A Supply-Side Explanation for the Use of Cause Marketing

Anil Arya

Ohio State University

Brian Mittendorf

Ohio State University

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As the name suggests, cause marketing is believed to be a practice that helps boost market demand for a firm's products or brands. By linking charitable giving to sales a firm can spur consumer interest in its offerings and, at times, even their willingness to pay. In this paper, we demonstrate that this demand-side view of cause marketing does not fully capture its effects. Using a parsimonious model of supply chain behavior, we show that even if consumers are not swayed by cause marketing efforts, a firm can benefit from linking its charitable giving to product sales in order to influence supplier pricing. In viewing cause marketing as a strategic supply-side activity, the paper demonstrates the wider motivations for and consequences of corporate social responsibility.

1. Introduction

As a new age of strategic corporate social responsibility (CSR) takes hold, those examining its motivations and ramifications have a seemingly singular view of CSR as an activity aimed of reaching more consumers and boosting brand loyalty. A prominent example is cause marketing, which aims to link a firm's brand to compassionate causes by tying its philanthropic giving with consumer purchases. Examples of cause marketing abound, including donations by Yoplait to Komen for the Cure tied to customers' yogurt purchases, donations by Target to participating local schools based on sales, and Product Red, a consortium of companies (including Apple, Nike, American Express, etc.) offering donations to The Global Fund that are tied to consumer purchases of select products. These examples only scratch the surface – the use of cause marketing has grown substantially over the past two decades to beyond $1 billion in annual giving and is now common among all types and sizes of businesses (File and Prince 1998; *Advertising Age* 7/28/03).

As its name suggests, cause marketing is commonly viewed as entirely a demand-side activity, aimed at boosting consumer demand for and perceptions of a particular brand or product (e.g., Varadarajan and Menon 1988). While such considerations are no doubt critical, it is also well recognized that another important facet of a firm's profitability lies in supply-side activities – those that cut input costs and streamline supply chain relationships. In this paper, we try to broaden the view of cause marketing by examining its supply-side motivations and consequences. In particular, we present a parsimonious model of a firm that buys inputs from a supplier and then converts the inputs for sale to end consumers. We consider the effects of engaging in cause marketing, wherein a firm pledges to donate some portion of product sales to a charitable cause. To highlight supply-side effects of cause marketing initiatives, we presume that engaging in such activities does not affect consumer attitudes or willingness to pay. Using this baseline model, we demonstrate that

by undercutting a firm's willingness to pay for inputs, cause marketing disciplines supplier pricing.

To elaborate, the paper starts with an obvious benchmark: firm profits under simple (non-strategic) corporate philanthropy wherein the firm pledges a donation amount to charity. The paper then demonstrates that the firm can achieve the same donation level while also cutting supplier costs by tying donations to sales. Such a cause marketing tie-in intrinsically undermines the per-unit profitability of each product by adding a new marginal cost of sales. As such, the cause marketing pledge makes the firm's input demand much more sensitive to supplier pricing. This increased sensitivity to pricing persuades the supplier to charge a lower price so as to boost demand for its input. In effect, by engaging in cause marketing, the firm is able to make the supplier a tacit (even if unwilling) partner in corporate philanthropy.

With this result in tow, we then examine a firm's preferred method of engaging in cause marketing. In particular, if the firm engages in sales in a variety of markets and/or product lines, the firm has the ability to target its marketing to these particular segments. Alternatively, it can instead engage in universal cause marketing. We demonstrate that not only is it in a firm's best interest to limit its cause marketing to a subset of products, but the supply-side consequences of doing so can alone justify corporate philanthropic efforts in the first place. In other words, even absent any consumer response to cause marketing, a firm's bottom line is improved by targeted philanthropic activities.

The intuition for the above result is roughly as follows. Say a firm uses its inputs to sell in two different markets (or, alternatively, to sell two different products). If the firm offers to donate a portion of all of its sales, the uniformly reduced willingness to pay results in lower supplier prices. However, the per unit input price cut is less than the pledged donation per unit, so the firm is not truly able to take advantage of the lower prices. If, however, the firm offers to donate a portion of sales in only one market, the reduced (average) willingness to pay again forces lower supplier prices. In this case,

however, the firm can better exploit the lower prices by selling more of its goods in the other, high-margin, market. That is, cause marketing is a means of sacrificing profitability from one product line (the one with a donation tie-in) in order to boost profitability in another (the one without a tie-in).

In practice, companies often utilize charity tie-ins only for particular product lines or in specific markets to support local charities. The Product Red and Target examples earlier are cases in point. The demand-side view of this practice would suggest that these efforts aim to enhance sales and boost profits for these particular products and/or markets with tie-ins. The supply-side view of cause marketing provides a different spin. This perspective suggests that by linking particular products (or markets) to charitable causes, the firm is not seeking to boost profitability of these products but instead is indirectly subsidizing the bottom line of its other products. While the selling firm, charities, and society as a whole may benefit from such activities, it is the supplier who serves as the foil.

We extend the analysis to provide a final set of contrasts with conventional views by examining the implications of (i) product market competition and (ii) inherent asymmetries in product line profitability on the propensity to engage in cause marketing. We show that greater competition (be it in the form of greater product substitutability or price competition) reduces a firm's preferred level of cause marketing. While a demand-side mindset suggests that greater competition increases the firm's desire to differentiate brands and, thus, the desire to engage in cause marketing, the supply-side view provides an opposing prediction. Since greater competition across brands serves to undercut each brand's margins and thereby reduce the firm's willingness to pay for inputs, the need for cause marketing tie-ins to serve that role is diminished. In other words, when supply market effects are considered, competition acts as a substitute (not motivation) for cause marketing. As such, the supply-side thinking predicts that output markets characterized by less competition and/or stronger inherent brand preferences would actually exhibit more, not less, cause marketing efforts.

In similar vein, by examining inherent profitability differences in a firm's product lines, we show that supply-side implications lead a firm to engage in cause marketing for product lines with less profit potential. Doing so undercuts supplier pricing securing gains for the more profitable lines. This result is again in stark contrast to the demand-side view of cause marketing that suggests investing in awareness and visibility of product lines with the greatest profit potential.

This paper's findings fit into two broader streams of literature: cause marketing and supply chain pricing. In terms of extant research on cause marketing, the focus has been almost exclusively on how such activities affect consumer demand. Among other things, this has led to studies that consider how different consumers are affected by different cause-related efforts (e.g., Bloom et al. 2006). The nature of the products with a cause marketing tie-in and the size of the tie-in have also been shown to affect consumer attitudes (Strahilevitz 1999). Competitive pressures can also influence the optimal linkage of private products and socially-responsible offerings (Bagnoli and Watts 2003). Furthermore, even when these efforts are tied to a particular product, consumer demand can spill over to other products in a brand's portfolio which itself can lead to different strategies (Krishna and Rajan 2009). This is not to say that the research has all been focused on the upsides of cause marketing. Cause marketing has also been shown to mislead buyers about the extent of corporate giving and crowd out product buyers' own philanthropic initiative, even leading some to wonder whether it can actually undermine the underlying causes (Olsen et al. 2003; Eikenberry 2009; Bermudez 2011). What is notably missing from research on cause marketing, however, is examination of its upstream consequences, the focus herein.

To that end, the upstream consequences of other facets of firm behavior have been extensively examined. At the core of the bulk of these studies is the inherent conflict of interest in pricing. Starting with the seminal work of Spengler (1950), many have examined distortions introduced by above-cost pricing by suppliers and firm efforts to alleviate such distortions (for thorough and excellent reviews of the literature on supply

chain pricing, see Katz 1989 and Lariviere 2008). The introduction of direct sales by a supplier (Tsay and Agrawal 2004), cost-plus transfer pricing by a firm (Arya and Mittendorf 2007), product returns policies (Pasternack 1985), quantity flexibility or revenue-sharing arrangements (Tsay 1999; Cachon and Lariviere 2005), and propping up loss-leader products (Arya and Mittendorf 2011) are just a few examples of practices justified by concerns over supplier pricing. This paper adds corporate social responsibility as a consideration, demonstrating that the use cause marketing has important ramifications for supplier pricing which, in turn, has ramifications for the ways in which firms engage in philanthropy.

The paper proceeds as follows. Section 2 presents the basic model. The results are presented in Section 3: the supply market effects of cause marketing are detailed in 3.1; the preferred means of cause marketing in light of such effects is examined in 3.2; the consequences of competition are demonstrated in 3.3; and cross-market asymmetries are studied in 3.4. Section 4 discusses implications and concludes the paper.

2. Model

A firm, F, operates in n segments (markets), with segments corresponding to differing product lines or geographical locations. The firm faces (Cournot) competition in segment i from rival $i, i = 1,\ldots,n$. Consumer demand in the segment is represented by the inverse demand curve $p_i = a - q_i - \gamma\tilde{q}_i$ ($\tilde{p}_i = a - \tilde{q}_i - \gamma q_i$), where p_i ($\tilde{p}_i$) is the firm's (rival's) retail price for each unit, and q_i ($\tilde{q}_i$) is the number of units sold by the firm (rival). In this formulation, a, $a > 0$, is the familiar demand intercept, and product substitutability γ, $0 \le \gamma \le 1$, reflects the degree of competitive intensity.

The firm relies on external supply for a key input. In particular, F utilizes one unit of input per unit of output in each segment, and this input is provided by a monopolist supplier S. For simplicity, and to hone in on the firm-supplier relationship, we normalize the supplier's production cost to zero, and presume rivals make their own inputs (also at

zero cost). The supplier sets a per-unit wholesale price of w, and the firm and its rivals (concurrently) choose the quantity of output to provide in their respective markets.

Having characterized the retail and wholesale markets, we now turn to the issue of the firm's philanthropic efforts. The firm can opt to make a charitable gift in any of its segments. Without loss of generality, assume the firm opts to give in the first *m* segments, $m \le n$. We also permit the possibility that marketing and administrative costs may be required to effectively implement such donations; the cost of such efforts in each segment is denoted c, $c \ge 0$.

Given this framework, we ask two questions. First, rather than simple cash pledges, would a firm prefer to make a contingent donation, one that is tied to consumer purchases (i.e., cause marketing)? Under cause marketing, the firm gives a fraction of its revenues, denoted f, $f \ge 0$, in each of *m* markets, yielding a total donation of $\sum_{i=1}^{m} f p_i q_i$. In contrast, traditional cash pledges entail separating the cause from sales and making a guaranteed donation of *d* in each of the *m* markets yielding total donation of md. Second, given donations are presumed to have no direct effect on consumer demand and firms are motivated solely by profits, why would a firm engage in corporate philanthropy to begin with?

Figure 1 summarizes the sequence of events.

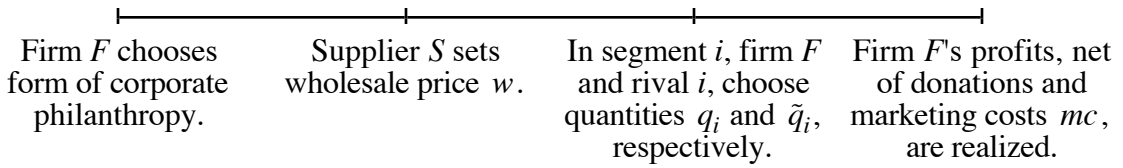

Figure 1: Timeline

3. Results

3.1. Cash Pledges vs. Cause Marketing

Before examining the optimal level of corporate philanthropy, we first consider the implications of the form of philanthropy on the supply market. That is, does the firm wish to make a standard cash pledge or engage in cause marketing? To determine the answer, we examine the equilibrium outcome in each case when the firm undertakes such giving across all segments.

Equilibrium under Cash Pledges

Working backward in the game, for a given cash pledge of d in each of its n segments, the firm chooses quantities to maximize its profit, solving (1):

$$\underset{q_i}{Max} \ \sum_{i=1}^{n}\left(q_i[p_i - w] - d - c\right). \tag{1}$$

The rival in market i, in turn, chooses its quantities to solve $\underset{\tilde{q}_i}{Max} \ \tilde{q}_i\tilde{p}_i$. Jointly solving the first-order conditions of (1) and each of the rival's respective maximization problem yields the competitive equilibrium for a given supplier wholesale price:

$$q_i(w) = \frac{a[2-\gamma]}{4-\gamma^2} - \frac{2w}{4-\gamma^2} \text{ and } \tilde{q}_i(w) = \frac{a[2-\gamma]}{4-\gamma^2} + \frac{\gamma w}{4-\gamma^2}. \tag{2}$$

The competitive equilibrium has intuitive features: (i) greater demand (a) promotes more product offerings (higher $q_i(w)$ and $\tilde{q}_i(w)$), (ii) a greater input price for the firm reduces its quantities ($dq_i(w)/dw < 0$) and boosts its competitors' quantities ($d\tilde{q}_i(w)/dw > 0$), with these comparative statics magnified the greater the competitive intensity (γ), and (iii) with corporate giving disentangled from market outcomes, the quantities are naturally unaffected by d. The supplier chooses its wholesale price cognizant of these effects, solving (3):

$$\underset{w}{Max} \ \sum_{i=1}^{n} q_i(w)w. \tag{3}$$

Taking the first-order condition of (3) yields the supplier's chosen price: $w = a[2-\gamma]/4$. As expected, the greater the demand (a), the greater the price the supplier charges; and, the greater the competitive intensity, the more the supplier is forced to charge a lower price in order to keep its customer "in the game." Using this equilibrium wholesale price in the competitive equilibrium in (2), and substituting the values in the supplier's and firm's profit expressions (denoted Π_S and Π_F, respectively) yields Lemma 1. (All proofs are provided in the appendix.)

LEMMA 1. Under cash pledge of d in each segment, the equilibrium wholesale price, quantity levels, supplier profit, and firm profit are:

$$w = \frac{a[2-\gamma]}{4};\ q_i = \frac{a}{2[2+\gamma]};\ \tilde{q}_i = \frac{a[4+\gamma]}{4[2+\gamma]};$$

$$\Pi_S = \frac{na^2[2-\gamma]}{8[2+\gamma]};\ \text{and}\ \Pi_F = n\left(\frac{a^2}{4[2+\gamma]^2} - d - c\right).$$

Equilibrium with Cause Marketing

We now characterize the equilibrium outcome when the firm engages in cause marketing. Working backward in the game, for a given cause marketing pledge of a revenue fraction f in each of its n segments, the firm chooses quantities to maximize its profit, solving (4):

$$\underset{q_i}{Max}\ \ \textstyle\sum_{i=1}^{n}\left(q_i[p_i - w] - fq_ip_i - c\right). \tag{4}$$

The rival in market i, in turn, again chooses its quantities to solve $\underset{\tilde{q}_i}{Max}\ \tilde{q}_i\tilde{p}_i$. Jointly the first-order conditions of (4) and each of the rival's respective maximization problem yields the competitive equilibrium for a given supplier wholesale price:

$$q_i(w;f) = \frac{a[2-\gamma]}{4-\gamma^2} - \frac{2w}{[4-\gamma^2][1-f]}\ \text{and}\ \tilde{q}_i(w) = \frac{a[2-\gamma]}{4-\gamma^2} + \frac{\gamma w}{[1-f][4-\gamma^2]}. \tag{5}$$

The difference in the competitive equilibrium due to cause marketing is succinct. The degree to which a greater input price for the firm reduces its quantities depends on the extent of its cause marketing (*f*). In particular, $\partial^2 q_i(w;f)/\partial w \partial f < 0$, reflecting that the greater the cause marketing (*f*), the more sensitive a firm's quantities are to supplier pricing. Intuitively, cause marketing erodes a firm's margins leaving less room for a supplier to hike prices so as to extract some of said margins. As a consequence, greater cause marketing by the firm also boosts the rival's response to wholesale prices, giving it an even steeper edge when prices are increased ($\partial^2 \tilde{q}_i(w;f)/\partial w \partial f > 0$). Naturally, such greater sensitivity to supplier pricing for both the firm and its rivals due to cause marketing has the potential to alter the supplier's chosen price. The supplier chooses its wholesale price cognizant of these effects, solving (6):

$$\underset{w}{Max} \ \ \sum_{i=1}^{n} q_i(w;f)w. \tag{6}$$

Taking the first-order condition of (6) yields the supplier's chosen price: $w = a[2-\gamma][1-f]/4$. Consistent with the above intuition, cause marketing undercuts the firm's willingness to pay and, as such, compels supplier concessions. This is evidenced crisply by the effect of the pledge level on input prices: $\partial w/\partial f = -a[2-\gamma]/4 < 0$. Using this wholesale price in the equilibrium quantities in (5) is then used to compute $\sum_{i=1}^{n} f q_i p_i$, the equilibrium level of donations for a given cause marketing campaign. In order to facilitate an "apples-to-apples" comparison, consider the level of cause marketing that achieves the equivalent level of donations as in cash pledges. That is, by choosing an appropriate f, the firm is able to achieve the same donation using cause marketing as it could with clash pledges (d). With this level of cause marketing, the equilibrium outcomes are confirmed in Lemma 2.

LEMMA 2. Cause marketing with $f = \frac{8d[2+k]^2}{a^2[6-k^2]}$ yields contributions of d in each segment. In this case, the equilibrium wholesale price, quantity levels, supplier profit, and firm profit are:

$$w = \frac{a[2-\gamma]}{4}\left[1 - \frac{8d(2+k)^2}{a^2(6-k^2)}\right];\ q_i = \frac{a}{2[2+\gamma]};\ \tilde{q}_i = \frac{a[4+\gamma]}{4[2+\gamma]};$$

$$\Pi_S = n\left(\frac{a^2[2-\gamma]}{8[2+\gamma]} - \frac{d[4-\gamma^2]}{6-\gamma^2}\right);\ \text{and}\ \Pi_F = n\left(\frac{a^2}{4[2+\gamma]^2} - d - c + \frac{d[4-\gamma^2]}{6-\gamma^2}\right).$$

The Preference for Cause Marketing

Using the relevant expressions from the two Lemmas, the firm's preference is formalized in the next proposition.

PROPOSITION 1. The firm prefers cause marketing rather cash pledges as a means of corporate philanthropy.

To elaborate on the proposition, comparing equilibrium outcomes under cash pledges and cause marketing reveals the firm profit under cause marketing is greater by $\frac{nd[4-\gamma^2]}{6-\gamma^2}$. The supplier, on the other hand, sees a reduction in profit of $\frac{nd[4-\gamma^2]}{6-\gamma^2}$. In effect, by making use of cause marketing, the firm is able to compel the supplier to indirectly subsidize $\left([4-\gamma^2]/[6-\gamma^2]\right)\%$ of its philanthropic donation. The reason the firm benefits from cause marketing is that it conveys a weaker posture to its supplier who, in turn, is incentivized to offer price concessions. As it turns out, the extent of the price concession is such that the competitive equilibrium is unchanged due to philanthropic giving (as can be seen comparing quantities in Lemmas 1 and 2). That is, the firm is able to donate a portion of its sales without dampening its incentives for sales at all.

Despite the fact that cause marketing is preferred to cash pledges, and the supplier subsidizes a portion of the donations in equilibrium, the firm's net profit in Lemma 2 is

nonetheless decreasing in the degree of corporate philanthropy (*d*). This raises the broader question of why would a firm engage in such behavior in the first place? And, given that the preferred method of doing so is engaging in cause marketing, what would the preferred form of cause marketing take? We next tackle each of these questions.

3.2. Optimal Cause Marketing

To most succinctly characterize the supplier pricing effect of cause marketing, the previous section presumed that cause marketing stipulated that a certain portion of all product sales were donated to charity. In practice, however, firms often tie cause marketing efforts to particular products and/or geographical areas. With this in mind, we relax the initial presumption of universally-applied cause marketing efforts to consider the possibility of targeted cause marketing. In particular, we permit the cause marketing effort to be made in *m* of the firm's *n* product offerings. In doing so, enables us to address both the preferred targeting (i.e., optimal *m*) and the preferred level of cause marketing (i.e., optimal *f*). Again working backward in the game, for a given cause marketing strategy, the firm chooses quantities to maximize its profit, solving (7):

$$\underset{q_i}{Max} \ \left\{\sum_{i=1}^{m}\left(q_i[p_i - w] - fq_i p_i - c\right) + \sum_{i=m+1}^{n} q_i[p_i - w]\right\}. \tag{7}$$

The rival in market *i*, again chooses its quantities to solve $\underset{\tilde{q}_i}{Max} \ \tilde{q}_i\tilde{p}_i$. Jointly the first-order conditions of (7) and each of the rival's respective maximization problem yields the competitive equilibrium for a given supplier wholesale price:

$$\text{For } i = 1,\ldots,m,\ q_i(w;f) = \frac{a[2-\gamma]}{4-\gamma^2} - \frac{2w}{[4-\gamma^2][1-f]} \text{ and}$$

$$\tilde{q}_i(w) = \frac{a[2-\gamma]}{4-\gamma^2} + \frac{\gamma w}{[1-f][4-\gamma^2]}; \tag{8}$$

$$\text{For } i = m+1,\ldots,n,\ q_i(w) = \frac{a[2-\gamma]}{4-\gamma^2} - \frac{2w}{4-\gamma^2} \text{ and } \tilde{q}_i(w) = \frac{a[2-\gamma]}{4-\gamma^2} + \frac{\gamma w}{4-\gamma^2}.$$

The competitive equilibrium is effectively a concatenation of those in the cause marketing (for $i = 1,...,m$) and the cash pledges (for $i = m+1,...,n$) cases examined previously. However, firm profits are not just a simple averaging of firm profits in each case. This is because there is still the matter of supplier pricing. The supplier chooses its wholesale price cognizant of the portfolio of markets in which the firm operates. Presuming the supplier wishes to price inputs so as to ensure firm participation in each market, the supplier solves the problem in (9):

$$\underset{w}{Max} \quad \left\{\sum_{i=1}^{m} q_i(w;f)w + \sum_{i=m+1}^{n} q_i(w)w\right\}. \tag{9}$$

Taking the first-order condition of (9) yields the supplier's chosen price: $w = a[2-\gamma][1-\Delta]/4$, where $\Delta = \dfrac{fm}{fm+[1-f]n}$ is the supplier's discount tied to the firm's cause marketing efforts. Notice the supplier's discount is increasing in both the reach of the cause marketing campaign (m) and the size of the donation (f). That is, the more intense the firm's cause marketing commitment, the more concessions it gleans from the supplier; further, the scope and scale of the campaign each can fill this role. Provided profitability in each market is sufficient that the supplier does not simply price some products of their market, the ensuing competitive equilibrium is summarized in Lemma 3.

LEMMA 3. When the firm engages in a cause marketing campaign by pledging f in each of m markets, and the supplier does not foreclose any market, the equilibrium wholesale price, quantity levels, supplier profit, and firm profit are:

$$w = \frac{a[2-\gamma]}{4} - \frac{af[2-\gamma]m}{4[fm+(1-f)n]};$$

$$\text{For } i = 1,...,m,\ q_i = \frac{a}{2[2+\gamma]} - \frac{af[n-m]}{2[2+\gamma][fm+(1-f)n]} \text{ and}$$

$$\tilde{q}_i = \frac{a[4+\gamma]}{4[2+\gamma]} + \frac{af\gamma[n-m]}{4[2+\gamma][fm+(1-f)n]};$$

For $i = m+1,\ldots,n$, $q_i = \dfrac{a}{2[2+\gamma]} + \dfrac{afm}{2[2+\gamma][fm+(1-f)n]}$ and

$$\tilde{q}_i = \frac{a[4+\gamma]}{4[2+\gamma]} - \frac{af\gamma m}{4[2+\gamma][fm+(1-f)n]};$$

$$\Pi_S = \frac{na^2[2-\gamma]}{8[2+\gamma]} - \frac{a^2 f[2-\gamma]mn}{8[2+\gamma][fm+(1-f)n]}; \text{ and}$$

$$\Pi_F = \frac{na^2}{4[2+\gamma]^2} + \frac{a^2 f[4f(n-m)-n]m}{4[2+\gamma]^2[fm+(1-f)n]} - mc.$$

Given the equilibrium outcome, we can now address the firm's optimal cause marketing campaign. Of course, if the administrative costs of engaging in cause marketing, c, are too large, the firm will opt out of such efforts. Interestingly, however, provided those costs are modest, the firm optimally engages in cause marketing. That is, endogenous cause marketing arises even though it gives no boost in consumer perceptions nor is there a direct pecuniary benefit of philanthropy. In particular, taking the first-order conditions of Π_F with respect to f and m reveals the optimal philanthropic efforts, as identified in Proposition 2.

PROPOSITION 2. For $c < \dfrac{a^2}{4[2+\gamma]^2}$, the firm optimally engages in corporate philanthropy. In this case, the firm's optimal campaign entails a pledge of f^*, $0 < f^* < 1$, provided in m^* segments, $0 < m^* < n$, yielding total donations of $D^* > 0$, where:

$$f^* = \sqrt{\frac{3}{8} - \frac{c[2+\gamma]^2}{2a^2}};\ m^* = 2n\left(1 - \sqrt{\frac{2}{3 - 4c[2+\gamma]^2/a^2}}\right); \text{ and}$$

$$D^* = \frac{a^2 m^{*2}[2(4-\gamma)^2(n-m^*) + (6-\gamma^2)m^*]}{8[2+\gamma]^2[2n-m^*]n}.$$

Besides showing that donating is optimal behavior solely due to supply market effects, the proposition also demonstrates its particular form. For one, the more costly it is to establish such efforts (c), the lower both the scope (m) and scale (f) of cause marketing.

Further, the optimal scope of efforts is interior in nature. That is, cause marketing entails at least one product line (otherwise there would be no cause marketing to speak of); yet, it does not entail all product lines. In fact, the optimal scope entails no more than $2[1-\sqrt{2/3}]\% \approx 37\%$ of product offerings.

The optimality of a limited scope comes from striking a balance of the effects of cause marketing. On the one hand, cause marketing helps incentivize lower supplier prices. On the other hand, though, it otherwise erodes profitability of the markets in which the campaign is conducted. A limited scope permits a firm to glean the advantages of lower supplier pricing while still maintaining sufficient product lines and/or geographic areas in which it can exploit such lower prices.

A similar force encourages an interior scale of cause marketing (*f*). If a firm offers to donate all its revenues in a particular market, the firm's complete lack of profits in this market implies that the supplier too is unconcerned with that market in setting its price; in such a case, supplier pricing cannot be suitably disciplined. With an intermediate level of donations, however, the firm is able to convince the supplier to make concessions hoping to prop up sales in that market; the remaining markets are the beneficiaries of such efforts. We next extend this primary line of reasoning to consider how competition affects the firm's cause marketing strategy.

3.3. Competition and Cause Marketing

With the justification provided herein for cause marketing rooted in supply market considerations, the usual view of cause marketing as a tool to boost consumer demand is notably absent. While the two forces can of course coexist in reality, they do present quite distinct views of corporate philanthropy. One way to see this dichotomy is to examine how competitive pressures affect supply-side motivated cause marketing. Under our baseline model of cause marketing, the degree of product substitutability, γ, provides a natural comparative static on competitive intensity. In particular, as products become more similar

(γ increases), competition naturally increases. When cause marketing is motivated by demand-side considerations, greater competition provides added reasons for firms' to boost consumer perceptions of brands and products leading to greater philanthropic efforts. When cause marketing is instead motivated by supply market pricing effects, the converse holds, as confirmed by the next proposition.

PROPOSITION 3. Greater competition decreases the incentives for corporate philanthropy in that f^*, m^*, and D^* are each decreasing in γ.

The intuition behind the reversal of conventional wisdom in Proposition 3 is that when competition increases, it acts a natural salve on supplier pricing and thus substitutes the need for cause marketing efforts. This is evidenced by the prevailing wholesale price absent cause marketing in Lemma 1: $w = a[2 - \gamma]/4$. Since competition reduces a firm's willingness to pay, greater competition precludes the firm's need to incur philanthropic costs in order to curtail supplier prices.

In a similar vein, one could ask how price (rather than quantity) competition can alter the conclusions. It is well known that the form of competition can often reverse many types of strategic behavior (e.g., trade policy (Eaton and Grossman 1986); disclosure (Darrough 1993); transfer pricing (Goex and Schiller 2006)). To examine the sensitivity to the initial presumption of quantity competition, we examine optimal cause marketing under price competition. Relegating the details to the appendix, the next proposition presents preferred cause marketing arrangement under price (Bertrand) competition.

PROPOSITION 4. Under Bertrand competition, the firm optimally engages in corporate philanthropy for $c < \dfrac{a^2[1-\gamma]}{4[2-\gamma]^2[1+\gamma]}$. In this case,

(i) the firm's optimal cause marketing is f^{*B}, $0 < f^{*B} < 1$, provided in m^{*B} segments, $0 < m^{*B} < n$, yielding total donations of $D^{*B} > 0$, where:

$$f^{*B} = \sqrt{\frac{3}{8} - \frac{c[2-\gamma]^2[1+\gamma]}{2a^2[1-\gamma]}};\ m^{*B} = 2n\left(1 - \sqrt{\frac{2}{3 - 4c[2-\gamma]^2[1+\gamma]/[a^2(1-\gamma)]}}\right);\ \text{and}$$

$$D^{*B} = \frac{a^2[m^{*B}]^2[1-\gamma][(4-\gamma^2)n - m^{*B}]}{2[2-\gamma]^2[1+\gamma][2-\gamma^2][2n - m^{*B}]n}.$$

(ii) f^{*B}, m^{*B}, and D^{*B} are each decreasing in γ, and

(iii) donations are less than under Cournot competition, i.e., $D^{*B} < D^{*}$.

While the equilibrium outcome under Bertrand is notably more messy, a few observations are worth noting. First, the basic forces and tension in the case of quantity competition remain under price competition. That is, provided cause marketing is not inherently too costly to administer, a firm finds it optimal to engage in a cause marketing campaign solely due to its supply market effects. Further, the optimal cause marketing campaign entails tie-ins in a targeted limited set of products/markets. Second, the comparative statics with respect to competitive intensity remain, in that both the scope and scale of cause marketing efforts are reduced the greater the level of competition. Finally, the notion that competition crowds out philanthropic efforts, because it serves as a substitute rather than a motive for cause marketing, is also manifest in a price vs. quantity competition comparison. It is well-known that price competition entails more intense product market competition than quantity competition. Since intense competition crowds out philanthropy, one would expect price competition to have the same effect on giving. This effect of price competition on dampening philanthropy is confirmed in Proposition 4(iii).

3.4. Effect of Asymmetric Markets

A key conclusion of our analysis is that not only do supply chain effects help justify the prevalence of cause marketing, but they also support targeting such marketing efforts at particular products or markets. This point is made in a model of (ex ante) symmetric

product lines and markets. Besides promoting parsimony, this modeling also highlights that inherent differences between products and markets need not be the reason firms target cause marketing efforts. That is, targeted marketing in our model is not due to product line differences. Rather, it *creates* product line differences. That said, our initial setup does raise the question of how a firm would choose to engage in such targeting if product lines were already inherently different.

To analyze asymmetric segments most succinctly, take the case of two product lines ($n = 2$) in the absence of competitive pressures ($\gamma = 0$); the product lines have different consumer demand with the demand intercept for product *i* now denoted a_i. Without loss of generality, say product 1 has higher inherent consumer demand. This, and to ensure both products are sold in equilibrium, implies the assumed condition $1 < a_1 / a_2 < 1 + \sqrt{2}$. Given this formulation, the question is not only whether to engage in cause marketing, but also which products to include in such cause marketing. The next proposition formally answers this question.

PROPOSITION 5. For $c < \dfrac{[6a_1 - 5a_2][(1+\sqrt{2})a_2 - a_1][(\sqrt{2}-1)a_2 + a_1]}{32[2a_1 + a_2]}$, the firm optimally engages in corporate philanthropy. In this case, the firm engages in cause marketing only for product 2 with the tie-in $f = 1 - \dfrac{a_2^2}{a_1[a_1 + 2a_2]} > 0$.

The proposition confirms that the targeted nature of cause marketing identified heretofore is not unique to the case of symmetric products (rather, it is in spite of symmetric products). The result goes beyond just demonstrating robustness of a key result, however. The proposition also demonstrates that the targeted nature of cause marketing takes the form of tying donations to the product with weaker demand.

The question of why firms target cause marketing to particular product lines is one without a clear answer. Some conjecture that firms should tie marketing to a product line that most needs an increase in visibility, i.e., the target should be a new or struggling product. Others suggest linking such marketing efforts to the firm's most visible and

profitable products since they are most likely to effectively boost brand visibility. Still others view it as being a means of developing local (targeted) charity ties for a brand which is otherwise viewed as "too corporate."

Given the novel focus on supply-side considerations, Proposition 5 provides a more clear-cut view: a firm may wish to link its cause marketing efforts to less profitable products not because doing so would boost their demand or generate better local visibility; rather, cause marketing tied to less profitable product lines allows the firm to leverage those products in the supply market to help further boost profitability of its more successful products. In other words, by engaging in cause marketing for less profitable lines, a firm can secure lower input prices. Since these inputs are dispersed among several product lines and geographical areas, the lower input prices, in turn, can be exploited by the firm's more profitable product lines and markets.

4. Conclusion

Conventional wisdom has pegged the growing use of philanthropic product tie-ins as being rooted in a desire to boost consumer perceptions of a firm's brand or to boost demand for specific products. To see the singular demand-side focus linked to such efforts one need look no further than the label "cause marketing" itself. In this paper, we demonstrate that cause marketing may have broader effects than boosting demand alone. We show that even if demand-side considerations are absent, cause marketing can help firm due to its supply-side implications. In particular, by pledging to give a portion of sales for a particular product line to charity, a firm inherently reduces its willingness to pay for inputs. The firm's supplier, in turn, is compelled to cut its prices in order to restore demand for its inputs. The reduced input prices alone can serve as an impetus for engaging in such philanthropic efforts. In effect, a firm enlists its supplier as a de facto philanthropic partner, and such supplier philanthropy can be exploited by the firm.

APPENDIX

Proof of Lemma 1. Consider the outcome when firm F makes a cash pledge of d in each segment. Given the supplier's wholesale price w and rival i's quantity $\tilde{q}_i$, firm F chooses $q_i,\ i = 1,\ldots n$, to solve:

$$\underset{q_i, i=1,\ldots n}{Max} \sum_{i=1}^{n}\left([a - q_i - \gamma\tilde{q}_i]q_i - wq_i - d - c\right). \tag{A1}$$

Similarly, given firm F's quantity q_i, rival i solves:

$$\underset{\tilde{q}_i}{Max}\ [a - \gamma q_i - \tilde{q}_i]\tilde{q}_i,\ i = 1,\ldots,n. \tag{A2}$$

Jointly solving the first-order conditions of (A1) and (A2) yields:

$$q_i(w) = \frac{a[2-\gamma] - 2w}{4 - \gamma^2} \text{ and } \tilde{q}_i(w) = \frac{a[2-\gamma] + \gamma w}{4 - \gamma^2},\ i = 1,\ldots,n. \tag{A3}$$

Given (A3), the supplier's problem is:

$$\underset{w}{Max}\ w\sum_{i=1}^{n} q_i(w) \equiv \underset{w}{Max}\ nw\left(\frac{a[2-\gamma] - 2w}{4 - \gamma^2}\right). \tag{A4}$$

The first-order condition of (A4) yields the wholesale price in Lemma 1; substituting this price in (A3) yields the Lemma 1 quantity levels; and substituting equilibrium wholesale price and quantities in (A1) and (A2), respectively, yields firm and supplier profits under cash pledges. ■

Proof of Lemma 2. Consider the outcome when the firm donates a fraction f of revenues in each segment. Given the supplier's wholesale price w and rival i's quantity $\tilde{q}_i$, firm F chooses $q_i,\ i = 1,\ldots n$, to solve:

$$\underset{q_i, i=1,\ldots n}{Max} \sum_{i=1}^{n}\left([1-f][a - q_i - \gamma\tilde{q}_i]q_i - wq_i - c\right). \tag{A5}$$

Similarly, given firm F's quantity q_i, rival i solves:

$$\underset{\tilde{q}_i}{Max}\ [a - \gamma q_i - \tilde{q}_i]\tilde{q}_i,\ i = 1,\ldots,n. \tag{A6}$$

Jointly solving the first-order conditions of (A5) and (A6) yields:

$$q_i(w) = \frac{a[1-f][2-\gamma] - 2w}{[1-f][4 - \gamma^2]} \text{ and } \tilde{q}_i(w) = \frac{a[1-f][2-\gamma] + \gamma w}{[1-f][4 - \gamma^2]},\ i = 1,\ldots,n. \tag{A7}$$

Given (A7), the supplier's problem is:

$$\underset{w}{Max}\ w\sum_{i=1}^{n} q_i(w) \equiv \underset{w}{Max}\ nw\left(\frac{a[1-f][2-\gamma] - 2w}{[1-f][4 - \gamma^2]}\right). \tag{A8}$$

The first-order condition of (A8) yields $w = a[1-f][2-\gamma]/4$. Using this wholesale price, and quantities from (A7), the donation in each segment equals:

$$f[a - q_i(w) - \gamma\tilde{q}_i(w)]q_i(w) = \frac{fa^2[6-\gamma^2]}{8[2+\gamma]^2}. \qquad \text{(A9)}$$

Equating the donation in (A9) to d, and solving for f, yields the f-value noted in Lemma 2. Using this f-value in $w = a[1-f][2-\gamma]/4$ yields the wholesale price in Lemma 2; substituting this price in (A7) yields the Lemma 2 quantity levels; and substituting equilibrium contingent donation, wholesale price and quantities in (A5) and (A8), respectively, yields firm and supplier profits under contingent donations. ■

Proof of Proposition 1. Using the expression for Π_F under cash pledges from Lemma 1 and under contingent donations from Lemma 2, firm profits in the latter case are higher by $nd[4-\gamma^2]/[6-\gamma^2] > 0$. ■

Proof of Lemma 3. Consider the outcome when the firm donates a fraction f of revenues in m out of n segment. Given the supplier's wholesale price w and rival i's quantity $\tilde{q}_i$, firm F chooses q_i, $i = 1,\ldots n$, to solve:

$$\underset{q_i, i=1,\ldots n}{Max} \sum_{i=1}^{m}\left([1-f][a - q_i - \gamma\tilde{q}_i]q_i - wq_i - c\right) + \sum_{i=m+1}^{n}\left([a - q_i - \gamma\tilde{q}_i]q_i - wq_i\right). \qquad \text{(A10)}$$

Given firm F's quantity q_i, rival i solves:

$$\underset{\tilde{q}_i}{Max}\ [a - \gamma q_i - \tilde{q}_i]\tilde{q}_i,\ i = 1,\ldots,n. \qquad \text{(A11)}$$

Jointly solving the first-order conditions of (A10) and (A11) yields:

$$\text{For } i = 1,\ldots,m,\ q_i(w) = \frac{a[1-f][2-\gamma] - 2w}{[1-f][4-\gamma^2]} \text{ and } \tilde{q}_i(w) = \frac{a[1-f][2-\gamma] + \gamma w}{[1-f][4-\gamma^2]}; \text{ and}$$

$$\text{For } i = m+1,\ldots,n,\ q_i(w) = \frac{a[2-\gamma] - 2w}{4-\gamma^2} \text{ and } \tilde{q}_i(w) = \frac{a[2-\gamma] + \gamma w}{4-\gamma^2}. \qquad \text{(A12)}$$

Given (A12), the supplier's problem, assuming it does not foreclose any market, is:

$$\underset{w}{Max}\ w\sum_{i=1}^{n} q_i(w) \equiv \underset{w}{Max}\ mw\left(\frac{a[1-f][2-\gamma] - 2w}{[1-f][4-\gamma^2]}\right) + [n-m]w\left(\frac{a[2-\gamma] - 2w}{4-\gamma^2}\right). \qquad \text{(A13)}$$

The first-order condition of (A13) yields the wholesale price in Lemma 3; substituting this in (A12) yields the equilibrium quantities; and substituting the wholesale price and quantities in (A10) and (A13), respectively, yields firm and supplier profits. ■

Proof of Proposition 2. We first derive the condition under which the supplier does not foreclose any market. In particular, the supplier has the option to set its wholesale price such that the firm finds it profitable to procure only for the markets in which it does not make a donation, i.e., the firm chooses $q_i(w) = 0$, $i = 1,...,m$. From (A12), the supplier's preferred wholesale price that achieves this objective is obtained by solving:

$$\underset{w}{Max}\ w \sum_{i=m+1}^{n} q_i(w) \equiv \underset{w}{Max}\ [n-m]w\left(\frac{a[2-\gamma]-2w}{4-\gamma^2}\right). \tag{A14}$$

The first-order condition of (A14) yields $w = a[2-\gamma]/4$, and using this in (A14), the supplier's profit when it forecloses m-segments is $[n-m]a^2[2-\gamma]/[8(2+\gamma)]$. Equating this to the Π_S-value in Lemma 3, the supplier does not foreclose if and only if:

$$f \le \overline{f} = \frac{n}{2n-m}. \tag{A15}$$

From Π_F in Lemma 3, it follows that the firm's profits are convex in f:

$$\frac{\partial^2 \Pi_F}{\partial f^2} = \frac{3a^2 m[n-m]n^2}{2[2+\gamma]^2[fm+(1-f)n]^3} > 0. \tag{A16}$$

From (A15) and (A16), firm profits are maximized at $f = 0$ or at $f = \overline{f}$. Using Lemma 3:

$$\Pi_F\big|_{f=0} = \frac{na^2}{4[2+\gamma]^2} - mc \quad \text{and} \quad \Pi_F\big|_{f=\overline{f}} = \frac{a^2[2n^2+mn-3m^2]}{4[2+\gamma]^2[2n-m]} - mc. \tag{A17}$$

From (A17), $\Pi_F\big|_{f=0}$ is maximized at $m = 0$. Also, $\Pi_F\big|_{f=\overline{f}}$ is concave in m, so its unique maximum is obtained by solving $\frac{\partial \Pi_F\big|_{f=\overline{f}}}{\partial m} = 0$. This yields $m = m^*$, as defined in Proposition 2. Thus, from (A17), the firm engages in philanthropy if and only if:

$$\frac{a^2[2n^2+m^*n-3m^{*2}]}{4[2+\gamma]^2[2n-m^*]} - m^*c > \frac{na^2}{4[2+\gamma]^2}. \tag{A18}$$

The condition in (A18) yields the c-condition noted in Proposition 2. In this case, $f^* = \overline{f}\big|_{m=m^*} = n/[2n-m^*]$. Using quantities from Lemma 3, $f = f^*$, and $m = m^*$, total donations equal:

$$D^* = m^* f^* \left[a - \left(\frac{a}{2[2+\gamma]} - \frac{af^*[n-m^*]}{2[2+\gamma][f^*m^*+(1-f)n]} \right) - \gamma\left(\frac{a[4+\gamma]}{4[2+\gamma]} + \frac{af^*\gamma[n-m^*]}{4[2+\gamma][f^*m^*+(1-f^*)n]} \right) \right] \left[\frac{a}{2[2+\gamma]} - \frac{af^*[n-m^*]}{2[2+\gamma][f^*m^*+(1-f^*)n]} \right]. \tag{A19}$$

Simplifying (A19) yields D^* listed in Proposition 2. Finally, tedious algebra verifies that given the upper bound on c, $0 < f^* < 1$ and $0 < m^* < n$. ■

Proof of Proposition 3. For $c < \frac{a^2}{4[2+\gamma]^2}$, using f^*, m^*, and D^* values from Proposition 2 yields:

$$\frac{\partial f^*}{\partial \gamma} = -\frac{c[2+\gamma]}{2a^2\sqrt{\frac{3}{8} - \frac{c[2+\gamma]^2}{2a^2}}} < 0;$$

$$\frac{\partial m^*}{\partial \gamma} = -\left[8\sqrt{2}ac[2+\gamma]n\right]\left[3a^2 - 4c[2+\gamma]^2\right]^{-3/2} < 0; \text{ and}$$

$$\frac{\partial D^*}{\partial \gamma} = -\left[\frac{a^2 m^*}{4[2+\gamma]^3[2n-m^*]^2 n}\right]\Big[-2(1+\gamma)m^{*3} + 4(3+2\gamma)m^{*2}n - 8(2+\gamma)m^* n^2 +$$

$$[(4+2\gamma-2\gamma^2-\gamma^3)m^{*2} - 2(2+\gamma)(5-2\gamma^2)m^* n + 4(2-\gamma)(2+\gamma)^2 n^2]\frac{\partial m^*}{\partial \gamma}\Big] < 0. \quad \blacksquare$$

Proof of Proposition 4. Under Bertrand competition, the strategic variables are retail prices (not quantities). Solving $p_i = a - q_i - \gamma\tilde{q}_i$ and $\tilde{p}_i = a - \tilde{q}_i - \gamma q_i$ yields $q_i(p_i, \tilde{p}_i) = \left[a(1-\gamma) - p_i + \gamma\tilde{p}_i\right]/[1-\gamma^2]$ and $\tilde{q}_i(p_i, \tilde{p}_i) = \left[a(1-\gamma) - \tilde{p}_i + \gamma p_i\right]/[1-\gamma^2]$. The arguments then follow the steps utilized in the proofs of Lemma 3 and Proposition 2. In particular, the analog to Lemma 3 under price competition is as follows:

$$w = \frac{a[2-\gamma-\gamma^2]}{2[2-\gamma^2]} - \frac{af[2-\gamma-\gamma^2]m}{2[2-\gamma^2][fm+(1-f)n]};$$

For $i = 1,\ldots,m$, $q_i = \frac{a}{2[2-\gamma][1+\gamma]} - \frac{af[n-m]}{2[2-\gamma][1+\gamma][fm+(1-f)n]}$ and

$$\tilde{q}_i = \frac{a[4+\gamma-2\gamma^2]}{2[2-\gamma][1+\gamma][2-\gamma^2]} + \frac{af\gamma[n-m]}{2[2-\gamma][1+\gamma][2-\gamma^2][fm+(1-f)n]};$$

For $i = m+1,\ldots,n$, $q_i = \frac{a}{2[2-\gamma][1+\gamma]} + \frac{afm}{2[2-\gamma][1+\gamma][fm+(1-f)n]}$ and

$$\tilde{q}_i = \frac{a[4+\gamma-2\gamma^2]}{2[2-\gamma][1+\gamma][2-\gamma^2]} - \frac{af\gamma m}{2[2-\gamma][1+\gamma][2-\gamma^2][fm+(1-f)n]};$$

$$\Pi_S = \frac{na^2[1-\gamma][2+\gamma]}{4[2-\gamma][1+\gamma][2-\gamma^2]} - \frac{a^2 f[1-\gamma][2+\gamma]mn}{4[2-\gamma][1+\gamma][2-\gamma^2][fm+(1-f)n]}; \text{ and}$$

$$\Pi_F = \frac{na^2[1-\gamma]}{4[1+\gamma][2-\gamma]^2} + \frac{a^2 f[1-\gamma][4f(n-m)-n]m}{4[1+\gamma][2-\gamma]^2[fm+(1-f)n]} - mc.$$

Following the logic in Proposition 2, the supplier's profit if it forecloses the first m-segments equals $\frac{[n-m]a^2[1-\gamma][2+\gamma]}{4[2-\gamma][1+\gamma][2-\gamma^2]}$. Equating this to the Π_S-value derived above, the supplier does not foreclose if and only if:

$$f \le \overline{f} = \frac{n}{2n-m}.$$

Again, Π_F is convex in f, so firm profits are maximized either at $f=0$ or at $f=\overline{f}$. At these values:

$$\Pi_F\big|_{f=0} = \frac{na^2[1-\gamma]}{4[1+\gamma][2-\gamma]^2} - mc \quad \text{and} \quad \Pi_F\big|_{f=\overline{f}} = \frac{a^2[1-\gamma][2n^2+mn-3m^2]}{4[1+\gamma][2-\gamma]^2[2n-m]} - mc.$$

Clearly, $\Pi_F\big|_{f=0}$ is maximized at $m=0$. Also, $\Pi_F\big|_{f=\overline{f}}$ is concave in m, and its maximum value is obtained at $m=m^{*B}$, as defined in Proposition 4. Thus, the firm engages in philanthropy if and only if:

$$\frac{a^2[1-\gamma][2n^2+m^{*B}n-3(m^{*B})^2]}{4[1+\gamma][2-\gamma]^2[2n-m^{*B}]} - m^{*B}c > \frac{na^2[1-\gamma]}{4[1+\gamma][2-\gamma]^2}.$$

The above inequality yields the c-condition noted in Proposition 4. In this case, $f^{*B} = \overline{f}\big|_{m=m^{*B}} = n/[2n-m^{*B}]$. Using quantities from Lemma 3, $f=f^{*B}$, and $m=m^{*B}$, total donations equal:

$$D^{*B} = m^{*B}f^{*B}\left[a - \left(\frac{a}{2[2-\gamma][1+\gamma]} + \frac{af^{*B}m^{*B}}{2[2-\gamma][1+\gamma][f^{*B}m^{*B}+(1-f^{*B})n]}\right) - \gamma\left(\frac{a[4+\gamma-2\gamma^2]}{2[2-\gamma][1+\gamma][2-\gamma^2]} + \frac{af^{*B}\gamma[n-m^{*B}]}{2[2-\gamma][1+\gamma][2-\gamma^2][f^{*B}m^{*B}+(1-f^{*B})n]}\right)\right] \times \left[\frac{a}{2[2-\gamma][1+\gamma]} + \frac{af^{*B}m^{*B}}{2[2-\gamma][1+\gamma][f^{*B}m^{*B}+(1-f^{*B})n]}\right].$$

These values for f^{*B}, m^{*B}, and D^{*B} are provided in Proposition 4(i). Given these closed form expressions, the proof of part (ii) follows from evaluating the sign of the corresponding derivatives as in the proof of Proposition 3. To prove part (iii), note that $m^* - m^{*B} > 0$ if both $c>0$ and $\gamma>0$; else $m^* - m^{*B} = 0$. From this result, and given the expressions for D^* and D^{*B} in Propositions 2 and 4, respectively, it follows that $D^* - D^{*B} > 0$ if $c>0$ and $\gamma>0$; else $D^* - D^{*B} = 0$. ■

Proof of Proposition 5. Rather than repeat the backward induction process, we simply note the outcome in all four feasible cases that correspond to whether or not donations are made in each of the two segments. In doing so, we assume $1 < a_1 / a_2 < 1 + \sqrt{2}$ – the lower bound is without loss of generality, and the upper bound ensures that the supplier does not foreclose either market in the absence of donations.

No donation in either segment

$$w = [a_1 + a_2]/4;\ q_1 = [3a_1 - a_2]/8;\ q_2 = [3a_2 - a_1]/8; \text{ and}$$

$$\Pi_F = \left[\frac{3a_1 - a_2}{8}\right]^2 + \left[\frac{3a_2 - a_1}{8}\right]^2.$$

Donation in both segments

$$f = 0;\ w = [a_1 + a_2]/4;\ q_1 = [3a_1 - a_2]/8;\ q_2 = [3a_2 - a_1]/8; \text{ and}$$

$$\Pi_F = \left[\frac{3a_1 - a_2}{8}\right]^2 + \left[\frac{3a_2 - a_1}{8}\right]^2 - 2c.$$

Donation only in segment 1

$$f = 0;\ w = [a_1 + a_2]/4;\ q_1 = [3a_1 - a_2]/8;\ q_2 = [3a_2 - a_1]/8; \text{ and}$$

$$\Pi_F = \left[\frac{3a_1 - a_2}{8}\right]^2 + \left[\frac{3a_2 - a_1}{8}\right]^2 - c.$$

Donation only in segment 2

$$f = 1 - \frac{a_1^2}{a_2[a_2 + 2a_1]};\ w = \frac{a_1^2}{2[a_1 + a_2]};\ q_1 = \frac{a_1[2a_2 + a_1]}{4[a_1 + a_2]};\ q_2 = \frac{a_2^2}{4[a_1 + a_2]}; \text{ and}$$

$$\Pi_F = \frac{a_1^2[5a_2 + 2a_1]}{16[a_2 + 2a_1]} - c.$$

From the above, the firm profits are highest either if it does not donate or if it donates only in segment 2. Thus, the firm engages in philanthropy if and only if:

$$\frac{a_1^2[5a_2 + 2a_1]}{16[a_2 + 2a_1]} - c > \left[\frac{3a_1 - a_2}{8}\right]^2 + \left[\frac{3a_2 - a_1}{8}\right]^2.$$

Simplifying the above yields the upper bound on c noted in the proposition. ■

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