

# An Internet-Enabled Donor-to-Nonprofit (D2N) Marketplace<sup>§</sup>

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## Abstract

Online intermediaries have recently started offering database services to donors and certification services to nonprofit organizations through the Internet. We conceptualize a Donor-to-Nonprofit (D2N) marketplace as an online intermediary that offers these two services and examine its effect on fundraising strategies of nonprofit organizations using an analytical model based on spatial competition under incomplete information and with donor search. We characterize the signaling equilibria where certification of quality conveys sometimes clear and sometimes noisy information about organizational effectiveness in generating socially valuable services. Interestingly, the emergence of the marketplace may lead to a drop in the total net fundraising revenues in the market, despite the fact that its database service eliminates search costs for some of the donor population. We also show that, given the choice, a service-maximizing D2N marketplace prefers a less costly and less accurate certification process over a more costly and more accurate one.

**Key Words:** *Nonprofit organizations, fundraising, charity certification, online marketplaces*

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## **1. Introduction**

The nonprofit sector accounts for 5% of GDP and 8% of wages and salaries paid in the U.S. With accumulated assets of almost \$1 trillion, nonprofit organizations constitute one of the largest economic sectors in the United States, even larger than banking and electronics (Jansen and Katz 2002). Every year Americans donate over two percent of their income to charitable organizations on average. Despite its importance, there is surprisingly little research in information systems (IS) about this particular sector, especially given the recent developments on the Internet.

Nonprofit organizations often are charitable or service organizations whose primary objectives are to support an issue or cause for non-commercial purposes. Each charity identifies itself with its mission, which can be related to homelessness, women's rights, human services, education, environment, etc., in both broad and narrow terms. To perform mission-related operations, charities engage in the process of soliciting and gathering money or other gifts in-kind collected from individuals, businesses, or governmental agencies. This process is also known as fundraising and is by far the most significant revenue source for charities in general. Most nonprofit organizations are small-sized institutions with annual budgets less than \$100,000. Nearly 700,000 of them are public charities that are classified as 501(c)(3) organizations by the Internal Revenue Service.

What makes the nonprofit sector interesting for IS researchers is that recent developments stand to alter fundraising strategies in profound ways. Of particular interest are the online intermediaries that offer information services to both charities and prospective donors. One of the pioneering online intermediaries is GuideStar.org, which provides prospective donors a comprehensive database service with information on more than 1.7 million charities in the U.S.

Global Giving ([www.globalgiving.com](http://www.globalgiving.com)), like many of its kind, provides a medium that allows nonprofit organizations from all over the world to post social projects on the website for funding. The organizations posting projects are pre-screened and monitored regularly.

Another important service provided by the intermediaries is online evaluation, accreditation, and seal programs that aim to help charities comply with government regulations and assist donors to make better informed decisions. Such services are offered by the American Institute of Philanthropy ([www.charitywatch.org](http://www.charitywatch.org)), CharityNavigator.org, and the Better Business Bureau ([www.give.org](http://www.give.org)) for fees as high as \$15,000. Charities have been reported to use these services to differentiate themselves from the competition (Quinn 2006). These programs essentially provide potential donors with information about an organization's governance, fundraising, and other fiscal practices. They also evaluate and rate nonprofit organizations by using different standards, leaving it up to donors to choose their own criteria when deciding on a donation. For example, the Maryland Association of Nonprofit Organizations' accreditation program ([www.standardsforexcellenceinstitute.org](http://www.standardsforexcellenceinstitute.org)) enforces about 55 governance and operation standards, including those on overhead limits, frequency of board meetings, and financial oversight. Organizations satisfying these criteria are granted a "Seal of Excellence." The Better Business Bureau's (BBB) Wise Giving Alliance ([www.give.org](http://www.give.org)) offers nonprofit organizations a voluntary evaluation system and a seal of approval that is granted based on 20 financial and governance standards. Another example is the program implemented by the American Institute of Philanthropy ([www.charitywatch.org](http://www.charitywatch.org)), which grades about 500 large nonprofit organizations using a scale from A to F. The grading mechanism is based on several financial criteria, such as the cost of raising \$100. Similarly, Charity Navigator ([www.charitynavigator.org](http://www.charitynavigator.org)) rates more than 5,000 nonprofit organizations according to their financial health by using data from the

Internal Revenue Service filings of organizations. The rating method depends on several organizational metrics, such as fundraising efficiency measured by the amount spent to raise \$1 in charitable contributions. Finally, the Evangelical Council for Financial Accountability ([www.ecfa.org](http://www.ecfa.org)) accredits and offers a seal to Christian ministries by examining their governance, financial transparency, and fundraising practices. Table 1 summarizes the characteristics of some of the major online database and certification services.

Name and Website	Scope of the Service Offered
GuideStar ( <a href="http://www.guidestar.org">www.guidestar.org</a> )	Online database on program and financial information of 1.7 million nonprofit organizations in the United States.
The Standards for Excellence Institute ( <a href="http://www.standardsforexcellenceinstitute.org">www.standardsforexcellenceinstitute.org</a> )	Online voluntary certification program for nonprofit organizations based on 55 governance and operation standards.
The Wise Giving Alliance ( <a href="http://www.give.org">www.give.org</a> )	A voluntary evaluation system and a seal of approval program for organizations according to 20 financial and governance standards.
The American Institute of Philanthropy ( <a href="http://www.charitywatch.org">www.charitywatch.org</a> )	Online grading program for large nonprofit organizations based on the organizations' financial statements.
Charity Navigator ( <a href="http://www.charitynavigator.org">www.charitynavigator.org</a> )	Online charity rating program that provides information on several organizational criteria such as financial health and fundraising efficiency.
The Evangelical Council ( <a href="http://www.ecfa.org">www.ecfa.org</a> )	Online seal and accreditation program for Christian ministries based on their governance and financial transparency.

Table 1. Online database and certification services

In short, the Internet is enabling the formation of ubiquitous digital marketplaces that stand to wring the inefficiencies out of fundraising processes through the dissemination of transparent information about nonprofit organizations. In this paper, we focus on the impact of what we call a Donor-to-Nonprofit (D2N) marketplace on fundraising markets. We consider the D2N marketplace as an online intermediary that offers two services: a database service for donors and a certification service for nonprofit organizations. The marketplace maintains a

comprehensive database that details the mission, program information, and contact information of the organizations in the market. In addition, the marketplace can audit and certify the effectiveness of an organization in generating social value from donation dollars. Referred to as “quality,” this effectiveness is assumed to influence donors’ willingness-to-donate.

We are concerned with the following research questions. What prices can a D2N marketplace expect to charge for its services? What will be the impact of these services on charities’ fundraising revenues? How will the online services affect total fundraising revenues in the market? How do the results vary depending on the characteristics of these services? The answers to these questions would be of potential interest to fundraising administrators, managers of D2N marketplaces, and scholars in information systems and nonprofit studies.

We first establish that a service-maximizing D2N marketplace should offer free access to its database service. We find that certification services are likely to induce competition in fundraising markets, since organizations facing certified competitors should increase their fundraising efforts at optimality. This is ironic because excessive fundraising is typically considered to be wasteful in this sector. We then characterize the signaling equilibria where certification of quality conveys sometimes clear and sometimes noisy information about organizational effectiveness in generating socially valuable services. Interestingly, the emergence of the marketplace may lead to a drop in the total net fundraising revenue in the market. We also show that, given the choice, a service-maximizing D2N marketplace will prefer a less costly and less accurate certification process over a more costly and more accurate one.

The paper proceeds as follows. We provide a brief survey of the relevant literature in the next section. We set up the model in Section 3 and present the analysis in Section 4. The last section provides a discussion of results and concluding remarks.

## **2. Literature Review**

Our paper draws upon three areas of research: the nonprofit sector, incomplete information in spatial markets, and quality certification programs on the Internet. We highlight some of the major research findings from each area that are relevant to the current study.

### **2.1. Nonprofit Sector and the Internet**

The nonprofit sector has witnessed an increasing competition and a more performance-driven approach to management of nonprofit organizations over the years (Porter and Kramer 1999). Ritchie et al. (1999) argue that if a new technology offers more efficient and cost-effective solutions to the nonprofit sector, competition among organizations intensifies. Indeed, nonprofit organizations have started using the Internet to disseminate information, interact with donors, and fundraise (Lee et al. 2001, Pollach et al. 2005). They have also leveraged it to differentiate themselves from competition by having their qualities certified and communicating this information (Quinn 2006). Finally, branding is an important tool for nonprofit organizations to gain a competitive advantage (Treiblmaier et al. 2003, Quelch et al. 2004). With the proliferation of the Internet, development of an effective brand has become even more essential because these technologies enable organizations to reach donors without geographical barriers. This paper confirms the importance of these issues as it focuses on fundraising strategies of nonprofit organizations in the presence of the new online services.

### **2.2. Spatial Differentiation and Incomplete Information**

The literature on spatial differentiation originates from Hotelling's linear city model, where it is shown that competition for a market share between duopolists results in minimum differentiation (Hotelling 1929). In a slightly modified version of the original Hotelling model, D'Aspremont et al. (1979) show that profit maximizing firms choose maximum differentiation. Extensive

research on the linear city model has emerged since then (De Palma et al. 1987, Bockem 1994, Nero 1999, Kim and Serfes 2006). One of the most famous variations of Hotelling's linear city model is Salop's circular city model, which is used to analyze the pricing decisions of oligopoly firms located around a circle (Salop 1979). Variants of Salop's model abound as well, including the works of Martinez-Giralt and Neven (1988), Dewan et al. (2003), Gupta et al. (2004), and Pal and Sarkar (2006). Furthermore, Balasubramanian (1998), Bouckaert (2000), Byers and Lederer (2001), King et al. (2004), and Viswanathan (2005) investigate the effects of innovative marketing channels, such as mail order or the Internet, on retailers' choices of distribution channel strategies. These papers typically examine the strategies of profit-maximizing firms that sell differentiated products. In this study, we use a modified version of the linear city model in a context where nonprofit organizations contact donors to maximize their total net fundraising revenues.

Another distinguishing aspect of our model is that donors have incomplete information about the organizational qualities. The literature on incomplete information in spatial markets is quite limited, and is confined to traditional markets in which physically proximate and locally constrained firms sell their products and services; see Polo (1991), Boyer and Moreaux (1993), and Boyer et al. (2003). More recent research, however, aims to extend the existing theory into online platforms by applying it to niche markets, such as online consultation initiatives in the healthcare industry (Ozdemir et al. 2006).

### **2.3. Quality Certification Programs on the Internet**

Certification of quality through seals of approval by third-party institutions has been a common practice in many industries for several years. It is argued that such certifications significantly affect consumer perception (Parkinson 1975) because they are considered to be useful

mechanisms for communicating a threshold of quality to uninformed consumers (Bennett and McCrohan 1993). Due to consumers' perceived risk of online transactions (Bailey and Bakos 1997), the use of similar seals of certification is especially important for e-commerce companies (Hoffman et al. 1999, Kim 2003, Rees et al. 2003). For example, by developing an evolutionary game theoretic model, Ba et al. (1999) demonstrate that disseminating information on quality through the use of third-party online intermediaries by e-commerce companies is a stable strategy in equilibrium. This implies that such a strategy will be eventually adopted by most e-commerce companies. Palmer et al. (2000) empirically investigate the role of online intermediaries offering seals of approval services in the development of trust on the Internet. They find that web sites that have a large number of incoming links tend to obtain seals of approval. In their experimental study, Miyazaki and Krishnamurthy (2002) find that participation in online seals of approval programs by e-commerce companies positively affects consumer perception on the Internet. We, too, consider the impact of such a program on fundraising strategies of organizations in the nonprofit sector.

### **3. A Model of Fundraising**

In this section we specify a game theoretic model of fundraising in a market for heterogeneous charity services. Our setting involves a variant of Hotelling's linear city market that allows us to examine the role played by a D2N marketplace in the competitive equilibrium.

#### *Charity Characteristics*

There are two nonprofit organizations in the market. By analogy to spatial competition, we represent each nonprofit organization as a point at each end of a line of unit length, where the unit line represents differentiation with respect to mission. In other words, the organizations have fixed locations (strategic missions) that involve significant sunk costs. For example, an

organization could be a university with its mission being "...to serve the residents of State X, the United States, and the world through discovery that expands the realm of knowledge, learning through dissemination and preservation of knowledge, and engagement through exchange of knowledge." Another organization could be Young Women's Christian Association (YWCA) with its mission being to eliminate racism and empower women.

We assume that organizations may be differentiated with respect to their effectiveness in performing their missions. Factors such as past experience and cost efficiency in managing social projects may allow a nonprofit organization to outperform others. In addition to these inherent capabilities, nonprofit organizations may also differ in terms of their trustworthiness. As indicated in a recent Newsweek issue (Quinn 2006), many organizations simply squander the donations they collect. Note that both the inherent capabilities and the trustworthiness of nonprofit organizations are difficult to observe. Therefore, organizations are differentiated based on organizational effectiveness, and we assume for simplicity that they can be of either high or low quality (denoted by the subscripts  $h$  and  $l$ , respectively). While organizational type is private information, the prior probability of an organization being high quality is common knowledge and is denoted with  $\alpha$ .

The organizations in our model aim to maximize net fundraising revenue, since this is the objective most consistent with the existing empirical studies on the objective functions of nonprofits. Steinberg (1986) examines the revealed objectives of nonprofits in five industries and sets a tradition in this literature by interpreting *net fundraising revenue maximization* as being equivalent to *charitable output and service maximization*. His results show that public welfare, education, and arts nonprofits maximize service (i.e., net fundraising revenue). In a similar vein, Posnett and Sandler (1989) study the demand for donations for charities in the U.K.

and report that nonprofits are net fundraising revenue maximizers. Rose-Ackerman (1982), Khanna et al. (1995), Tinkelman (2004), and Brooks (2005) all find evidence for the maximization of net fundraising revenue and service.

### ***Donor Preferences***

Potential donors are differentiated with respect to their charity preferences and are distributed uniformly along the linear market. A potential donors' willingness to give to an organization depends on three characteristics: (i) her own type (denoted by  $i \in \{H, L\}$ ), (ii) her mission preference, and (iii) the expected quality (denoted by  $q$ ) of the organization being considered. The first of the three characteristics is related to differences in potential donors' ability to give. The second characteristic is related to the concept of horizontal differentiation typically employed in analytical studies; donors differ in their personal mission preferences and the causes they support. The third characteristic is related to the concept of vertical differentiation and captures the expected ability and effectiveness of a nonprofit organization in generating a socially valuable service. We next explain these three characteristics in more detail.

First, there are two types of potential donors: those who have a high willingness to give (the high type) and those who have a low willingness to give (the low type), with the high type donors comprising  $\gamma$  proportion of the market. The maximum willingness to give for the two types of donors are given by  $z_i \theta(q)$ , where  $z_H > z_L$  and  $\theta$  is a function of expected quality. Both types are uniformly distributed along the linear market.

Second, each potential donor is identified by the point on the line which corresponds to her most preferred mission. We assume that potential donors' willingness to give to an organization decreases linearly with their distance from the organization. More specifically, the willingness to give for a potential donor of type  $i$  to an organization with expected quality  $q$  and

with a mission  $x$  units away from the donor's most desired mission is given by  $D_i(x, q) = \max\{0, z_i\theta(q) - tx\}$ , where the parameter  $t$  represents the misfit cost per unit distance which measures the sensitivity of potential donors to differences in missions. The organizations know only the distribution of mission preferences in the market. Without loss of generality, we normalize  $z_L$  to one and take  $z_H = z$ .

Finally, potential donors' willingness to donate increases with the expected quality of the organization under consideration. In specific, denoting the probability of the organization being high quality with  $q$ , we adopt the following functional form:  $\theta(q) = q\theta_h + (1-q)\theta_l$ , where  $\theta_h > \theta_l \geq 0$ . Please note that  $q$  equals  $\alpha$  (the prior probability of an organization having high quality) at the start of the game.

Potential donors derive a utility from giving and a disutility from having to search in order to donate. We assume that the utility of giving is proportional to the amount of giving and that the utility enjoyed by a donor of type  $i \in \{H, L\}$  who is  $x$  units away from an organization with an expected quality  $q$  is given by  $U_i(x, q) = uD_i(x, q) - S$ , where  $u$  is a parameter and  $S$  represents the total cost of search associated with "learning" the existence of the organization and its mission. The next subsection describes the information structure and the associated concept of donor search.

### ***Information Structure and Donor Search***

We employ an information structure similar to that in Grossman and Shapiro (1984). Potential donors rely on information garnered from organizations' solicitations as well as their own searches to locate specific charities in the mission space. In other words, a potential donor may know that a service with certain characteristics is being provided in the market, but she does not know *a priori* which charity provides a service of a given nature. A solicitation tells the

potential donor the characteristics of the service provided by the solicitor as well as its mission. We assume that potential donors remember all solicitations that are successfully transmitted to them.

Organizations choose to present their missions truthfully in their solicitations, as our model provides no incentive for deceptive soliciting. Not knowing the precise mission preferences of individual donors, organizations cannot target solicitations towards donors who value their missions most (i.e., those potential donors nearby on the line). Having limited resources, organizations are likely to find contacting additional donors increasingly expensive. The target population may also be differentiated based on their tendency to pay attention to solicitations. We therefore assume that the total cost of achieving a reach of  $r$ ,  $0 \leq r \leq 1$ , is given by the convex function,  $vr^2/2$ , where  $v$  is a cost parameter (Tirole 1997, p. 292). A fundraising reach of  $r$  means that a fraction  $r$  of the target population is exposed to the message at least once. The fundraising reach decisions are private information.

Potential donors become actual donors only when they give a positive amount, and they give only if they are aware of the existence of an organization whose mission they like. In contrast to Grossman and Shapiro (1984), market participants are not passive in our model and can search (when necessary) for a charity that suits their taste. Through personal costly search, potential donors can find out about an organization, its mission, and the services it offers. The necessity of search arises especially when a potential donor is not solicited by any of the organizations in the market. Our setting is similar to Wolinsky (1984) in that potential donors can sample organizations and find out their contact information, mission, and services at a cost  $s$  per organization. The sampling process is without replacement and is assumed to be with perfect recall (at each stage the donor remembers the previously sampled organization(s) and can pick

anyone of them without incurring the search cost again).<sup>1</sup> In the absence of additional information, potential donors do not have a way of sampling the desired organization first.

Not all unsolicited potential donors actually search, as it is reasonable to conceive that at least for some donors the cost of search exceeds the expected utility of giving, perhaps because of the possibility that they will not be able to find an organization with a mission that inspires them to donate a positive amount. We therefore assume that the unit cost of misfit ( $t$ ) and the cost of sampling an organization ( $s$ ) are sufficiently high such that there exists some low type potential donors in the market who never donate to an unpreferred organization nor do they search ( $\theta_h < \min\{t/2, s/u\}$ ).

### *The D2N Marketplace*

Following the practices of prominent intermediaries such as GuideStar and Charity Navigator, we consider a D2N marketplace that maintains a database that contains detailed information about the organizations and a voluntary certification service. Accessing the database allows the subscriber to learn the contact information and the mission of both organizations in the market, eliminating the need for further (offline) search on the donor's part. Only  $\delta$  proportion of potential donors are aware of the database and have internet access to use the service. Of those,  $\gamma'$  proportion are of the high type. (We distinguish this proportion from  $\gamma$  since the ability to access the database may be correlated with the willingness to give.) The marketplace charges a fixed fee (denoted by  $p_d$ ) for subscription to use the service. The marginal cost of enrolling a new subscriber is normalized to zero.

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<sup>1</sup> The sampling process is without replacement when the donor, after contacting an organization, remembers his actions and never contacts the same organization twice. The sampling process is with replacement when the donor may contact the same organization on several occasions.

In line with current practice such as that of the BBB's Wise Giving Alliance (www.give.org), the D2N marketplace also provides a certification service about organizational quality. The marketplace charges  $p_c$  for each certification application and incurs a marginal cost  $c$  during the process. A certification of quality is an additional piece of information that may alter donors' perception about the quality of organizations in our model. The certification process is such that high quality organizations always get certified, and low quality organizations may also manage to be certified with some probability.<sup>2</sup> This noisy setup allows us to examine the effectiveness of certification on equilibrium outcomes. We denote the probability that the marketplace correctly identifies a low quality organization with  $\mu$ , and henceforth refer to this parameter as the accuracy of certification.

Since the current major providers of database and nonprofit certification services are nonprofits, the D2N marketplace in our model is a nonprofit as well. Given that the model is concerned with only the services provided by the marketplace and not its fundraising activities, we assume that the marketplace prices its services to maximize usage while making sure that its costs are covered.

### ***Equilibrium Concept***

The game described above is one of incomplete information, and perfect Bayesian equilibrium (Fudenberg and Tirole 1992, pp. 321-330) is the most appropriate game theoretic refinement that can be utilized in solving it. In such an equilibrium, the strategies of market players are required to yield a Bayesian equilibrium at every stage of the game in accordance with the posterior beliefs, which are updated using Baye's law whenever it is applicable.

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<sup>2</sup> We thank an anonymous reviewer for suggesting this noisy setup.

The extensive form of this game is as follows. In the first stage, the D2N marketplace decides which services to offer and announces its price(s) for its chosen service(s). In the second stage, organizations observe their own qualities and decide whether (if offered) to apply for quality certification, the results of which will be available to both organizations. Organizations then solicit for donations (with or without the certification information). In the third stage, potential donors update their beliefs about the quality of contacting organizations based on the available certification (or lack thereof). The fourth stage features donor search. If not contacted or after being contacted by an unpreferred organization, potential donors decide on whether to search while taking into account the expected value and cost of search. The search process may continue until a donor finds its preferred organization. Potential donors may either do a traditional (offline) search or subscribe to the marketplace’s database and search there. In both cases donors learn the certification status of the organization(s) they find. Finally, in the fifth stage, each potential donor decides where and how much to donate. The stages of the game are illustrated in Figure 1.

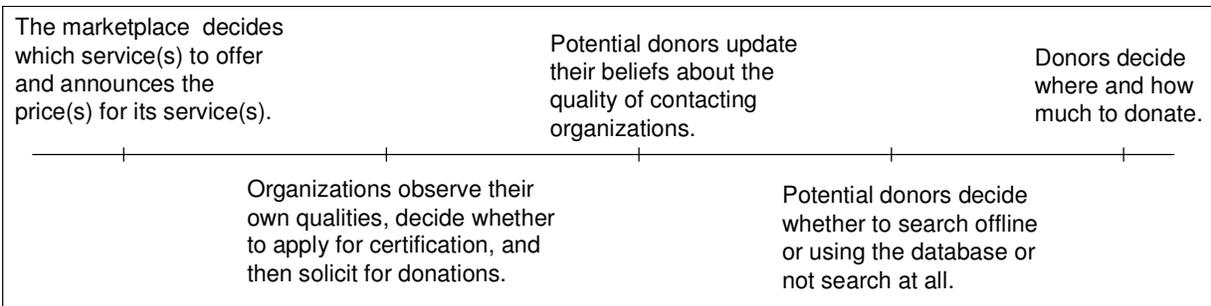


Figure 1. The extensive form of the game.

## 4. Analysis

### 4.1. Benchmark Case: The Traditional Market

For benchmarking purposes, we first analyze the case where organizations fundraise and donors search and donate without using the services of the D2N marketplace. Let us first derive potential donors' optimum search behavior, given their expectations and the cost of search. With none of the organizations certified ( $q = \alpha$ ), the expected value of  $\theta(q)$  equals

$$\theta_b \equiv \alpha\theta_h + (1 - \alpha)\theta_l. \quad (1)$$

From the perspective of potential donors, there are three possibilities once solicitations are complete. Namely, a potential donor may be contacted by (i) both organizations, (ii) only one of the organizations, and (iii) none of the organizations. When a potential donor is contacted by both organizations, the donor does not need to search because she then knows her preferred organization (i.e., the one nearby on the line) and donates to it accordingly. When a potential donor is contacted by only one of the organizations, there is no need for search if the soliciting organization is the preferred one. On the other hand, if it is the unpreferred one, the optimal search decision depends on the value and cost of search. Suppose that a high type potential donor is contacted by an organization  $x$  units away from her, where  $x > 1/2$ .<sup>3</sup> She can improve on it only by finding the other organization which is at a distance  $1 - x < 1/2$ . Her utility is  $u(z\theta_b - tx)$  when she does not search versus  $u(z\theta_b - t(1 - x)) - s$  when she does. Thus, search is preferable when  $x > \frac{1}{2} + \frac{s}{2ut}$  and will occur with probability  $1 - \frac{s}{ut}$  whenever a high type potential donor is contacted by only one of the organizations.

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<sup>3</sup> Low type potential donors do not search in this case given  $\theta_h < \min\{t/2, s/u\}$ .

Suppose now that a potential donor is not contacted by any of the organizations and decides to search. Given her expectations, the first organization she finds will be her preferred one ( $x < 1/2$ ) with probability  $1/2$ , in which case there will not be a need for further search, and the donor will obtain an expected utility of  $u\left(z\theta_b - \frac{t}{4}\right) - s$ . With probability  $\frac{1}{2}\left(1 - \frac{s}{ut}\right)$ , the organization will be the unpreferred one and another search will be conducted, yielding an expected utility of  $u\left(z\theta_b - \frac{t}{4}\right) - 2s$ . Finally, with probability  $\frac{s}{2ut}$ , the organization will be the unpreferred one and another search will *not* be conducted, resulting in an expected utility of  $u\left(z\theta_b - t\left(\frac{1}{2} + \frac{s}{4ut}\right)\right) - s$ . After simplification, we find the expected utility of a high type donor not contacted by any organization and who decides to search as  $u\left(z\theta_b - \frac{t}{4}\right) - \frac{s}{8}\left(13 - \frac{3s}{8ut}\right)$ . This expression is assumed to be positive; otherwise, all potential donors will be passive because only those who are contacted by an organization will actually donate.

Given the optimal search behavior described above, let us now derive organizations' optimal fundraising levels. We index the organizations with numbers 1 and 2, denote the reach of the organizations' solicitations by  $r_1$  and  $r_2$ , and assume that the probability of being solicited by one organization is independent of the probability of being solicited by the other organization. Then, the probability that a potential donor gets contacted by both organizations is  $r_1r_2$ , that she gets contacted only by organization 1 is  $r_1(1 - r_2)$ , that she gets contacted only by organization 2 is  $r_2(1 - r_1)$ , and that she does not get contacted at all is  $1 - r_1 - r_2 + r_1r_2$ . Note that only  $\gamma$  proportion of the contacted potential donors will be of the high type. In the case of these donors,

each organization raises a fundraising revenue of  $\frac{z\theta_b}{2} - \frac{t}{8}$  from those contacted by both

organizations,  $z\theta_b\left(\frac{1}{2} + \frac{s}{2ut}\right) - \frac{t}{2}\left(\frac{1}{2} + \frac{s}{2ut}\right)^2$  from those contacted by itself only,

$z\theta_b\left(\frac{1}{2} - \frac{s}{2ut}\right) - \frac{t}{2}\left(\frac{1}{2} - \frac{s}{2ut}\right)^2$  from those contacted by the other organization only, and

$\frac{z\theta_b}{2} - \frac{t}{8} - \frac{s^2}{8u^2t}$  from those not solicited by any organization (please see the Appendix for

details). Low type donors on average donate  $\frac{\theta_b^2}{2t}$  when contacted by their preferred

organization. We obtain fundraising revenues of the two organizations by multiplying these

expressions with their associated probabilities given the organizations' fundraising efforts.

Optimizing net fundraising revenues with respect to  $r_1$  and  $r_2$  (organizations keep soliciting for

donations until the marginal increase in fundraising revenue equals the marginal increase in

contact costs), we find the optimal (symmetric) reach to be

$$r_b = \frac{2u(\gamma s(2z\theta_b - t) + 2(1 - \gamma)u\theta_b^2)}{8vu^2t - \gamma s^2}. \quad (2)$$

From this we obtain the fundraising revenue ( $R_b$ ) and the net fundraising revenue ( $NR_b$ ) as

$$R_b = \gamma\left(\frac{z\theta_b}{2} - \frac{t}{8} - \frac{s^2(1 - r_b^2)}{8u^2t}\right) + (1 - \gamma)\frac{\theta_b^2 r_b}{2t}, \text{ and} \quad (3)$$

$$NR_b = R_b - \frac{v}{2}r_b^2. \quad (4)$$

All proofs are in the Appendix. Total fundraising revenue in the market is twice the amount

raised by each firm. As expected, fundraising revenues increase with the expected quality of

organizations and fundraising reach, while they decrease with search and contact costs.

## 4.2. The Market with the D2N Marketplace

### *The Database Service Only*

Let us now determine the optimal fundraising reach when only the database service of the D2N marketplace goes online. Given that the marketplace is a service maximizer, it reduces its subscription price for as long as doing so increases usage.

**Lemma 1.** *The D2N marketplace provides the database service free of charge.*

This result is consistent with current practice; database services such as those of GuideStar.org and Give.org are provided for free. The implication of Lemma 1 is that, with the D2N marketplace,  $\delta$  fraction of the donor population finds its preferred organization without having to go through a costly offline search. Still, the organizations continue fundraising to reach the uninformed segment of the market. We find the corresponding optimal fundraising reach as

$$r_{db}^* = \frac{2(1-\delta)u(\gamma''s(2z\theta_b - t) + 2(1-\gamma'')u\theta_b^2)}{8vu^2t - \gamma''s^2 + \delta\gamma''s^2}, \quad (5)$$

where  $\gamma'' = (\gamma - \delta\gamma')/(1 - \delta)$  is the fraction of high type donors who are unaware of the database service or unable to use it. Note that (5) reduces to (2) when  $\delta = 0$ . As expected, the optimal fundraising reach decreases with the accessibility of the database service.

### *Both Database and Certification Services*

With the availability of the certification service, there arises the possibility of different certification outcomes for the applicants and hence asymmetric fundraising strategies. Organizations can have two posterior types: those that have successfully obtained certification (denoted with  $y$ ), and those that either did not apply for certification or could not obtain one

(denoted with  $n$ ). We find the optimal fundraising reach for an organization of posterior type  $j \in \{y, n\}$  facing a competing organization of posterior type  $k \in \{y, n\}$  to be

$$r_c^*(j, k) = \frac{2(1-\delta)u(2u(1-\gamma')(8vu^2t\theta_j^2 + \gamma's^2(1-\delta)\theta_k^2) + \gamma's(z\theta_j + z\theta_k - t)(8vu^2t + \gamma''s^2 - \delta\gamma''s^2))}{(8vu^2t - \gamma''s^2 + \delta\gamma''s^2)(8vu^2t + \gamma''s^2 - \delta\gamma''s^2)}. \quad (6)$$

Note that (6) reduces to (5) when  $\theta_j = \theta_k = \theta_b$  and  $\delta = 0$ . We can now state our first proposition, which suggests that nonprofit organizations should fundraise more when they face quality-certified opponents than when they do not.

**Proposition 1.** *The optimal fundraising reach increases with an organization's expected quality level. The optimal fundraising reach increases further when the competing organization is certified.*

Both  $\theta_j$  and  $\theta_k$  in equation (6) depend on the equilibrium belief that a certificate holder is of high quality. Given this equilibrium belief  $\rho$ , we denote the net fundraising revenue of the organization of posterior type  $j$ , facing a competing organization of posterior type  $k$ , that follows the fundraising strategy as specified in (6) by  $NR_c(j, k | \rho)$ .

There are three types of perfect Bayesian equilibria: separating, pooling, and hybrid. In a separating equilibrium, only high quality organizations seek certification where donors expect the holder of an online quality certificate to be of high quality with certainty (i.e.,  $\rho = 1$ ). In a pooling equilibrium, both types of organizations apply for certification. In a hybrid equilibrium, high quality organizations always get certified, while low quality organizations randomly apply for certification. Organizations that do not apply for certification are always believed to be of low quality with certainty.

For a separating equilibrium to exist, applying for a certification should not be worthwhile for a low quality organization. In other words, the expected increase in net fundraising revenues due to the application should be negative. Given the accuracy of certification  $\mu$ , the next two equations show the expected increases in net revenues for high and low quality organizations, respectively, in an equilibrium where only high quality organizations apply for certification and the holder of a certificate is believed to be of high quality with certainty ( $\rho = 1$ ).

$$\Delta NR_c^h(\rho = 1) = \alpha(NR_c(y, y|1) - NR_c(n, y|1)) + (1 - \alpha)(NR_c(y, n|1) - NR_c(n, n|1)) \quad (7)$$

$$\Delta NR_c^l(\rho = 1) = (1 - \mu)\Delta NR_c^h \quad (8)$$

We assume  $\Delta NR_c^h(\rho = 1) \geq c$ , otherwise the certification service is never used. Suppose the following is true.

$$\frac{c}{1 - \mu} > \Delta NR_c^h(\rho = 1) \quad (9)$$

No matter what the D2N marketplace charges for certification at or above its cost, a low type organization is never interested in applying for it. A high quality organization, on the other hand, will always get certified as long as the price  $p_c$  is less than the expected benefit ( $\Delta NR_c^h(\rho = 1)$ ). Clearly, these strategies and beliefs form a perfect Bayesian equilibrium, so equation (9) is necessary and sufficient for the existence of a separating equilibrium.

Let us now consider the pooling equilibrium where both types of organizations always apply for certification. In this case the expected increase in net fundraising revenues due to the application should be positive for a low quality organization as well. Since a low quality organization will obtain the certificate with probability  $1 - \mu$ , according to Baye's rule the holder of a certificate will be of high quality with probability  $\hat{\alpha} = \alpha / [\alpha + (1 - \mu)(1 - \alpha)]$ . The

next two equations provide the expected increases in net revenues for high and low quality organizations, respectively, in an equilibrium where both types of organizations apply for certification and the holder of a certificate is believed to be of high quality with probability  $\hat{\alpha}$ .

$$\begin{aligned} \Delta NR_c^h(\rho = \hat{\alpha}) &= (1 - \mu(1 - \alpha))(NR_c(y, y | \hat{\alpha}) - NR_c(n, y | \hat{\alpha})) \\ &\quad + \mu(1 - \alpha)(NR_c(y, n | \hat{\alpha}) - NR_c(n, n | \hat{\alpha})) \end{aligned} \quad (10)$$

$$\Delta NR_c^l(\rho = \hat{\alpha}) = (1 - \mu)\Delta NR_c^h(\rho = \hat{\alpha}) \quad (11)$$

Suppose the following is true.

$$\Delta NR_c^h(\rho = \hat{\alpha}) > \frac{c}{1 - \mu} \quad (12)$$

As long as the price of certification ( $p_c$ ) is less than the expected benefit for a low quality firm  $((1 - \mu)\Delta NR_c^h(\rho = \hat{\alpha}))$ , both high and low quality firms will apply to get certified. Equation (12) ensures a feasible price range that would allow the D2N marketplace to cover its cost while serving both types of organizations, and therefore is a necessary condition for the pooling equilibrium. If equation (9) is violated, these strategies and beliefs form a pooling perfect Bayesian equilibrium.

A third possibility is a hybrid equilibrium. Suppose that both equations (9) and (12) are violated. Given appropriate pricing by the marketplace, this implies that a low quality organization would want to deviate from its strategy of not applying for certification in a separating equilibrium, yet it would not be interested in getting certified in a pooling equilibrium. The optimal strategy for a low quality organization under these circumstances is to randomize between applying and not applying for the certificate. Let  $a \in (0, 1)$  denote the probability that a low quality organization applies for certification. Then, the organization will obtain the certificate with probability  $a(1 - \mu)$ , and using Baye's rule the holder of a certificate will be of

high quality with probability  $\tilde{\alpha} = \alpha / [\alpha + a(1 - \mu)(1 - \alpha)]$ . Below are the expected increases in net revenues for high and low quality organizations, respectively, in an equilibrium where high quality organizations always apply for certification, low quality organizations apply with probability  $a$ , and the holder of a certificate is believed to be of high quality with probability  $\tilde{\alpha}$ .

$$\begin{aligned} \Delta NR_c^h(\rho = \tilde{\alpha}) &= [\alpha + (1 - \alpha)a(1 - \mu)](NR_c(y, y | \tilde{\alpha}) - NR_c(n, y | \tilde{\alpha})) \\ &\quad + (1 - \alpha)[1 - a + a\mu](NR_c(y, n | \tilde{\alpha}) - NR_c(n, n | \tilde{\alpha})) \end{aligned} \quad (13)$$

$$\Delta NR_c^l(\rho = \tilde{\alpha}) = (1 - \mu)\Delta NR_c^h(\rho = \tilde{\alpha}) \quad (14)$$

For randomization between applying and not applying for certification to be an optimal strategy, a low quality organization should be indifferent between these two choices in the proposed equilibrium. In other words, the expected net increase in fundraising revenues due to certification should be equal to the price of the service. Equation (15) is therefore a necessary condition for the hybrid equilibrium.

$$\Delta NR_c^h(\rho = \tilde{\alpha}) = \frac{P_c}{1 - \mu}, \quad p_c \geq c \quad (12)$$

If equations (9) and (12) are violated while equation (15) is satisfied, these strategies and beliefs form a hybrid perfect Bayesian equilibrium. Our next proposition characterizes the three types of equilibria discussed above. Please note that  $\hat{\alpha} < \tilde{\alpha} < 1$ .

**Proposition 2. a.** (Separating equilibrium) *When  $\frac{c}{1 - \mu} > \Delta NR_c^h(\rho = 1)$ , the cost and accuracy of certification is sufficiently high such that only high quality organizations get certified.*

**b.** (Pooling equilibrium) *When  $\Delta NR_c^h(\rho = \hat{\alpha}) > \frac{c}{1 - \mu}$ , the cost and accuracy of certification is sufficiently low such that both types of organizations apply for certification.*

c. (Hybrid equilibrium) When  $\Delta NR_c^h(\rho = 1) > \frac{c}{1-\mu} > \Delta NR_c^h(\rho = \hat{\alpha})$ , the cost and accuracy of certification both take intermediate values. In this case high quality organizations get certified while low quality organizations randomly apply for certification such that  $\Delta NR_c^h(\rho = \tilde{\alpha}) = \frac{P_c}{1-\mu}$ .

A service maximizing D2N marketplace reduces its certification fee sufficiently to increase the number of applications for certification. However, if the accuracy and cost of certification are both high, a low quality organization does not find the application economically feasible. Figure 2 illustrates the parametric regions that are likely to produce the equilibria characterized by Proposition 2. Note that the hybrid equilibrium is less likely to arise when the cost of certification is low and when its accuracy is high.

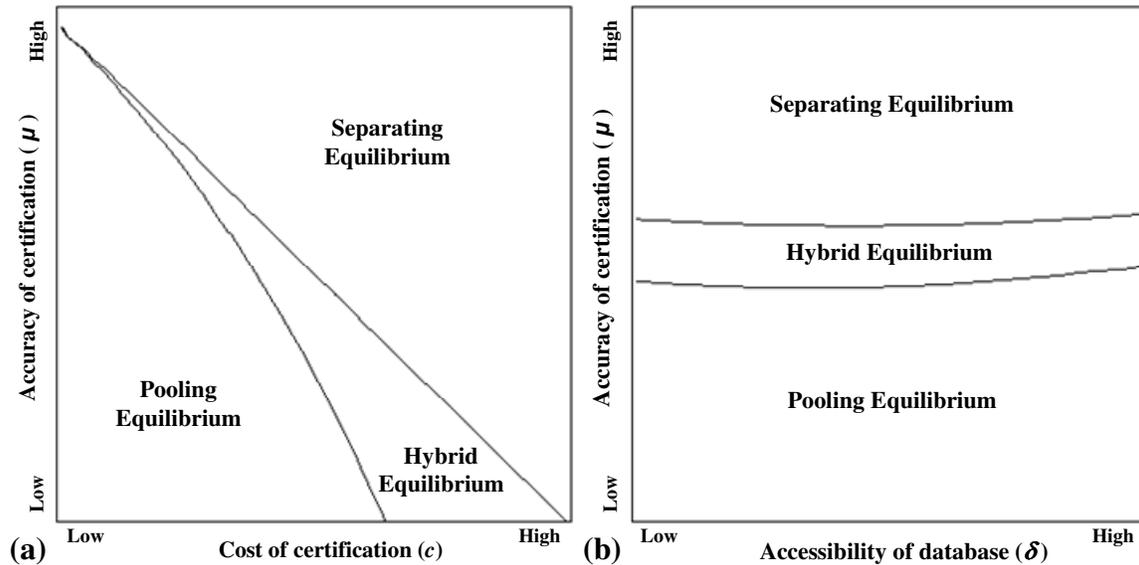


Figure 2. The equilibria of the game.

Figure 3 provides a comparison of total fundraising revenues and total net fundraising revenues in the market in separating and pooling equilibria. It is drawn assuming that the certification fee is set at marginal cost. Total net fundraising revenues clearly decrease with the cost of certification, and interestingly may in fact drop below the benchmark level for high values

of certification cost in both types of equilibria, despite the availability of the comprehensive database. The intuition is that the gains from the database service and certifications of high quality organizations can be offset by certification costs and debasement of low quality organizations. Proposition 3 formalizes this result. Because a low certification cost is likely to lead to a pooling equilibrium, such an outcome seems to be more efficient than a separating equilibrium from a social standpoint. Note, however, that total fundraising revenues will likely be lower in a pooling equilibrium than in a separating equilibrium.

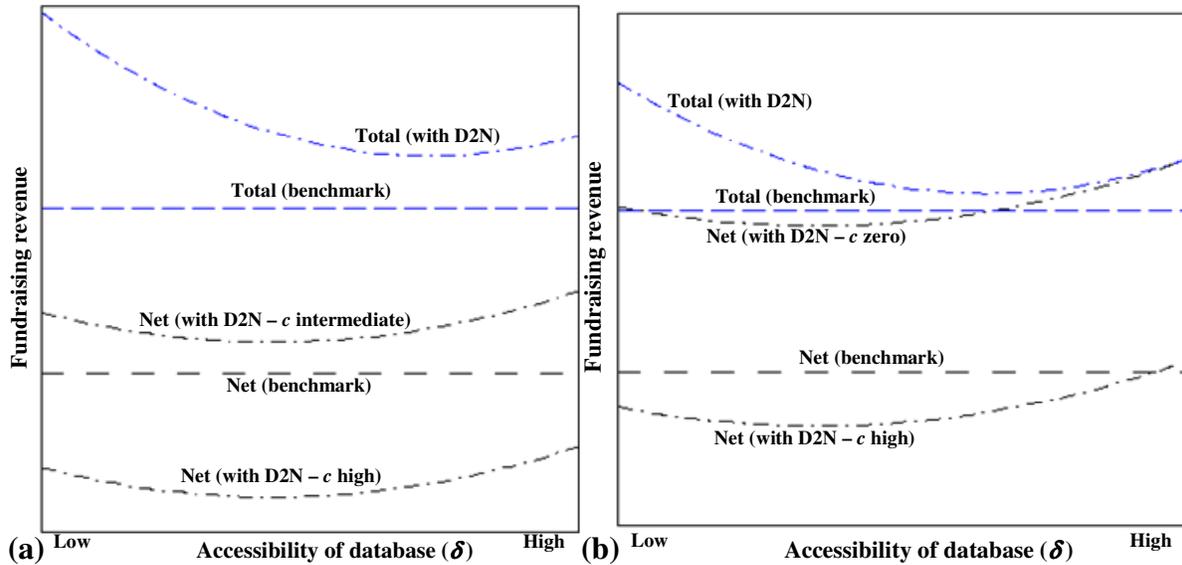


Figure 3. Total fundraising revenues in the (a) separating and (b) pooling equilibria

**Proposition 3.** *Despite the effective and free database service, the total net fundraising revenue of the organizations in the market may decrease after the emergence of the D2N marketplace if the cost of certification is sufficiently high.*

Another issue of interest is the D2N marketplace’s impact on the organization’s fundraising effectiveness. Organizations get bad publicity when they spend a disproportionate amount of their revenues on fundraising, and past research shows how competition for donation dollars can force organizations to fundraise excessively (Rose-Ackerman 1982). Experts

recommend charitable organization to spend at least 70 percent of their revenues on mission-related social services and operations. Figure 4 shows that the proportion of revenues available for social services increases with the accessibility of the database service and decreases with the cost of certification.<sup>4</sup> We also observe that the proportion would be higher in the separating equilibrium than in the pooling equilibrium for the same level of certification cost but a slightly higher level of certification accuracy (so that the separation is optimal), all else equal.

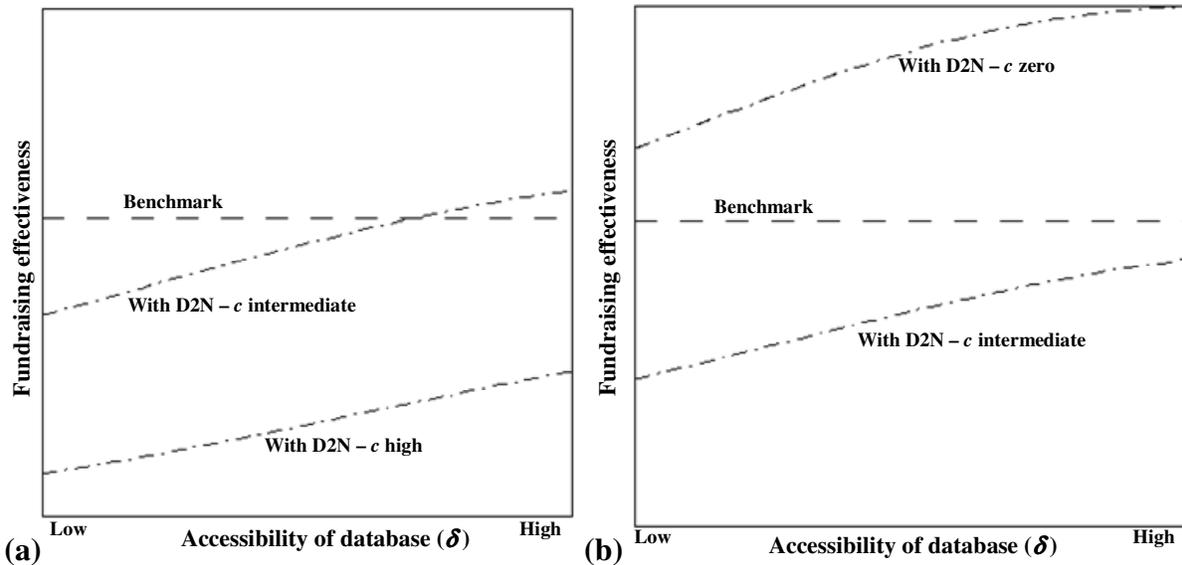


Figure 4. Proportion of fundraising revenues available for social services in the (a) separating and (b) pooling equilibria

Thus far we have assumed an exogenous level of accuracy for the certification process. In reality, a marketplace can conceivably decide on the level of rigor for the certification process. For example, Charity Navigator takes into account only financial criteria in its ratings, while the Better Business Bureau imposes various additional controls over the use of funds, the nature of fundraising practices, and governance.<sup>5</sup> In our setting, the D2N marketplace prefers the pooling

<sup>4</sup> The proportion hits 100 percent in the pooling equilibrium when the cost of certification is zero and the database service is accessible to all. This observation is due to our assumption that subscribers find their preferred organizations with certainty when they search through the database. Specifying a success probability of less than one would lower the fundraising effectiveness values presented in these figures.

<sup>5</sup> See <http://www.give.org/standards/cbbbstds.asp>.

equilibrium over the separating equilibrium because the former allows it to serve more organizations. Consequently, it also prefers a less costly and less accurate certification process over a more costly and more accurate one because, according to Proposition 2, the former process is more likely to produce a pooling equilibrium.

**Proposition 4.** *A service-maximizing D2N marketplace prefers a less costly and less accurate certification process over a more costly and more accurate one.*

The sole reliance on financial statements is key for Charity Navigator's ability to track and rate more than 5,000 charitable organizations. The American Institute of Philanthropy, another major intermediary ([www.charitywatch.org](http://www.charitywatch.org)), follows a similar set of criteria in its evaluations. Evidently, while rating charitable organizations based just on financial metrics allows these entities to expand their services, this practice may also render the reliability of their ratings suspect, especially considering the empirical research that reports inaccuracies and manipulation in the financial statements of nonprofit organizations (Trussel 2003, Krishnan et al. 2006).

## **5. Conclusion**

Fundraising is by far the most significant revenue source for nonprofit organizations in general. In this paper, we analytically examine the impact of database and certification services of an Internet-enabled D2N marketplace on nonprofit organizations' fundraising strategies. In addition to conceptualizing a D2N marketplace as the provider of these two services, our model incorporates salient aspects of fundraising markets, such as the extensive variety of missions (horizontal differentiation), differences in organizational effectiveness (qualities), fundraising

expenditures, and donor search. To the best of our knowledge, this is the first study that explores the impact of the Internet on fundraising using an analytical research framework.

We obtain the following results. As is the case in the real world, the D2N marketplace provides the database service free of charge. Although the emergence of the D2N marketplace generally allows individual organizations to generate larger fundraising revenues than what they can do traditionally, the total net revenues in the market may actually drop, especially when certification is costly. Finally, given that the marketplace aims to maximize service, it has an incentive to lower the rigor of its certification process to entice low quality organizations to apply.

Easing the requirements of certification criteria would help raise total net revenues in the market as long as this is accompanied with a reduction in certification cost. Although a separating equilibrium allows donors to more clearly observe the effectiveness of charitable organizations, it requires an accurate certification process which is likely to be more costly and thus wasteful compared to an inaccurate one. In this respect we believe that Charity Navigator and the American Institute of Philanthropy have chosen the right the strategy.

There are important issues different from what we have examined in this study. For example, one may argue that the continuous use of certification services will gradually diminish the uncertainty on organizational qualities. Even if this argument is correct, a D2N marketplace can still provide value to potential donors and maintain their viability by tracking organizational performance of established charitable organizations over time and rating new ones that are entering the market (currently at a rate of 25,000 to 30,000 a year). We cannot comment on the best course of action in such a scenario as our model does not incorporate the related dynamics. However, it is easy to see that first movers in this sector will clearly be at a better position to

help donors and fundraisers, establishing themselves as major information platforms for the nonprofit sector in the process.

There are also interesting avenues for future IS research in this context. For example, the current model, which features a monopolist D2N marketplace, can be extended to an oligopolistic context where multiple marketplaces compete to serve potential donors and organizations. Such an analysis could be construed to investigate whether and how multiple marketplaces could co-exist through differentiation in database and certification services. Also, the optimal design of certification criteria deserves further examination, as it could provide more insights about the effective management of D2N marketplaces.

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## Appendix

### List of Notation

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$\alpha$	The prior probability that an organization is of high quality
$\gamma$	The proportion of high type donors in the market
$\theta_j$	A low type donor's maximum willingness-to-donate to an organization of type $j \in \{h, l\}$ , where $h$ and $l$ denote high and low quality, respectively.
$z$	The parameter distinguishing high type donors' willingness to pay from those of low types
$t$	Unit cost of misfit between the preferred mission of a donor and the actual mission of an organization
$u$	Utility parameter
$s$	Search cost to sample one organization
$r$	Fundraising reach
$v$	Parameter for the cost of contacting donors
$\delta$	The proportion of potential donors who are aware of the database and have internet access to use the service.
$\gamma'$	The proportion of high type potential donors among those who have access to the database.
$\gamma''$	The proportion of high type potential donors among those who do not have access to the database.
$\mu$	The accuracy of certification service
$p_d$	The price of database subscription
$p_c$	The price of the certification service
$c$	Cost of certification

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### Proofs of Results

**The Benchmark Case.** Denote the reach of the organizations' solicitations by  $r_1$  and  $r_2$ , and assume that the probability of being solicited by one organization is independent of the probability of being solicited by the other organization. For ease of exposition, we will focus on the strategy of the organization with index 1 (referred to as the first organization); the strategy of the second organization is identical.

Given the parameter range, low type donors do not search and donate only when contacted by their preferred organization. Thus, the organization contacts  $r_1(1-\gamma)$  low type

donors. Only those closely located in the mission space actually donate  $x < \theta_b / t$ , and thus total

$$\text{fundraising revenue from low type donors equals } R^l = r_1(1 - \gamma) \int_0^{\theta_b/t} (\theta_b - tx) dx = r_1(1 - \gamma) \frac{\theta_b^2}{2t}.$$

Let us turn our attention to the donations by high types. The probability that a potential donor gets contacted by both organizations is  $r_1 r_2$ , in which case she is completely informed about the organizations and their missions. Therefore, all such donors give to their preferred

$$\text{organizations, yielding a fundraising revenue of } r_1 r_2 \gamma \int_0^{1/2} (z\theta_b - tx) dx = r_1 r_2 \gamma \left( \frac{z\theta_b}{2} - \frac{t}{8} \right).$$

With probability  $r_1(1 - r_2)$  donors will be contacted by only the first organization. Half of such donors will also prefer the contacting organization, so there is no need for search. On the other hand, they may or may not search if it is the unpreferred one. Suppose that the organization contacts a potential donor  $x$  units away from it, where  $x > 1/2$ . The donor can improve on it only by finding the other organization which is at a distance  $1 - x < 1/2$  through costly search. Her utility is  $u(z\theta_b - tx)$  when she does not search versus  $u(z\theta_b - t(1 - x)) - s$

when she does, respectively. Thus, search is preferrable when  $x > \frac{1}{2} + \frac{s}{2ut}$ . We assume that

offline search costs are sufficiently high such that this expression is less than one, otherwise incomplete mission information does not play any role in our results since all donors find and donate to their preferred organization in equilibrium. Consequently, the organization obtains a

$$\text{fundraising revenue of } r_1(1 - r_2) \gamma \int_0^{\frac{1}{2} + \frac{s}{2ut}} (z\theta_b - tx) dx = r_1(1 - r_2) \gamma \left[ z\theta_b \left( \frac{1}{2} + \frac{s}{2ut} \right) - \frac{t}{2} \left( \frac{1}{2} + \frac{s}{2ut} \right)^2 \right]$$

from donors solicited by itself. Similarly, the organization obtains a fundraising revenue of

$r_2(1-r_1)\gamma \left[ z\theta_b \left( \frac{1}{2} - \frac{s}{2ut} \right) - \frac{t}{2} \left( \frac{1}{2} - \frac{s}{2ut} \right)^2 \right]$  from high type donors contacted only by the second organizations.

Finally, potential high type donors are not contacted by any organization with probability  $1-r_1-r_2+r_1r_2$ . When conducting a search, the first organization to be found will be the preferred one ( $x < 1/2$ ) with probability  $1/2$ , in which case there will not be a need for further search, and the donor will obtain an expected utility of  $u \left( z\theta_b - \frac{t}{4} \right) - s$ . With probability  $\frac{1}{2} \left( 1 - \frac{s}{ut} \right)$ , the organization will be the unpreferred one and another search will be conducted, yielding an expected utility of  $u \left( z\theta_b - \frac{t}{4} \right) - 2s$ . Finally, with probability  $\frac{s}{2ut}$ , the organization will be the unpreferred one and another search will not be conducted, resulting in an expected utility of  $u \left( z\theta_b - t \left( \frac{1}{2} + \frac{s}{4ut} \right) \right) - s$ . After simplification, the expected utility of a high type donor not contacted by any organization and who decides to search equals  $u \left( z\theta_b - \frac{t}{4} \right) - \frac{s}{8} \left( 13 - \frac{3s}{8ut} \right)$ .

This expression is assumed to be positive for high type donors; otherwise, donors will be passive because they will donate only after being contacted by an organization (preferred or unpreferred). The fundraising revenue from donors not contacted by any organization equals

$$\begin{aligned} & \frac{(1-r_1-r_2+r_1r_2)\gamma}{2} \left[ \int_0^{\frac{1}{2}} (z\theta_b - tx) dx + \int_0^{\frac{1}{2} - \frac{s}{2ut}} (z\theta_b - tx) dx + \int_{\frac{1}{2}}^{\frac{1}{2} + \frac{s}{2ut}} (z\theta_b - tx) dx \right] \\ & = (1-r_1-r_2+r_1r_2)\gamma \left[ \frac{z\theta_b}{2} - \frac{t}{8} - \frac{s^2}{8u^2t} \right]. \end{aligned}$$

The benchmark net fundraising revenue for the first organization thus equals

$$\begin{aligned}
NR_b^1(r_1, r_2) = & r_1(1-\gamma)\frac{\theta_b^2}{2t} + r_1r_2\gamma\left(\frac{z\theta_b}{2} - \frac{t}{8}\right) + r_1(1-r_2)\gamma\left[z\theta_b\left(\frac{1}{2} + \frac{s}{2ut}\right) - \frac{t}{2}\left(\frac{1}{2} + \frac{s}{2ut}\right)^2\right] \\
& + r_2(1-r_1)\gamma\left[z\theta_b\left(\frac{1}{2} - \frac{s}{2ut}\right) - \frac{t}{2}\left(\frac{1}{2} - \frac{s}{2ut}\right)^2\right] + (1-r_1-r_2+r_1r_2)\gamma\left[\frac{z\theta_b}{2} - \frac{t}{8} - \frac{s^2}{8u^2t}\right] - \frac{v}{2}r_1^2.
\end{aligned}$$

Replace  $r_1$  with  $r_2$  and  $r_2$  with  $r_1$  to obtain the net fundraising revenue for the second organization. We maximize net fundraising revenues with respect to  $r_1$  and  $r_2$ . Since the organizations are symmetric in terms of expected qualities, optimal fundraising levels are also symmetric. The following optimal (symmetric) reach is obtained by simultaneously solving for the first order conditions. Second order conditions are satisfied since  $\frac{\partial^2 NR_b^1}{\partial r_1^2} = \frac{\partial^2 NR_b^2}{\partial r_2^2} = -v$ .

$$r_b^* = r_1^* = r_2^* = \frac{2u(\gamma s(2z\theta_b - t) + 2(1-\gamma)u\theta_b^2)}{8vu^2t - \gamma s^2}$$

After simplification, total fundraising revenue and net fundraising revenue equal

$$R_b^* = \gamma\left(\frac{z\theta_b}{2} - \frac{t}{8} - \frac{s^2(1-(r_b^*)^2)}{8u^2t}\right) + (1-\gamma)\frac{\theta_b^2 r_b^*}{2t} \text{ and } NR_b^* = R_b^* - \frac{v}{2}(r_b^*)^2, \text{ respectively.}$$

**Proof of Lemma 1.** A service maximizing D2N marketplace reduces the price of its database service as long as it can cover its cost and the price reduction increases usage. The marginal cost of subscribing a potential donor to the database service is zero, which is therefore the lower bound for the subscription price. Note that the price of the database service ( $p_d$ ) should be less than the offline search cost ( $s$ ) so that donors contacted by only one of the organizations search online rather than offline. As discussed in the previous proof for the benchmark case, potential high type donors who are contacted only by their unpreferred organization search if they are sufficiently away from the contacting organization in the mission space  $\left(x > \frac{1}{2} + \frac{s}{2ut}\right)$ . With the

database service, such high type donors search if  $x > \frac{1}{2} + \frac{p_d}{2ut}$ . Consequently, given  $p_d > 0$  and

fundraising levels  $r_1$  and  $r_2$ , there exists a segment of high type donors of size

$\frac{p_d \gamma}{2ut} (r_1(1-r_2) + r_2(1-r_1))$  that would search through the database had the price of the service

been lower. It follows that price reductions always increase usage and hence  $p_d^* = 0$ .

**The Database Service Only.** The solution of the optimal level of fundraising is similar to the approach in the benchmark case, except that now  $\delta$  fraction of donors can find their preferred organization using the database service free of charge. The fundraising revenue from such

donors equals  $\delta \left( \gamma \left( \frac{z\theta_b}{2} - \frac{t}{8} \right) + (1-\gamma) \frac{\theta_b^2}{2t} \right)$ . On the other hand, the fundraising revenue of

organization organization with index 1 from donors not using the database service equals

$$(1-\delta) \left( r_1(1-\gamma'') \frac{\theta_b^2}{2t} + r_1 r_2 \gamma'' \left( \frac{z\theta_b}{2} - \frac{t}{8} \right) + r_1(1-r_2) \gamma'' \left[ z\theta_b \left( \frac{1}{2} + \frac{s}{2ut} \right) - \frac{t}{2} \left( \frac{1}{2} + \frac{s}{2ut} \right)^2 \right] \right. \\ \left. + r_2(1-r_1) \gamma'' \left[ z\theta_b \left( \frac{1}{2} - \frac{s}{2ut} \right) - \frac{t}{2} \left( \frac{1}{2} - \frac{s}{2ut} \right)^2 \right] + (1-r_1-r_2+r_1 r_2) \gamma'' \left[ \frac{z\theta_b}{2} - \frac{t}{8} - \frac{s^2}{8u^2 t} \right] \right),$$

where  $\gamma'' = (\gamma - \delta\gamma')/(1-\delta)$  is the fraction of high type donors who are unaware of the database service or unable to use it. Replace  $r_1$  with  $r_2$  and  $r_2$  with  $r_1$  to obtain the net fundraising revenue for the other organization. Maximizing net fundraising revenues with respect to  $r_1$  and  $r_2$  by simultaneously solving for the first order conditions, we obtain the following optimal (symmetric) fundraising reach. Second order conditions are satisfied.

$$r_{db}^* = \frac{2(1-\delta)u(\gamma''s(2z\theta_b - t) + 2(1-\gamma'')u\theta_b^2)}{8vu^2t - \gamma''s^2 + \delta\gamma''s^2}$$

**Proof of Proposition 1.** With the certification service, the optimal fundraising reach of an organization will naturally depend on both its own certification outcome and its competitor's. Organizations can have two posterior types: those that have successfully obtained certification (denote with  $y$ ), and those that either did not apply for certification or could not obtain one (denote with  $n$ ). Let  $\theta_y$  and  $\theta_n$  respectively denote the expected quality of an organization with and without certification, and  $r_y$  and  $r_n$  respectively denote its chosen level of fundraising reach. The fundraising revenue for an organization of posterior type  $j \in \{y, n\}$  facing a competing organization of posterior type  $k \in \{y, n\}$  can be derived as follows.

With asymmetric quality expectations, the location of the high type donor indifferent between donating to the two organizations (when contacted by both) changes. The location of the high type donor indifferent between searching and not searching for the preferred organization (when contacted by the unpreferred one) also changes. Specifically, a  $\frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t}$  fraction of donors who know both organizations donate to organization  $j$ . For donors who don't have access to the database, a  $\frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} + \frac{s}{2ut}$  fraction of them who are contacted only by organization  $j$  donate to organization  $j$ , while a  $\frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} - \frac{s}{2ut}$  fraction of them who are contacted only by organization  $k$  donate to organization  $j$ .

Thus, the fundraising revenue of organization  $j$  from donors that can access the database

equals  $\delta \left( \gamma' \left( z\theta_j \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} \right) - \frac{t}{2} \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} \right)^2 \right) + (1 - \gamma') \frac{\theta_j^2}{2t} \right)$ . As before, the

fundraising revenue from donors not using the database service has five components. First, the

revenue from low type donors equals  $r_j(1-\gamma'')\frac{\theta_j^2}{2t}$ . Second, the revenue from high type donors

contacted by both organizations equals

$$(1-\delta)r_j r_k \gamma'' \left( z\theta_j \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} \right) - \frac{t}{2} \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} \right)^2 \right). \text{ Third, the revenue from high type}$$

donors contacted only by organization  $j$  equals

$$(1-\delta)r_j(1-r_k)\gamma'' \left( z\theta_j \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} + \frac{s}{2ut} \right) - \frac{t}{2} \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} + \frac{s}{2ut} \right)^2 \right). \text{ Forth, the revenue}$$

from high type donors contacted only by organization  $k$  equals

$$(1-\delta)r_k(1-r_j)\gamma'' \left( z\theta_j \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} - \frac{s}{2ut} \right) - \frac{t}{2} \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} - \frac{s}{2ut} \right)^2 \right). \text{ And finally, the}$$

revenue from high type donors not contacted by any organization equals

$$(1-\delta)(1-r_j-r_k+r_j r_k)\gamma'' \left( z\theta_j \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} \right) - \frac{t}{2} \left( \frac{1}{2} + \frac{z\theta_j - z\theta_k}{2t} \right)^2 - \frac{s^2}{8u^2 t} \right). \text{ The net}$$

fundraising revenue of organization  $j$  is obtained from adding all of the above expressions and

subtracting the cost of fundraising,  $vr_j^2/2$ . The net fundraising revenue of organization  $k$  is

derived in a similar fashion. Maximizing with respect to  $r_j$  and  $r_k$  by simultaneously solving

for the first order conditions, we find the optimal fundraising reach for the organization of

posterior type  $j \in \{y, n\}$  facing a competing organization of posterior type  $k \in \{y, n\}$  to be

$$r_c^*(j, k) = \frac{2(1-\delta)u(2u(1-\gamma')(8vu^2t\theta_j^2 + \gamma's^2(1-\delta)\theta_k^2) + \gamma's(z\theta_j + z\theta_k - t)(8vu^2t + \gamma''s^2 - \delta\gamma''s^2))}{(8vu^2t - \gamma''s^2 + \delta\gamma''s^2)(8vu^2t + \gamma''s^2 - \delta\gamma''s^2)}.$$

Second order conditions are satisfied. Note that  $\frac{\partial r_c^*(j, k)}{\partial \theta_j} > 0$  and  $\frac{\partial r_c^*(j, k)}{\partial \theta_k} > 0$ .

**Proof of Proposition 2.** The sketch of the proof is provided in the body of the paper. Here we provide further details about the derivation of expected gains in net fundraising revenues.

Consider first the strategies and beliefs that support a perfect Bayesian separating equilibrium. In this case potential donors view the holder of a certificate as a high quality organization with certainty. Given the certification technology, high quality organizations definitely get certified when they apply. When facing a competing organization with a certificate, a high quality organization obtains a net fundraising revenue of  $NR_c(y, y|1)$  when it applies for certification versus  $NR_c(n, y|1)$  when it doesn't. Since only high quality organizations apply for certification in equilibrium, the likelihood of this event is  $\alpha$ . With the remaining probability the organization faces a competitor without a certificate. In this case a high quality organization obtains a net fundraising revenue of  $NR_c(y, n|1)$  when it applies for certification versus  $NR_c(n, n|1)$  when it doesn't. Thus, the expected net gain in fundraising revenues is the amount given in equation (7). The same logic applies to the case of a low quality organization, but in this case this net gain is obtained only when the marketplace awards the organization a certificate, which happens with probability  $1 - \mu$ .

Consider now the strategies and beliefs that support a perfect Bayesian pooling equilibrium. Since low quality organizations will be denied certification with probability  $\mu$ , the likelihood of observing a competitor without a certificate is  $\mu(1 - \alpha)$ . In this case a high quality organization obtains a net fundraising revenue of  $NR_c(y, n|\hat{\alpha})$  when it applies for certification versus  $NR_c(n, n|\hat{\alpha})$  when it doesn't. With the remaining probability the competing organization will have a certificate, in which case a high quality organization obtains a net fundraising revenue of  $NR_c(y, y|\hat{\alpha})$  when it applies for certification versus  $NR_c(n, y|\hat{\alpha})$  when it doesn't.

Thus, the expected net gain in fundraising revenues is the amount given in equation (10). As before, the corresponding gain for a low quality organization is  $1 - \mu$  times that amount.

Finally, consider the strategies and beliefs that support a perfect Bayesian hybrid equilibrium. Given that low quality organizations apply for certification with probability  $a$  and that they will be denied certification with probability  $\mu$ , the likelihood of observing a competitor without a certificate is  $(1 - \alpha)[1 - a + a\mu]$ . In this case a high quality organization obtains a net fundraising revenue of  $NR_c(y, n | \tilde{\alpha})$  when it applies for certification versus  $NR_c(n, n | \tilde{\alpha})$  when it doesn't. With the remaining probability the competing organization will have a certificate, in which case a high quality organization obtains a net fundraising revenue of  $NR_c(y, y | \tilde{\alpha})$  when it applies for certification versus  $NR_c(n, y | \tilde{\alpha})$  when it doesn't. Thus, the expected net gain in fundraising revenues is the amount given in equation (13). Again, the corresponding gain for a low quality organization is  $1 - \mu$  times that amount.

**Proof of Proposition 3.** When  $\delta = 0$ , the database service provides no benefit to the organizations. In a separating equilibrium, the implication is that low quality organizations are worse off compared to the benchmark case because of the revelation of their qualities. Meanwhile, if the cost of certification takes a high value such as  $c = \Delta NR_c^h(\rho = 1)$ , then high quality organizations are also worse off compared to the benchmark case because their fundraising revenues net of certification fee equals the net fundraising revenues of low quality organizations (i.e., the service fee equals the difference between the equilibrium net fundraising revenues of high and low quality organizations). Hence, total net fundraising revenues in this case will indeed drop after the emergence of the marketplace. It is easy to see that this will still be true for small but positive values of  $\delta$ .