarded Close-Up as being less attractive than Crest as a toothpaste, suggesting that the attractiveness of extensions does not depend on a unidimensional indicator of "quality."

[8]Crest entered the toothbrush market around 1992.

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

[10]This is treated as known, contrary to the case treated in Sappington and Wernerfelt (1985).

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 for 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 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 someone's observed behavior is incompatible with the altruism people expect. As Rotemberg (2008) notes, these angry reactions can explain behavior in experimental games such as ultimatum and dictator games.[11] 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. 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, however, these losses in sales occur only if consumers lower their estimate of the quality of existing goods when they purchase an extension they are dissatisfied with.[12] By

[11]Rotemberg (2008) also argues that this explanation has advantages relative to others that have been proposed in the fairness literature.

[12]This assumption is crucial. As demonstrated in Choi (1998), if one modifies the Wernerfelt (1988) and

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. Summarizing their study of this issue, Roedder-John, Loken and Joiner (1998, p. 25) say, "Overall, these findings provide support for our view that beliefs about flagship products are highly resistant to change."[13]

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

The paper is organized as follows. Section 1 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 2 studies the introduction of a new good by a new firm. It demonstrates that this good is more likely to be of high quality if the firm is altruistic. Section 3 turns its attention to the new product introductions of a brand that has already sold a successful product to the target of the extension. It shows that this existing product raises the likelihood that altruistic firms provide high quality and leads consumers to increase their demand for the extension. This occurs even if consumers do not respond to a low quality extension by reducing their existing purchases. The case where they react with anger strengthens the incentive for altruistic firms to provide high quality. Section 4 demonstrates that the demand for a new good can be lower if it is sold by a brand that is altruistic towards all its consumers rather than by one whose altruism is targeted only towards its most quality-conscious segment. Section 5 presents some concluding remarks.

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.

[13]In their study, 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.

1 The setup

The temporal structure of the model is close to Wernerfelt (1988) 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 version have the same marginal cost $\bar{c}$, which is also the marginal cost of the old good.[14] In addition, a positive setup cost κ is required to produce high quality. 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.[15]

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 towards the brand and on his assessment of the extent to which the brand acts altruistically towards him. In particular,

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

where a_j denotes his direct altruism towards the brand and the function ξ takes a value of zero 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 zero. A fraction γ of consumers is "altruism aware" 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 zero, 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

[14] 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 the new good have the same marginal cost is made only for simplicity.

[15] It may seem odd not to let the old good be available in period 1 as well. This is done only for simplicity. Since 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.

incremental material payoff from consuming one unit of the good rather than none equals ψ, where this is drawn from a distribution with 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 below when the focus shifts to the h^n individuals that are potential customers for the new good introduced in period 1. 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.

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 while $a < 1$ is a parameter giving a firm's altruism towards 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

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

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

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

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 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. Since 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

$F(\psi) = \psi/Y$ 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 since the maximum willingness to pay Y must exceed marginal cost.

A high price can thus lead altruism-aware 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-aware consumers use to test the hypothesis that firms' altruism equals at least $\bar{a}$. I neglect these details here and simply assume that altruism-aware consumers accept the price of $p^*(\bar{a})$ as indicating sufficient altruism. Firms with an altruism level of $\bar{a}$ then charge this price, so that a statistician would not reject the null hypothesis that a firm charging $p^*(\bar{a})$ does indeed have an altruism level of $\bar{a}$.

On the other hand, this hypothesis is rejected when the price is higher, and altruism-aware 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 assured by the assumption that a is smaller than one 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

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

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-aware 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-aware 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 $(1-\gamma)h^o(1-p_2^o/Y)$. The cost in this market from taking an earlier action that allows altruism-aware 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.

2 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; and 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 low quality, its value to these consumers equals L. If the good is of high quality, a fraction $F(\theta)$ 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. 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 equal 0 otherwise. Since the consumer does not buy more than one unit of the new good, $(I^h + I^\ell)$ is, at most, equal to one. Supposing that the consumer pays p_1^n for a newly introduced good, his actual material payoffs are

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

A different indicator variable, σ_H, equals 1 with probability β and equals zero otherwise. When it equals zero, 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 non-introduction 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.

2.1 Period 2

The analysis is simplified by supposing that $\bar{c} > L$ so that the value to consumers of low quality goods is smaller than the marginal cost of their production. As a result, sellers of a new good that is known to be of low quality in period 2 cannot sell this good profitably. It turns out to be convenient to let ϵ denote $\bar{c} - L$, the excess of the cost of production relative to the consumers' valuation of this good. In a sense to be made precise below, I focus on situations where ϵ is relatively small.

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.

2.2 Period 1

This is the period in which the new firm must make a quality choice. While 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, though 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 while $B_1^n(p_1^n, \text{low})$ denotes 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 high to low quality in period 1 if

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

The entrant also has the option of not producing at all, and this can be attractive to an altruist who does not wish to saddle her consumers with a low quality good. By not producing, the firm foregoes the profits $q_1^n(p_1^n - \bar{c})$ where q_1^n is the quantity sold. Therefore, the entrant prefers to produce high quality rather than not producing the new good if

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

Lastly, 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 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, since 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 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. When this is true, consumers 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 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 high quality to be offered. The following proposition 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.

Proposition 2. *Let*

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

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 $\bar{a}$ while they 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 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 $p^*(\bar{a})$.

Since (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 of firm altruism. Suppose, then, that consumers believe that the probability that a firm has an altruism parameter $\bar{a}$ equals $\mu \leq 1$ while they expect the firm to be selfish with probability $(1-\mu)$. If (13) is satisfied, all firms provide high quality 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 one). It turns out that, for certain changes in μ, altruistic firms continue to provide high quality. For others, high quality is unsustainable even if the conditions of Proposition 2 are satisfied.

If customers expect high quality from altruistic firms, their expected utility from a purchase of the new good is $(\mu\theta + (1-\mu)L)$. As a result, only those 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 because such increases make the good more likely to be of high quality. The resulting increase in demand turns out to raise altruists' desire to provide high quality. It does so by raising both the vicarious benefit from selling high quality goods and the vicarious loss from providing low quality. The following proposition 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 $\bar{a}$ while 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 at a price above $\bar{c}$ is

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

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 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 one still lead (19) to hold so that altruistic firms provide high quality while selfish firms do not. Notice that, while 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. Under some circumstances there exist equilibria where the price is actually below $\bar{c}$. These equilibria exist because this low price allows altruists to signal their quality. This

signal works because a selfish firm does not gain from selling at a price below marginal cost and thus stays out.[16]

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

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

If (20) is satisfied, there is no equilibrium where firms provide high quality 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, so equilibria of this sort exist.

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, since these are already acting in accord with the expectations of altruism-aware consumers. They do, however, reduce selfish entrants' incentive to provide high quality. More specifically, they lower the period 2 profits $W_2^n(0)$ that accrue to selfish firms that provide high quality. 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 towards all h^n potential consumers of the new good, or towards none. It is worth noting, however, that altruism towards

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

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.

3 The introduction of a new good by a related brand

If all firms were known to be selfish and γ were zero 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 towards 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 in situations where a selfish brand would have sold goods of low quality should adjust upwards their expectation of this brand's altruism towards themselves. With this as 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 towards 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 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 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 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 towards 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, since 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, since these 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.

Before demonstrating this formally, it is worth noting that consumer anger would have a more limited role if an existing brand provided an extension aimed at a group of customers that was not buying its original product. In this case, purchasers of good n would not be able to reduce their purchases of the old good if the new good were of low quality. Furthermore, the introduction of a new good of low quality would give purchasers of the old good little reason for anger. 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 Ohbuschi *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.[17] While this evidence comes from a

[17]They show that people are angered when people who are close to them engage in actions that do not,

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-aware 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-aware 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-aware consumers forces selfish firms to charge $p^*(\bar{a})$ instead of their optimal price $p^*(0)$. Still, for $\bar{a}$ sufficiently small (so that $W_2^n(0, p^*(0))$ is not much larger than $W_2^n(0, p^*(\bar{a}))$) and 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 rather than low quality. 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

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

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

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

for example, take proper account of their feelings while anger is less likely to be triggered in response to such behavior from people who are less close.

The changes in these conditions can make it easier for equilibria to exist where high quality goods are produced, even by altruistic firms. This is demonstrated in the next two propositions.

Proposition 4. *Consider a price $p_1^n = \bar{p}$, which leads altruistic firms to provide high quality when consumers expect $\mu = 1$. Even if the actual probability that firms are altruistic is less than one, 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 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 not because they are altruistic but because they are expected to be, and are better off acting as if they were.[18]

In the next proposition, (23) is violated so that selfish firms are not induced to supply high quality. 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 $F^n(1-\tilde{p}_1^n/Y)$. Then, if* (10) *and* (11) *are satisfied for $a = \bar{a}$ at this price while* (23) *is not, there exists an equilibrium in which consumers rationally expect high quality at this price, altruistic firms provide this high quality, 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, though it is not enough to actually lead

[18]There is an interesting contrast between Proposition 4 and the result at the end of Section 2 that selfish entrants are less likely to provide high quality if they get punished for being insufficiently altruistic *in their pricing*. The production of high quality as a result of pretending to be an altruist is thus operative only for firms who have already become established as high quality producers.

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 because condition (11) becomes easier to meet as the price rises from $\bar{c}$ to the critical price $\tilde{p}_1^n$.

4 High-end versus broad brands

The previous section has shown that incumbent brands have an advantage over new entrants as long as the perception that an incumbent is altruistic towards her existing customers leads people to expect altruism towards 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 towards, or whether it can be more valuable for a brand to be regarded as being altruistic *only* towards 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 towards all their potential customers while firms of type x are altruistic only towards 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. Since both types of firms are in fact altruistic towards their more quality-conscious customers, actions that are consistent with altruism towards this narrow group of customers would not induce anger according to (1). Actions that demonstrate altruism only towards this group, and not towards

less quality-conscious customers, have the potential for inducing anger by 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.

This section shows that firms of type x, whose altruism is narrower, have a higher incentive to improve their quality. The reason is that they have less to gain from doing what price-sensitive customers want, which is to ultimately cut costs. The result is that firms of type x can have a higher demand for their new product than firms of type b. Because type b firms would also like to have a high demand, the conditions that ensure this are nontrivial. They are, in effect, conditions under which there is no price such that it is credible for firms of type b to offer goods in high demand.

To develop these conditions, consider again a situation where firms can introduce goods whose value to consumers depends on the consumer's realized value of θ. The level of quality of the new good is given by a parameter m so that the value of these goods to consumers equals $m\theta$.[19] 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 a low value for m.

Since 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 while it equals zero 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 firms of type x can convince their customers in period 1 that their good is of the highest possible

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

quality in situations where firms of type b can't. The difficulty, for firms of type b, is that customers suspect that their good has been designed instead with an eye towards future cost reductions.

4.1 Period 2

In period 2, customers know that the good is worth $m\theta$ to them. Since 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 Section 1, the logic of (2) implies that total consumer welfare is $h^n(mY - p_2^n)^2/2mY$, while 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 which 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

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

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 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 zero. 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

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

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

The first of these expressions is positive because p_2^n exceeds marginal cost while 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 leave 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 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 the following proposition

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.

While 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 $\bar{a} = .5$. For each m between .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 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 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, since 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 while those of type x derive 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.

4.2 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 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, though this is not essential for the results. Lastly, 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

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

For the numerical example considered above, these inequalities are satisfied when $c^H = 5$, $c^L = 1.43$, $m^H = 1$, and $m^L = .5$. With these parameters, welfare is about 2 percent 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 one percent 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

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

The parameter ρ captures both discounting and the relative sales, or length, of periods 1 and 2.[20]

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

[20]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 $\tilde{\rho}$.

quality m at a price p_1^n is then

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

The price that maximizes this is

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

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 since it affects neither cost nor demand.

Differentiating (33) with respect to m^e yields

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

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.

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

$$W_1^x(m, m^e, p_1^n, X) = h^n \left\{ \left(1 - \frac{p_1^n}{m^e Y}\right)(p_1^n - c^H) + \bar{a} \int_{X}^{Y} \frac{\theta m - p_1^n}{Y} d\theta \right\}$$
$$= h^n \left\{ \left(1 - \frac{p_1^n}{m^e Y}\right)(p_1^n - c^H) + \bar{a} \left(1 - \frac{X}{Y}\right) \left(\frac{m(X + Y)}{2} - p_1^n \right) \right\}. \quad (36)$$

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.

Since 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

$$W_1^i(m^H, m^H, p_H^i) - W_1^i(m^L, m^L, p_L^i) + \rho(W_2^i(m^H, c^H) - W_2^i(m^L, c^L)) \geq \kappa^H - \kappa^L \qquad (37)$$

$$W_1^i(m^H, m^H, p_H^i) - W_1^i(m^L, m^H, p_H^i) + \rho(W_2^i(m^H, c^H) - W_2^i(m^L, c^L)) \geq \kappa^H - \kappa^L, \qquad (38)$$

where i equals either b or x. The first of these conditions says that the firm prefers to provide high quality 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 (since 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. Since broadly altruistic 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 less, if they (counterfactually) charged this price.

5 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 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 their 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 that the brand is altruistic towards. Whether this particular definition of brand image is sufficient to capture a brand's extensibility remains an open empirical question. Aaker and Keller (1990) may be seen as suggesting that the formalization provided here is insufficient because they stress other kinds of brand associations. 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 "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 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.

While 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 towards brands after people read articles describing these extensions. Not surprisingly, their data shows 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.

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Appendix:

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

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

Rearranging, this becomes

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

and the expression in the text follows.

Proof of Proposition 1: Suppose first that (13) is satisfied. Since 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 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

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

The left hand side of this inequality is maximized when p_1^n equals $p^*(\bar{a})$. Moreover, since 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 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 high quality. 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 (since (10) would be violated if demand were given by (8)). This too lowers firm welfare since it implies a W_1^n of zero.

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

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

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 zero implies that p equals to $p^\mu(\bar{a})$. Since 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

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

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 $\mu(\bar{c} - \epsilon)$. Since 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.

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

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

Since $\tilde{p}_1^n$ 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 at this price. Since altruistic firms provide high quality, 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 as well since they prefer this to producing low quality and to producing no new good. 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 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

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

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 zero while it is strictly greater than θ^- when $\zeta > 0$. Note that ζ is at most equal to one 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 zero and one.

Proof of Proposition 7: Let

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

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

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 $p_1^x(m^H, m^H)$ while (37) is not satisfied for firms of type b at a price of $p_1^b(m^H, m^H)$.

Table 1

Timing of the model

Period	0	1	2
Goods	Incumbent good	New good	Incumbent and new goods
Prices	p_0^o	p_1^n	p_2^o and p_2^n

Figure 1: Variations in m and c that keep W^b constant

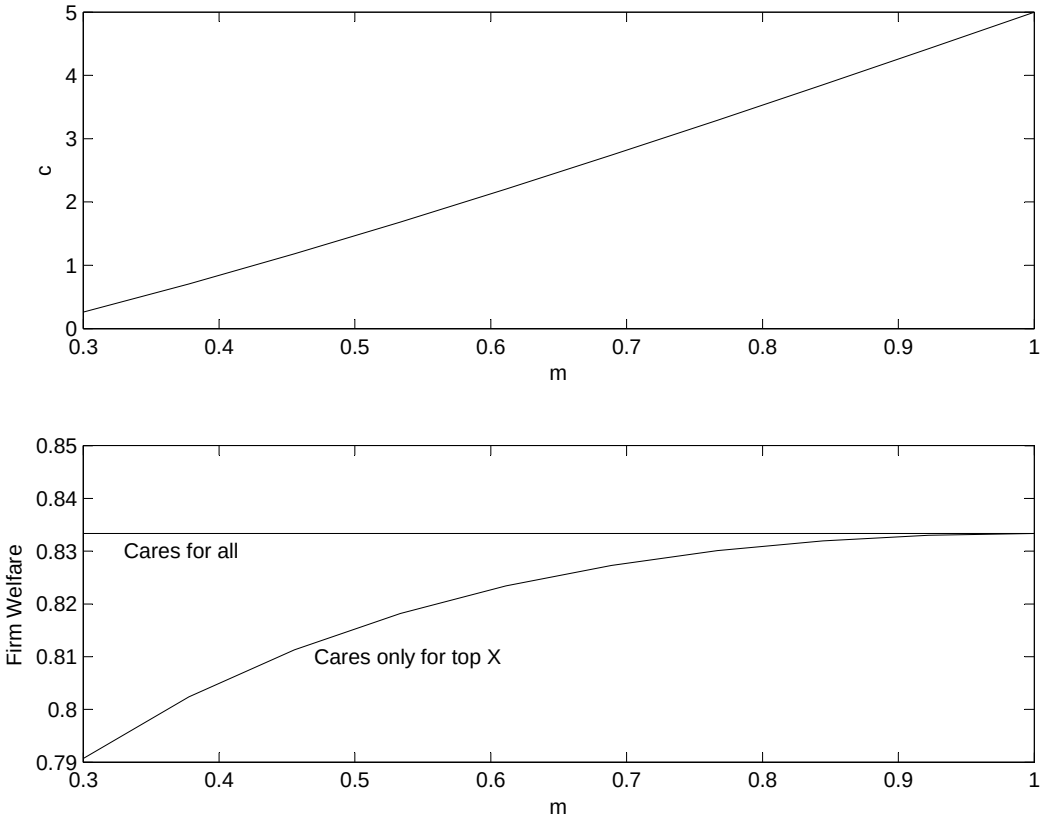

Figure 2: Variations in m and c that keep W^x constant