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ABSTRACT

This paper studies quality choice in a model where consumers expect firms (or brands) to act altruistically. Under plausible assumptions regarding this altruism and the reaction of consumers to firms that demonstrate insufficient altruism, existing brands can face a larger demand for new products than new entrants. Moreover, the failure of new products can reduce the demand for a brand's existing products even if the quality of these existing products is well understood by consumers. The model provides an interpretation for the dependence of the success of brand extensions on the ``fit'' between the original product and the extension. The model can also explain why a ``high-end'' brand that is expected to care only for its most quality sensitive customers can have an advantage in introducing a product relative to a brand that is expected to be more widely altruistic.

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While there exists an extensive theoretical literature on quality provision, the role of altruism from firms to consumers in the supply of quality appears to have been completely neglected. This paper seeks to fill this gap. It should be intuitive that this kind of altruism can contribute to quality in the case of experience goods, where consumers only learn the quality of the good after purchasing it. Managers (and employees) of altruistic firms obtain vicarious benefits when consumers have a good experience after buying their goods. The result is that, relative to selfish firms, they have more to gain from from providing a good of higher quality.

The literature's neglect of this straightforward mechanism of quality enhancement may be due to skepticism about the relevance of altruism on the part of firms. It is worth noting, however, that firms's mission statements routinely assert their desire to serve customers.[1] Consumers also appear to expect some suppliers to care for them, as evidenced by their reactions when companies disappoint them. Fournier (1998, p. 355) discusses a consumer she calls "Karen" who, recollecting a design change Mary Kay Cosmetics said: "I remember feeling, 'how could they do that to me?'." Similarly, the price cut of Apple's iPhone in 2007 led one customer to describe his reaction as "a feeling of betrayal of trust by a corporation I adored."[2]

Consumers know firms principally through their brands, and this paper tries to analyze some sources and some consequences of consumer's expectations regarding brand altruism. Since altruistic firms provide higher quality goods, a consumer who is impressed by the quality of her purchase should come to expect more altruism towards her from the brand under which this good is sold. As a result, she should expect high quality when this brand launches a new good ("a brand extension") that is also directed at her. This raises the demand for brand extensions, and this effect should be particularly strong when, as in Rotemberg (2010), consumers become angry if they are able to reject the hypothesis that a

[1]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).

[2]See http://www.cultofmac.com/breaking-apple-gives-100-credit-to-iphone-early-adopters/1206

supplier has the level of altruism that they expect.[3]

Interestingly, expected quality need not be a monotonic function of the number of consumers a firm is expected to be altruistic towards. I show, in particular, that extensions introduced by "high-end" brands who are seen as caring only for connoisseurs can be more desirable than similar extensions by brands that are perceived as caring also for less quality-sensitive consumers.

One aim of this paper is to rationalize several empirical findings from the marketing literature on brand extensions which, when taken together, seem difficult to reconcile with existing formal models. The marketing literature has repeatedly shown that, at least in the laboratory, two attributes of brand extensions are significant predictors of consumer acceptance. The first is that the original brand be liked (or seen as having high quality) and the second is that the extension "fit" with the original brand (Aaker and Keller (1990), Broniarczyck and Alba (1993)). As Klink and Smith (2001) note, the concept of "fit" is not very precisely defined in this literature.[4]

In the real-world examples of successful extensions described in Keller (1998), two types of fit predominate. First, several successful extensions depend on an input that also plays a key role in the original product. Examples of this include Hershey chocolate milk and Honda lawnmowers. In these cases, consumers may believe that the technological knowledge used to make the original product is helpful in making a high-quality extension. In a second set of examples, the technologies used in the two products are unrelated but the target market is similar. In these cases, altruism for the customers of the original product should extend to those for the new product as well. 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.

In these two examples, the extension is meant to be used at the same time as the original

[3]See Anderson and Simester (2010) for evidence that consumers react in this way to firms that whose prices lead them to regret their earlier purchases.

[4]Klink and Smith (2001, p. 333-34) note, in particular that "This raises a more general and critical point, however, related to construing perceived fit. If knowledge in this area is to progress in a meaningful manner, it would be useful to arrive at some consensus about how to define and measure the perceived fit construct."

product. 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 extension by Crest.[5] By contrast, an extension by Crest into toothbrushes was regarded more favorably than a similar extension by Close Up.[6] Broniarczyk and Alba (1993) also observed statistically significant differences between the attractiveness of category extensions by the cereals brands Cheerios and Froot Loops. While consumers said they would be more attracted by an oatmeal offering from the former, they were more likely to be favorably impressed by a lollipop offering from Froot Loops.

There does seem to be more overlap between the target market for lollipops (parents who enjoy buying sweets for their children) and the target market for Froot Loops than there is between the target market for Cheerios and that of lollipops. Similarly, the target market for Cheerios appears relatively similar to the target market for oatmeal. In the case of toothpastes, 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.

My basic assumption that consumers imbue brands with intentions fits with Fournier (1998, p. 345) who says "Another form of animism involves complete anthropomorphization of the brand object itself, with transference of the human qualities of emotionality, thought, and volition." The attribution of intentions to a brand "object" may seem like a particularly extreme form of irrationality. It is important to remember, however, that the behavior of brands is governed by people and these people may indeed have intentions vis-a-vis their customers. It may thus not be entirely irrational to suppose that a brand that sells a well-liked product is managed by people with a particularly large degrees of empathy for the customers that most enjoy this product.[7]

[5]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."

[6]Crest did enter the toothbrush market around 1992.

[7]If people differ in the groups that they most empathize with, this difference in tastes presumably affects

An alternative hypothesis is that customers do not regard brands as having intentions but see them as having only capabilities, where these capabilities may include their knowledge of consumer tastes. Consumers might reason, for example, that brands which have demonstrated superior knowledge in the past by providing a high quality good would be particularly adept at producing complementary goods that are valuable to the same consumers. Moreover, the pursuit of profits would provide these firms with an incentive to provide such goods. Consumers would thus be able to count on the attractiveness of "related" category extensions by successful brands.

One way of differentiating between the view that brands are treated as capabilities and the view that they are seen as having intentions is to analyze the purchases of a brand's original products in those cases where category extensions fail. If consumers bought products only on the basis of their beliefs about a firm's capabilities, they would not reduce their purchases of existing products unless the failure of the extension conveyed information about the quality of the existing product. By contrast, if consumers care about firm intentions, their experience with a brand extension can lead them to reevaluate a brand's intentions and reduce their purchases of existing products.

Two studies suggest that consumers do reduce their purchases of existing products when new product carrying the same brand fail. Sullivan (1990) shows that, after the Audi 5000 was accused of having a problem with sudden acceleration, the demand for other Audi cars fell. This was true even of the Audi Quattro, which used a different technology that was not associated with any acceleration problem. It could be argued, however, that consumers did not know enough about automobile technology to be certain of these differences across Audi cars. The second study involves a product that customers knew better. Using scanner data, Swaminathan *et al* (2001) examined the demand for a food product that had had a 53% market share in its category before its manufacturer introduced an unrelated extension that was withdrawn after 18 months. Swaminathan *et al* (2001) show that individuals who had

the employer that people most wish to work for. Workers should, in particular, flock to those firms whose products are particularly well-liked by the groups that they feel close to.

bought the extension were significantly less likely to buy the original product afterwards.

If the failure of an extension changes the perceived quality of the original product, this reduction in demand can be rationalized with the formal models of Wernerfelt (1988) and Cabral (2000). In these models, consumers are uncertain about the quality of a brand's initial (or flagship) product. When the brand introduces an extension, consumers obtain a signal of the new product's quality. If this signal is adverse, so that consumers judge the extension to be of low quality, they reduce their demand for the flagship product because they reduce their estimate's of this product's quality.

In fact, many unsuccessful extensions do not appear to affect the demand for the original product. Consistent with this, my model predicts that the demand for the original product should be unaffected if the original product and the extension target different consumer segments. In this case, the perception of altruism for the purchasers of the original product is not contradicted by the failed extension.

A second advantage of focusing on altruism relative to quality is Roedder-John, Loken and Joiner's (1998) demonstration that the perceived quality of flagship products is fairly resilient in consumers' minds.[8] They show that the attributes that subjects attribute to a flagship brand (Johnson & Johnson Baby Shampoo) are essentially impervious to the introduction of dissonant extensions carrying the same brand name. It is also possible to be somewhat skeptical *a priori* of the idea that consumers change their mind about a product that they have consumed repeatedly (which is their typical experience with well-known branded goods) after a short experience with a new product from the same brand. This is particularly true when the extension does not share any inputs with the original good.

As demonstrated in Choi (1998), if one modifies the Wernerfelt (1988) and Cabral (2000)

[8]They build on an extensive earlier literature (see for example, Keller and Aaker (1992) and Loken and Roedder-John (1993), Pina *et al.* (2006)) that focused on subjects' overall ratings of brands after these are described to them as having introduced either successful or failed extensions. This literature did not always find statistically significant effects. Loken and Roedder-John (1993) showed that subjects who are told that a brand has introduced an ungentle or low-quality product do sometimes reduce the degree to which they subsequently associate a brand with "gentleness" or "high quality." But this says little about the attitudes of subjects towards the original product, since their overall brand evaluation is presumably a mixture of their evaluation of the original product and their judgment regarding the extension.

models so that quality judgments of the original product are unaffected by failed extensions, the demand for the existing product is unaffected as well. The result is that the use of an existing brand in a new product loses some of its signaling value.[9]

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, and demonstrates that this firm is more likely to produce a high quality good if it is altruistic. This sets the stage for section 3, which studies the provision of quality by a firm that consumers expect to act altruistically. Section 4 considers firms that differ in the breadth of altruism that consumers expect from them. Section 5 presents some concluding remarks.

1 The Old Good

The 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 firm is the monopoly provider of an "old" good with known quality. In period 1, either the incumbent or another firm can start production of a new good. Before they produce, entrants determine the quality of their good, where higher quality is more costly. Consumers do not learn this quality until after they purchase the good in period 1. In period 2, this new good is available for sale once again. This timing is illustrated in Table 1.

As in Rotemberg (2008, 2010), consumer j's utility U_j depends on his material payoffs x_j, on the material payoffs of the firm he purchases from π, on his altruism towards the firm a_j and on his assessment of the extent to which the firm acts altruistically towards him. In particular

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

[9]In Choi's (1998) model, branding can still signal high quality because firms have a repeated choice between high and low quality extensions. There is then a reputational equilibrium where brands introduce only high quality extensions. While this is an attractive model, it should be noted that it would need to be modified to be consistent with the common failure of newly introduced products.

where a_j denotes his direct altruism towards the firm and the function ξ takes a value of zero if given the information set $\hat{a}$, consumers cannot reject the hypothesis that the firm 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, $\bar{a}_j = 0$.

Let π_j^i and B_j^i denote, respectively, the profits and consumer surplus from the sale of the good of type i in period j while a is a parameter giving a firm's true altruism towards its consumers. The distribution of firms' actual altruism parameters is given by the pdf G_a. For simplicity, discounting is ignored in this section and the three periods are assumed to be of equal length. A firm that produces only the old good then has a level of welfare given by

$$W^o = W_0^o + W_2^o \qquad \text{where} \qquad W_i^0 = \pi_i^o + aB_i^o \qquad \text{and} \quad i = 0, 2,$$

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

$$W^n = W_1^n + W_2^n \qquad \text{where} \qquad W_i^n = \pi_i^n + aB_i^n \qquad \text{and} \quad i = 1, 2.$$

In both these formulas, a firm values a unit of consumer surplus by a times the amount it values a unit of profits. Finally, an incumbent firm that produces both the old and the new good, has a welfare level W, which equals $W^0 + W^n$.

There are K^o potential consumers for the old good. The incremental material payoff from consuming one unit of the good rather than none equals ψ, where this is drawn from a distribution with pdf F_ψ. Individuals gain nothing by buying additional units.

It is convenient to begin the analysis with period 2. Suppose first that $\xi = 0$ for all consumers so that they are all "calm" and 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 so that total sales equal $K^o(1 - F_\psi(p_2^o))$. I simplify the analysis by supposing that F_ψ is uniform between 0 and Y so sales would equal $K^o(1 - (p_2^o/Y))$.

Total consumer surplus is then

$$K^o \int_{p_2^o}^{Y} (\psi - p_2^o) dF_\psi(\psi) = \frac{K^o(Y - p_2^o)^2}{2Y}. \tag{2}$$

Let c_o be the constant cost of producing one unit. Consider a firm that acts as if its altruism parameter were a_2^o. When all consumers are calm, it would set the price p_2^o to maximize

$$W_2^o(a_2^o, c_o, p_2^o) = K^o \left\{ \left(1 - \frac{p_2^o}{Y} \right) (p_2^o - c_o) + \frac{a_2^o (Y - p_2^o)^2}{2Y} \right\}. \tag{3}$$

After multiplying through by Y, the first order condition for this problem is

$$2p_2^o - Y + a_2^o (Y - p_2^o) = c_o, \tag{4}$$

so that its optimal price equals

$$p_2^{o*}(a_2^o, c_o) = \frac{c_o + (1 - a_2^o)Y}{2 - a_2^o}. \tag{5}$$

The derivative of this price with respect to a_2^o equals $(c_o - Y)/(2 - a_2^o)^2$, which is negative since the maximum willingness to pay Y must exceed marginal cost.

Rotemberg (2010) considers a signaling game where firms signal their altruism level through their price. He shows that, regardless of the distribution of types G_a, there is a unique equilibrium where firms whose actual altruism equals $\bar{a}$ charge $p_2^{o*}(\bar{a}, c_o)$. 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 $p_2^{o*}(\bar{a}, c_o)$ 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 $p_2^{o*}(\bar{a}, c_o)$ does indeed have an altruism level of $\bar{a}$.

A higher price, on the other hand, immediately causes this hypothesis to be rejected so that altruism-aware consumers respond by setting $\xi = \bar{\xi}$. These consumers then cease purchasing as long as $\bar{\xi}$ is large enough and price exceeds marginal cost, so that profits rise with each additional purchase. Whenever a firm's altruism parameter is less than one, which I assume, this latter condition is satisfied since charging a price below marginal cost would

not be optimal. Thus, the assumption that $\bar{\xi}$ is large enough ensures that a firm that charges more than $p_2^{o*}(\bar{a}, c_o)$ loses a fraction γ of its customers and faces a demand for its product equal to $(1-\gamma)K^o(1-p_2^o/Y)$. If it has an altruism parameter $a < \bar{a}$ its objective function becomes $(1-\gamma)W_2^o(a, c_o, p_2^o)$ and its welfare maximizing price equals $p_2^{o*}(a, c_o)$. Such a firm therefore charges $p_2^{o*}(a, c_o)$ if and only if $\Delta(a, c_o) > 0$ where

$$\begin{aligned}\Delta(a, c_o) &= W_2^o(a, c_o, p_2^{o*}(\bar{a}, c_o)) - (1-\gamma)W_2^o(a, c_o, p_2^{o*}(a, c_o)) \\ &= \frac{(Y-c_o)^2}{Y(2-\bar{a})^2}(1-\bar{a}+\frac{a}{2}) - \frac{(1-\gamma)(Y-c_o)^2}{Y(2-\lambda_2^o)}(1-\frac{\lambda_2^o}{2}), \qquad (6)\end{aligned}$$

and the second equality is established in the Appendix. Notice that $\Delta(a, c_o)$ is unambiguously rising in the altruism parameter a. A more altruistic firm has more to lose from the reduction in demand by $(1-\gamma)$ because it obtains more utility from each unit that it sells.

To simplify the analysis, I suppose from now on that firms are either selfish so that $a = 0$ or their altruism a equals the level $\bar{a} > 0$ that is expected by altruism-aware consumers. The first issue that arises, then, is whether selfish firms prefers charging the selfish price $\frac{Y+c_o}{2}$ or the altruistic price $\frac{Y(1-\bar{a})+c_o}{2-\bar{a}}$. Since W is just equal to profits in this case,

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

It is apparent from this that, as long as $\gamma > 0$, there exists a positive level of altruism $\bar{a}$ such that $\Delta(0, c_o) > 0$. Rotemberg (2010) shows numerically that fairly modest levels of γ lead to $\Delta(0, c_o) > 0$ for nontrivial levels of $\bar{a}$.

I complete the analysis of period 2 by considering the case where altruism-aware consumers were able to reject the hypothesis a firm's altruism level was greater than or equal to $\bar{a}$ in earlier periods. By assumption, this implies that these consumers set ξ equal to $\bar{\xi}$ in the second period regardless of the firm's current price. While this assumption is somewhat stark, it can be interpreted as resulting from consumers being unable to remember the details of a firm's earlier violation and remembering only whether it was large enough to reject the null hypothesis of altruism. The demand for such a firm is thus $(1-\gamma)K^o(1-p_2^o/Y)$. This implies that a firm with altruism parameter $\bar{a}$ that takes an action before period 2 that

allows altruism-aware consumers to reject the hypothesis that it is in fact altruistic incurs a period 2 cost of $\Delta(\bar{a}, c_o)$. As we shall see below, this cost of being seen as selfish contributes to the provision of high quality new goods.

If one ignores the possibility of introducing a new good, the analysis of the equilibrium price of the old good in period 0 turns out to be identical to the pricing analysis we just saw for period 2. I skip the analysis of this market, however. The reason is that it is inessential for the main purpose of this paper, which is to study the quality of new goods in period 1.

2 The Provision of a New Good by New Entrant

There are K^n potential consumers for this good. Each of these buys at most a single unit. If the new good is of low quality, its value to all consumers equals L. A newly introduced high quality good, by contrast, is valued differently by different consumers. Let θ denote this valuation where θ is drawn from the pdf F_θ. To express the utility received by consumers, let I^h and I^ℓ be indicator functions that take a value of 1 if the consumer buys a high quality new good or a low quality new good respectively. Otherwise, these indicator functions equal 0. Since consumers cannot buy more than one of these goods, at most one of these indicator functions can equal 1. Supposing that the consumer pays p_1^n for a newly introduced good, his material payoffs are

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

In period 1, a potential entrant has a probability $\beta < 1$ of having the capacity to produce a new good that competes in this market. In other words, there is an indicator variable σ_H, which equals 1 with probability β and equals zero otherwise. When it equals zero, the potential entrant is unable to produce such a good. By contrast, when it equals 1, the potential entrant can produce one of the two goods whose demand was described above. 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 an incumbent 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.

For simplicity, I suppose that both the high and the low quality new goods have the same marginal cost of production $\bar{c}$. There is, however, a difference in the cost of the two goods in that the high quality good has a setup cost κ while the low quality good involves no setup cost. Consumers do not know the quality of the new good in period 1 though they do learn it in time for making purchases in period 2.

2.1 Period 2

The analysis is simplified by supposing that $\bar{c} > L$ so that low quality new goods are sufficiently unattractive that consumers are not willing to pay their marginal cost of 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, people with $\theta \geq p_2^n$ increase their material payoffs by buying it. The quantity demanded of this good is then

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

As in the case of F_ψ, the analysis is simplified if F_θ is set to be uniform between 0 and Y. Indeed, the analysis is then the same as that for the old good in period 2. The demand curve in (8) is then linear and consumer surplus B_2^n is given by the expression in (2) with p_2^o replaced by p_2^n and K^o by K^n.

The incentives faced by the firm in period 2 depend to some extent on whether it is also supplying the old good. If it does not, its welfare in period 2 is given by

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

which is analogous to (3).

For a firm with altruism parameter $\bar{a}$, the equilibrium price is $p_2^n(\bar{a})$, which equals $p_2^{o*}(\bar{a}, \bar{c})$ in (5). Its resulting level of period 2 welfare is $W_2^n(\bar{a}, p_2^{o*}(\bar{a}, \bar{c})))$. A selfish firm also charges $p_2^{o*}(\bar{a}, \bar{c})$ if $\Delta(0, \bar{c}) \geq 0$, and its period 2 welfare is then $W_2^n(0) = W_2^n(0, p_2^{o*}(\bar{a}, \bar{c})))$. If, instead, $\Delta(0, \bar{c}) < 0$, the selfish firm charges $p_2^n(0) = p_2^{o*}(0, \bar{c})$ and its resulting welfare is $W_2^n(0) = (1 - \gamma)W_n^o(0, p_2^{o*}(0, \bar{c})))$. Note that, in either case, $W_2^n(\bar{a}) > W_2^n(0)$. This occurs both because the altruistic firm enjoys vicariously the welfare of its consumers and because the altruistic firm is able to charge its optimal price without fear of punishment.

2.2 Period 1

If the entrant is altruistic, her utility depends on the level of consumer surplus, which depends in turn on the quality of the good. While consumers only learn this quality after their purchase is complete, the seller knows it before and can thus compute the surplus that consumers will obtain *ex post*. This surplus depends on the quality provided, on the price that consumers pay and on the quantity that they purchase. Using the equilibrium demand curve, it can be written as a function of only price and quality so it equals $B_1^n(p_1^n, \text{high})$ when quality is high and $B_1^n(p_1^n, \text{low})$ when it is low. As a result, an entrant with an altruism parameter of a prefers to produce high to low quality in period 1 if

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

Similarly, this entrant prefers to produce high quality rather than not producing the new good if

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

where q_1^n is the quantity sold. Lastly, this entrant prefers to produce a low quality good to not producing the new good if

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

An equilibrium where all entrants supply high quality exists if a price can be found such that (10) and (11) are satisfied when the demand at this price is given by (8) and such that

the entering firm does not wish to deviate from this price. 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.

I first analyze a benchmark case where all entrants are selfish and $\gamma = 0$ so that firms are not punished for their selfishness. Even so, $W_2^n(0)$ still denotes the welfare of these entrants in period 2 if they provide high quality. This benchmark case provides a useful contrast for the analysis where consumers expect firms to be altruistic. The following proposition characterizes equilibria in this case

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

$$W_2^n(0) \geq \kappa \tag{13}$$

Proofs are in the Appendix.

Ignoring setup costs, profits in period 1 are the same whether the firm produces high or low quality. Thus, the selfish firm's choice of high as opposed to low quality is based exclusively on whether second period profits cover the setup costs.

Consider now the incentives faced by an altruistic firm. For such a firm, the choice between high and low quality depends also on the effect of quality on consumer welfare. The benefits of high quality affect (11) and (10) equally (since both conditions involve comparing the provision of high quality to an alternate course of action) while the losses from low quality affect only (10). To determine the conditions under which (11) is a tighter constraint than (10), one must compute the size of losses when quality is low.

From the utility function (7), 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

$$B_1^n(p_1^n, \text{low}) = (\bar{c} - \epsilon - p_1^n)q_1^n. \tag{14}$$

Conditions (11) and (10) are thus identical when the price p_1^n is equal to the critical value $\tilde{p}_1^n$, such that

$$a(\tilde{p}_1^n - \bar{c} + \epsilon)q_1^n = (\tilde{p}_1^n - \bar{c}) \qquad \text{or} \qquad \tilde{p}_1^n = \bar{c} + \frac{a}{1-a}\epsilon. \tag{15}$$

For prices above $\tilde{p}_1^n$, (10) is a tighter constraint because sales are so profitable that abstaining from production is not attractive to the firm. By contrast, for a low price close to $\bar{c}$, firm profits are negligible but consumer losses are not because $\epsilon > 0$. Thus, the vicarious losses to an altruistic firm from providing low quality exceeds its profits and the constraint (11) that keeps the firm from not producing at all is tighter than the constraint that the firm prefer high to low quality.

As mentioned above, I let ϵ be relatively small. I suppose, in particular, that ϵ is small enough that the critical price $\tilde{p}_1^n$ is smaller than the altruistic firm's desired price. Using (5), the latter equals $(\bar{c} + (1 - \bar{a})Y)/(2 - \bar{a})$, so that it is always possible to find an ϵ such that $\tilde{p}_1^n$ is below this.

It is useful to study the special case where all firms are known to have an altruism parameter $\bar{a}$. Demand is then given by $K^n(1-p_1^n/Y)$ and consumer welfare can be computed as in (2) so that $B_1^n(p_1^n, \text{high})$ equals $K^n[Y - p_1^n]^2/2Y$. If this price p_1^n is above the critical price $\tilde{p}_1^n$, high quality is provided if (10) is satisfied. This requires that

$$W_2^n(\bar{a}) + \bar{a}\frac{K^n[Y - p_1^n)]^2}{2Y} - \bar{a}\left[K^n\left(1 - \frac{p_1^n}{Y}\right)(\bar{c} - \epsilon - p_1^n)\right] \geq \kappa. \tag{16}$$

Now consider the derivative of the left hand side of (16) with respect to price. This is

$$\bar{a}K^n\left[-\frac{Y - p_1^n}{Y} + \frac{1}{Y}(R - \epsilon - p_1^n) + \left(1 - \frac{p_1^n}{Y}\right)\right] = \frac{\bar{a}K^n}{Y}[\bar{c} - \epsilon - p^n],$$

which is negative as long as firms do not charge prices below $\bar{c} - \epsilon$. Since $\bar{c} - \epsilon$ is below the critical price, this analysis demonstrates that high quality becomes easier to sustain when the price is lowered from the price that is optimal towards the critical price $\tilde{p}_1^n$.

For p_1^n below the critical price, high quality is provided if (11) is satisfied. This requires that

$$W_2^n(\bar{a}) + \bar{a}\frac{K^n(Y - p_1^n)^2}{2Y} + \left(1 - \frac{p_1^n}{Y}\right)(p_1^n - \bar{c}) \geq \kappa. \tag{17}$$

It is apparent that the left hand side reaches a maximum at $p_2^{o*}(\bar{a}, \bar{c})$, the price that firms wish to charge for high quality. Moreover, since the expression is quadratic in the price, it declines monotonically as the price is lowered below this. This means that high

quality becomes harder to sustain as the price is lowered below the critical price. Putting this together with the argument above, it follows that high quality cannot be sustained at any price if it cannot be sustained at the critical price $\tilde{p}_1^n$. If firms do supply high quality at this price, the price that they charge in equilibrium is either the highest price that satisfies (16) or the firms preferred price $p_2^{o*}(\bar{a}, \bar{c})$, whichever is smaller.

Retaining for the moment the assumption that $\gamma = 0$, I now turn to the question of whether high quality continues to be provided when some firms are altruistic while others are not. Suppose that entrants have a probability μ of having an altruism parameter equal to $\bar{a}$ and that they have a probability $(1 - \mu)$ of being selfish. I focus on the case where (13) is violated, because this assures that selfish firms prefer to provide low rather than high quality. The question is then whether this incentive to provide low quality by a fraction $(1 - \mu)$ of firms is sufficient to prevent altruists from offering high quality as well.

One determinant of this is the inequality

$$\mu Y + (1 - \mu)L \geq \bar{c} \qquad \text{or} \qquad \mu(Y + \epsilon - \bar{c}) \geq \epsilon. \tag{18}$$

If this inequality is satisfied, consumers who value the high quality good at Y (θ's largest possible value) are willing to pay the marginal cost of production of the new good even if only altruistic suppliers provide high quality. If (18) is not satisfied, there is no equilibrium where the altruistic firms provide high quality while the selfish ones provide low quality. The reason is that selfish firms stand ready to sell low quality goods if the price equals at least $\bar{c}$, but the violation of (18) implies that there would be no demand for the new good at a price of $\bar{c}$ even if altruistic firms sold high quality goods at this price. Higher prices reduce consumer's willingness to buy a good of uncertain quality even further. Lower prices, instead, lead the selfish low quality firms to leave the market. Note that (18) is more likely to be violated when μ is low so that true altruism is relatively rare. Indeed, one can always find a μ low enough that (18) is violated.

If, instead, (18) is satisfied, there is at least the potential for a "mixed" equilibrium where altruistic firms sell high quality and selfish firms sell low quality. Consumers for

whom $(\mu\theta + (1-\mu)L)$ exceeds the price p_1^n buy the good so that its demand d_1^n is given by

$$d_1^n = K^n \left(1 - \frac{p_1^n - (1-\mu)L}{\mu Y}\right). \tag{19}$$

One immediate property of this demand worth curve is that its derivative with respect to μ equals $(K^n/Y)(p_1^n - L)/\mu^2$. Since L is smaller than the marginal cost $\bar{c}$, this is positive if any goods are actually sold. It follows that this demand rises when the firm is more likely to be selling high quality.

A mixed equilibrium with a price above $\bar{c}$ requires that (10) and (11) hold for the altruistic firms at this price. The following proposition demonstrates that these conditions are more stringent than in the case where it is common knowledge that all firms are altruistic (so that $\mu = 1$).

Proposition 2. *For any $p \geq \bar{c}$, $B_1^n(p, \text{high})$ and $-B_1^n(p, \text{low})$ are higher when $\mu = 1$ than when $\mu < 1$.*

These conditions establish that, for any given price, the left hand side of (10) and (11) are larger when $\mu = 1$ so that these conditions are easier to meet. The intuition for this result is straightforward. When some firms are providing low quality, demand is lower so that a firm producing high quality generates less consumer surplus. Similarly, the reduced sales mean that total customer losses are not as large if consumers buy low rather than high quality. The vicarious benefits of providing high quality are therefore reduced and this mutes altruists' incentives to raise quality.

A selfish firm is unwilling to sell goods at a price below $\bar{c}$ when (13) is violated. A firm that is willing to sell at such a price is thus necessarily altruistic.[10] Relative to not selling any good at all, an altruistic firm is worse off selling a low quality good at a price below $\bar{c}$, since it incurs losses that cannot be made up by gains from consumers. Thus, a firm that charges less than $\bar{c}$ must be selling a high quality good with the result that its the demand

[10]The model thus allows a low price to be used as a signal of quality. See Bagwell and Riordan (1991) for a model where, because high quality goods cost more than low quality ones, it is high prices that can be signals of quality.

curve is (8). If the price together with the resulting level of sales satisfies (10), the altruistic firm is indeed willing to provide high quality at this price. This can yield an equilibrium with high quality even if (18) is violated. Note, however, that if a price below $\bar{c}$ satisfies (10) so does a price equal to the critical value $\tilde{p}_1^n$. This means that the parameters that lead all new suppliers to supply high quality when $\mu < 1$ also imply that all firms would produce high quality if μ were equal to one.

The reverse is obviously not true, however. There are parameters such that (10) is satisfied by the critical price, which can exceed $\bar{c}$ by a substantial margin, but where this condition is not satisfied by $\bar{c}$ so that altruistic firms would be unwilling to sell high quality at this price. If, in addition, (18) is violated, there is no mixed equilibrium in which altruistic firms produce high quality.

This has established that the possibility that firms might be selfish reduces the range of parameters for which high quality provision is an equilibrium. It is also immediately obvious that in the cases where (18) is satisfied and altruistic firms produce high quality at a price above $\bar{c}$, the demand for the new good at a given price is lower than when selfish firms are absent.

So far, the discussion in this section has been carried out setting $\gamma = 0$ so that consumers are not concerned with the altruism of firms. As I now show, however, a positive γ does not facilitate the provision of high quality by new entrants. Indeed, it makes this slightly more difficult. To see this, note first that a positive γ has no effect on altruistic firms since these are already acting in accord with the expectations of altruism-aware consumers. A positive γ does affect selfish firms because it reduces $W_2^n(0)$, the welfare of these firms in period 2 if they provide high quality. The reason is that they must either charge a price they regard as suboptimal or lose a fraction $(1 - \gamma)$ of their customers. This reduction in $W_2^n(0)$ makes it more difficult to satisfy (13), and therefore more difficult for them to provide high quality. When condition (13) is violated, the analysis of selfish firms is the same as when $\gamma = 0$. As in that case, selfish firms provide low quality if they enter and charge the same price as altruists. Consumers realize this and lower their demand for goods accordingly.

In summary, this section shows that the presence of selfish potential entrants reduces the range of parameters such that high quality is provided by all firms that sell the new good. When consumers do not expect to receive high quality, their demand for the new good at any given price is obviously lower. In spite of this, there are circumstances where a new good is provided either at a price so low that only altruistic firms sell it or at a higher price that leads selfish firms to provide a low quality good. In either case, the provision of a high quality good can demonstrate, *ex post* that the firm must have been altruistic to start with. This matters for the analysis because it suggests that consumers may be rational when they expect altruism from firms that already offer high quality products. This is true, particularly, if the parameters are such that selfish firms would have either not introduced a product at all or would have introduced a low quality good.

3 The Introduction of the New Good by an Incumbent Brand

I now consider the possibility that the new good is introduced by the firm that produces the old good. By using the same brand, the firm can make it clear to consumers that the firm producing both goods is the same. If the old good is of sufficiently high quality that consumers regard this firm as being altruistic towards its target customers, this common branding can convey information about the altruism of the firm producing the new good. A key issue, however, is the extent to which altruism for customers of the old good is related to altruism for consumers of the new one. One possibility is that altruism is a general disposition so that firms are either selfish or they are equally altruistic towards all people.

This seems implausible, in part because individuals often appear to be selective in their generosity and their altruism. Krebs (1975), for example, presents evidence that individuals are more likely to feel empathy and be generous towards people who are similar to themselves. This fits with the fact that many successful businesses were started to solve a problem faced by segments of the population that the founder belonged to.[11] The selectivity of expected

[11]Kevin Plank's founding of the company Under Armour is a leading example of this.

firm altruism also fits with Fournier's (1998) demonstration that many individuals have personal relationships with particular brands, and that this leads consumers like the one discussed in the introduction to expect particularly good treatment from them.

This selectivity implies that there exist two related measures of "fit" between a brand's existing product and its new product extension. The first is the extent to which consumers believe that altruism towards consumers of the old product implies altruism towards the consumers of the new. The second is the extent to which altruism-aware consumers of the old product become angry when the new product's quality allows them to reject the hypothesis that the firm is altruistic towards the consumers of the new product.[12] This second measure of fit presupposes that altruism-aware consumers expect a brand that was altruistic towards the consumers of the old good to be altruistic towards the consumers of their brand extension as well. This second measure requires, in addition, that altruism-aware consumers of the old product be aware of the quality of the new one, which is most easily satisfied if they consume both. Fit should thus be very tight along both dimensions when the old and new products of a brand are meant to be used at the same time by the same consumers.

The first dimension of fit can be captured by the parameter μ, which gives the probability that the new product is provided by an altruistic firm. Condition (18) is violated for μ sufficiently low while it is satisfied for large values of μ. Thus, an increase in μ can allow an equilibrium where altruistic firms provide high quality to exist where it would not exist otherwise. Note, however, that true altruism by firms is still needed for high quality to be forthcoming. Once (18) is satisfied, an increase in μ has the further effect of raising demand for the new product, which is given by (19). Both of these effects facilitate the introduction of new goods by incumbents whose old product leads them to be perceived as altruistic

[12]This assumes that altruism-aware consumers who expect more altruism from a company become angry in response to actions they would tolerate from others, so that they impose higher standard on these firms. Some evidence for the view that expected altruism leads people to be more angry at selfish acts can be found in Ohbuschi *et al.* (2004). They show that people are angered when people who are close to them engage in actions that do not, 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.

towards the customers of the new good.

The importance of the second dimension of fit can be studied by analyzing whether the potential willingness of altruism-aware consumers to become angry at firms that provide low quality further increases the demand for new goods in equilibrium. To carry out this analysis, I start by supposing that altruism aware consumers do indeed perceive the provision of a low quality new good as demonstrating insufficient altruism. I demonstrate that this leads altruistic firms to provide high quality in some circumstances. It follows that, under these circumstances, there is an equilibrium in which it is rational for altruism-aware consumer to become angry at an incumbent that introduces a low quality new good. One consequence of this analysis is that, for certain parameters, selfish firms also provide high quality new goods even though (13) is violated so that selfish firms would only provide low quality if there were no altruism-aware consumers.

Under the assumption that altruism-aware customers become angry at the provision of low quality, selfish firms that introduce a low quality good lose $\Delta(0, c)$ in the second period. Thus, the condition under which a selfish firm prefers producing high quality rather than low quality ceases to be (10) and becomes

$$W_2^n(0) + \Delta(0, c) \geq \kappa. \tag{20}$$

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

$$q_1^n(p_1^n - \bar{c}) - \Delta(0, c) > 0. \tag{21}$$

The condition (11) that the selfish firm prefer the production of high quality to not producing the new good remains unchanged. It can be rewritten as

$$W_2^n(0) + q_1^n(p_1^n - \bar{c}) \geq \kappa. \tag{22}$$

The changes in (10) and (12) make it easier for equilibria where high quality goods are produced to exist. This is demonstrated in the next two propositions.

Proposition 3. *Consider a price p_1^n which is an equilibrium with high quality in the case where $\mu = 1$. Then both altruistic and selfish firms provide high quality new products at this price when $\mu < 1$ as long as a)* (20) *is satisfied and b)* (22) *is satisfied when q_1^n is given by $F^n(1 - p_1^n/Y)$.*

To see that this proposition implies that high quality is easier to provide when firms have an existing product, note that selfish new entrants are unwilling to provide high quality unless (13) is satisfied. Moreover (13) is more difficult to satisfy than either (20) or (22). Thus, when (13) is violated while (20) and (22) are satisfied at p_1^n, the fact that new goods are being provided by existing brands ensures that all suppliers offer high quality. What is attractive about this proposition is that it covers a case where firms provide high quality not because they are in fact altruistic but only because they pretend to be.

In the next proposition, (22) 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 incumbents.

Proposition 4. *Let $\hat{p}_1^n$ denote the minimum of the critical price $\tilde{p}_1^n$ and the price that makes* (21) *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 at this price while* (22) *is not, altruistic firms provide high quality while 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 them to produce high quality new goods. Nonetheless, the lack of low quality provision by selfish firms helps altruistic ones sell 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 be willing 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 when the perception that an incumbent is altruistic towards her existing customers leads potential buyers of the new good to expect this altruism to be directed towards them also. 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 it 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 is true.

To demonstrate this, I 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 group of customers would not induce anger according to (1). Actions that denote altruism only towards these individuals, and not towards less quality conscious customers, have the potential for inducing anger by these less quality conscious customers. 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 kind of firms can act differently even without this additional incentive.

This section shows that firms of type x, whose altruism is narrower, sometimes 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, I once again consider 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 $m\theta$.[13] 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. As a result, I assume that the altruism parameter of firms of type x equals $\bar{a}$ 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.

4.1 Period 2

In period 2, customers know that the good is worth $m\theta$ to them. Since I am treating customers as pursuing only their material rewards, they purchase the good if $m\theta$ exceeds the price p_2^n so that demand is $K^n(1 - p_2^n/mY)$. Adapting the analysis of section 1, the logic of (2) implies that total consumer welfare is $K^n(mY - p_2^n)^2/2mY$, while that of (5) implies that the optimal price for firms that care about all their consumers is

$$p_2^b = \frac{mY(1-\bar{a}) + c}{2 - \bar{a}}, \tag{23}$$

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

$$\theta^- = \frac{(1-\bar{a})Y + c/m}{2 - \bar{a}}. \tag{24}$$

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

Firm welfare for a firm of type b that charges the price in (23) equals

$$W_2^b(m,c) = K^n \left\{ \left(1 - \frac{p_2^b}{mY}\right)(p_2^b - c) + \frac{\bar{a}(mY - p_2^b)^2}{2mY} \right\} = K^n \left(\frac{mY - c}{2 - \bar{a}}\right)^2 \left(1 - \frac{\bar{a}}{2}\right) \frac{1}{mY}. \tag{25}$$

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

$$K^n \int_X^Y (m\theta - p_2^n) dF_\theta(\theta) = K^n \left(1 - \frac{X}{Y}\right) \left(\frac{m(X+Y)}{2} - p_2^n\right). \tag{26}$$

This expression can easily be interpreted. It equals the number of buyers with θ between X and Y, which is $K^n(1 - X/Y)$, times their average surplus, which is $m(X+Y)/2$.

In period 2, a firm of type x maximizes

$$W_2^x(m,c,X) = K^n \left[\left(1 - \frac{p_2^n}{mY}\right)(p_2^n - c) + \bar{a} \left(1 - \frac{X}{Y}\right) \left(\frac{m(X+Y)}{2} - p_2^n\right) \right], \tag{27}$$

so that its optimal price is

$$p_2^x = \frac{mY + c - \bar{a}m(Y - X)}{2}. \tag{28}$$

The maximum θ that buys at this price is p_2^x, and it is immediately verified that this is lower than X if $X > \theta^-$, so that, indeed, all individuals with $\theta \geq X$ buy the good. The price p_2^x is increasing in X because higher values of 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 is optimal price is (23).

One clear and unsurprising implication of (27) is that the firm is better off if either quality m rises or marginal cost c declines. This can be verified by differentiating this equation and

obtaining

$$\frac{dW_2^x(m,c,X)}{dm} = \frac{p_2^x}{m^2 Y}(p_2^x - c) + \frac{\bar{a}Y}{2}\left[1 - \left(\frac{X}{Y}\right)^2\right] \tag{29}$$

$$\frac{dW_2^x(m,c,X)}{dc} = -\left(1 - \frac{p_2^x}{mY}\right). \tag{30}$$

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 (29) and (30) 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 at 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 5. *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 tend to 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 (though 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 5 deals only with marginal changes, its validity for all $X > \theta^-$ implies that it has global implications. Suppose, in particular, that we consider any pair of c and m

combinations that give the same welfare to a firm of type b. One can then reach the higher $\{c, m\}$ combination from the lower one by a series of infinitesimal changes, each of which leaves the firm of type b indifferent and each of which makes the firm of type x 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 when X is such 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 (23). At this point, both types of firms care about the same customers so the two welfare levels are identical. For lower values of m, 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 this Figure 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 I consider. 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 section thus has 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 situations where both types of firms prefer the same $\{c, m\}$ combination. 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

In this period, firms can either introduce a good with quality m^H or one with quality $m^L < m^H$. The marginal cost of these goods in the second period is c^H and c^L respectively, with

$c^L < c^H$. For illustration, I 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^H and κ^L.

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

$$W_2^b(m^L, c^L) > W_2^b(m^H, c^H) \qquad W_2^x(m^L, c^L, X) < W_2^x(m^H, c^H, X). \tag{31}$$

For the numerical example considered above, for example, 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 length 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 length of periods 1 and 2.[14]

One difference between period 1 and period 2 is that consumers do not know m in the former. Letting m^e denote consumer's expectation of m, consumer demand is $K^n(1 -$

[14]Suppose one slices period 2 into n periods of time of the same length as period 1 and lets $\tilde{\rho}$ denote the discount rate between period 1 and the first of these subperiods of period 2. Then $\rho = \tilde{\rho}(1 - \tilde{\rho}^n)/(1 - \tilde{\rho})$, which rises with n and $\tilde{\rho}$.

$p_1^n/m^eY)$). 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

$$W_1^b(m, m^e, p_1^n) = \left(1 - \frac{p_1^n}{m^eY}\right)(p_1^n - c^H) + a\int_{p_1^n/m^e}^{Y} \frac{\theta m - p_1^n}{Y} d\theta$$
$$= \left(1 - \frac{p_1^n}{m^eY}\right)(p_1^n - c^H) + a\left[\frac{mY}{2} + \frac{2m^e - m}{2(m^e)^2}\frac{(p_1^n)^2}{Y} - p_1^n\right]. \quad (32)$$

The price that maximizes this is

$$p_1^b(m, m^e) = \frac{m^eY(1-\bar{a}) + c^H}{2(1-\bar{a}) + \bar{a}m/m^e}. \quad (33)$$

Price is increasing in perceived quality (because this increases demand). It is declining in actual quality, however. While an increase in actual quality would have no effect on the price of selfish firms (since it affects neither cost nor demand), it leads altruistic ones to wish to sell more because consumers gain more from their purchases.

Differentiating (32) with respect to m^e yields

$$\frac{dW_1^b}{dm^e} = \frac{p_1^n}{(m^e)^2Y}\left[p_1^n - c^H + a_1^n\left(\frac{m}{m^e} - 1\right)\right]. \quad (34)$$

This expression is positive when $p_1^n > c^H$ (which is guaranteed if the firm acts optimally) and $m^e \geq m$. 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 a firm supplying a good of quality m^H has nothing to gain from being expected to supply a good of quality m^L while a firm supplying quality m^L would prefer to be seen as supply quality m^H.

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

$$W_1^x(m, m^e, p_1^n, X) = \left(1 - \frac{p_1^n}{m^eY}\right)(p_1^n - c^H) + \bar{a}\int_X^Y \frac{\theta m - p_1^n}{Y} d\theta$$
$$= \left(1 - \frac{p_1^n}{m^eY}\right)(p_1^n - c^H) + \bar{a}\left(1 - \frac{X}{Y}\right)\left(\frac{m(X+Y)}{2} - p_1^n\right). \quad (35)$$

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 (28) with m replaced by m^e. The earlier analysis thus demonstrates again that the condition $X \geq \theta^-$ ensures that all consumers with $\theta \geq X$ buy the good. Inspection of (35) 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

$$W_1^i(m^H, m^H, p_H^i) - W_1^i(m^L, m^L, p_L^i) + \rho(W_2^i(m^H, c^H) - W_2^i(m^L, c^L)) \geq \kappa^H - \kappa^L \qquad (36)$$

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

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 (36) 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 involves $m = m^H$.

Proposition 6. *When* (31) *is satisfied, one can always find values of* ρ *and* $\kappa^H - \kappa^L$ *such that there exists no price for which firms of type b supply a good of quality* m^H *while there do exist prices for which firms of type x do so.*

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 $K^n(1 - p_H^x/m^H Y)$ units. Since broadly altruistic would be expected to sell a good of quality m^L, they would only sell $K^n(1 - p_H^x/m^L Y)$ units 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 both why consumers are quick to accept certain new product offerings from particular brands, but also why some brand extensions are regarded by consumers with suspicion. The model also shows why it may be difficult for brands to "move up" and acquire associations with higher quality whereas "moving down" and generating demand by consumers with limited quality sensitivity may be easier. 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.

While the model seems to have promise for explaining both some of the advantages and some limitations of incumbent brands relative to newcomers, there may well be aspects of this phenomenon that are not consistent with the model developed here. This model emphasizes that brands obtain credibility from the identity of the customers that buy their core product as opposed to obtaining it from other brand associations. This means that evidence suggesting that other brand associations are important in determining the success of extension would require some modification of the model.

A different dimension of the model that would benefit from further analysis is the way in the perceptions of a firm's altruism evolves over time. As emphasized by Tadelis (1999), some firms lose their reputations for good quality over time. In the model of Tadelis (1999), this is the result of reductions in quality that are the result of changes in ownership (where some owners are intrinsically able to provide high quality while others are not). The model developed here has the potential for providing a complementary explanation. This is that new product introductions can lead customers to reject a hypothesis that they had earlier accepted, namely that managers are sufficiently altruistic. Extending the model so that this disappointment takes place in equilibrium (as opposed to being only a threat that induces good behavior) would seem to be a promising avenue of future research.

The current paper focuses on only one aspect of the innovation process, namely the extent to which firms knowingly keep quality and development costs low when consumer are unable to ascertain a good's quality before consumption. Altruism on the part of firms may also play a role in other situations of imperfect information, as when firms are themselves uncertain about the extent to which their development effort will ultimately yield a product that consumers value. It thus seems worthwhile to gain a more general understanding of the role of this kind of altruism in technical progress.

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Appendix:

Derivation of $\Delta(a, c_o)$ Using the formula in (5) to substitute for both $p_2^{o*}(\bar{a}, c_o)$ and $p_2^{o*}(a, c_o)$ in (6), one obtains

$$\Delta(a, c_o) = \left(1 - \frac{c_o + (1-\bar{a})Y}{(2-\bar{a})Y}\right)\left(\frac{c_o + (1-\bar{a})Y}{(2-\bar{a})Y} - c_o\right) + \frac{a_2^o}{2Y}\left(Y - \frac{c_o + (1-\bar{a})Y}{(2-\bar{a})Y}\right)^2$$
$$- (1-\gamma)\left\{\left(1 - \frac{c_o + (1-a_2^o)Y}{(2-a)Y}\right)\left(\frac{c_o + (1-a)Y}{(2-a)Y} - c_o\right) + \frac{a}{2Y}\left(Y - \frac{c_o + (1-a)Y}{(2-a)Y}\right)^2\right\}$$

Rearranging, this becomes

$$\Delta(a, c_o) = \frac{(1-\bar{a})(Y-c_o)^2}{(2-\bar{a})^2 Y} + \frac{a_2^o}{2Y}\left(\frac{Y-c_o}{2-\bar{a}}\right)^2$$
$$- (1-\gamma)\left\{\frac{(Y-c_o)^2(1-a_2^o)}{(2-a_2^o)^2 Y} + \frac{a_2^o}{2Y}\left(\frac{Y-c_o}{2-a_2^o}\right)^2\right\}$$

and the expression in the text follows immediately.

Proof of Proposition 1: When consumers expect high quality, the price $p_2^{o*}(0, \bar{c})$ is optimal for selfish firms. Since this yields positive profits, (13) implies that (10) and (11) are satisfied at this price. Thus, the firm wishes to provide high quality and has no reason to deviate from this price. This establishes that a high quality equilibrium exists when (13) is satisfied.

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

Proof of Proposition 2: $B_1^n(p, \text{high})$ is given by

$$B_1^n(p, \text{high}) = K^n \int_{\frac{p-(1-\mu)(\bar{c}-\epsilon)}{\mu}}^{Y} \frac{\theta - p}{Y} d\theta \tag{38}$$

Moreover, $p \geq \bar{c}$ implies $p - \bar{c} + \epsilon > 0$, which implies that $(1-\mu)(p - \bar{c} + \epsilon) > 0$ when $\mu < 1$. Therefore, $[p - (1-\mu)(\bar{c} - \epsilon)]/\mu > p$. This means that, when $\mu < 1$, θ goes between a number strictly larger than p and Y in the integral above, whereas it goes between p and Y when μ equals one. Therefore, $B_1^n(p, \text{high})$ is larger in the latter case.

Similarly, $B_1^n(p, \text{low})$ is given by

$$-B_1^n(p, \text{low}) = K^n \left[1 - F\left(\frac{p - (1-\mu)(\bar{c} - \epsilon)}{\mu}\right)\right](p - \bar{c} + \epsilon)$$

so that $B_1^n(p, \text{low})$ is also larger when $\mu = 1$.

Proof of Proposition 3: If consumers expect high quality at p_1^n, the quantity demanded is $F^n(1 - p_1^n/Y)$. Moreover, because this is an equilibrium price when $\mu = 1$, altruistic firms provide high quality if they expect selfish firms to do so. Moreover, if (20) and (22) 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 4: With (22) failing so that the selfish firm prefers not to produce over producing a high quality good, the definition of $\hat{p}_1^n$ leads the selfish firm not to produce at all. This means that the altruistic's firm's actions are guided by (10), (11) and (12). Given that the first two inequalities are satisfied, altruistic firms produce high quality.

Proof of Proposition 5: For clarity, I neglect most superscripts and subscripts of W, a and p in this proof. Using (25), the cost c that leads firms that care for all their consumers to obtain a particular welfare level W satisfies

$$c = mY - \sqrt{2(2-a)mYW} \tag{39}$$

Using (39) to substitute for c in (27), one obtains

$$W^x(X) = \frac{2-a}{2}W - \frac{a(2-a)m(Y-X)^2}{4Y} + \frac{a(Y-X)}{2Y}\sqrt{2(2-a)mYW}$$

The derivative of this welfare with respect to m is then

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

When marginal cost is given by (39), the minimal value of X, namely θ^- is

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

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

$$X = Y - (1-\zeta)\sqrt{\frac{2YW}{(2-a)m}}$$

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 6: Let

$$\chi_o^i \equiv W_1^i(m^H, m^H, p_1^i(m^H, m^H)) - W_1^i(m^L, m^L, p_L^i) \tag{40}$$

$$\chi_c^i \equiv W_1^i(m^H, m^H, p_1^i(m^H, m^H)) - W_1^i(m^L, m^H, p_1^i(m^H, m^H)) \tag{41}$$

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 (33), $p_1^b(m^L, m^H) > p_1^b(m^H, m^H) > p_L^b$ 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 (34) 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 (37) is more stringent than condition (36) for firms of type b. Because the left hand side of (36) reaches a maximum at this price, any other price makes condition (36) harder to meet. Therefore, if (36)) 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 (35) 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 (37) is more stringent than condition (36) 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 (37) is satisfied at this price.

The expressions for W_1^b and W_1^x in (32) and (35) respectively are linear in m with coefficients that depend only on $\bar{a}$, Y X and p_1^b/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 ρ^*, $(\kappa^H - \kappa^L)^*$ 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 (31). Therefore, $\rho > \rho^*$ and $(\kappa^H - \kappa^L) = (\kappa^H - \kappa^L)^*$ lead to (37) being satisfied for firms of type x at a price of $p_1^x(m^H, m^H)$ while (36) 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

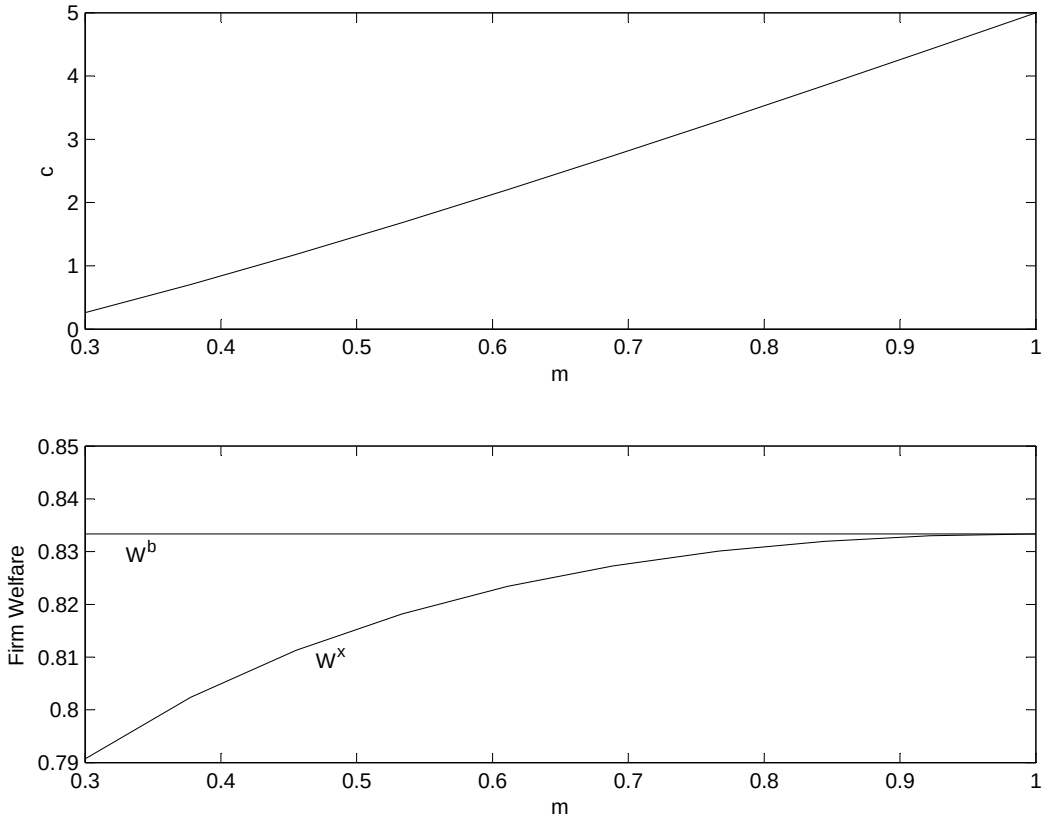

Figure 2: Variations in m and c that keep W^x constant