

# **Certification As A Viable Quality Assurance Mechanism: Theory and Suggestive Evidence\***

*by*

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## 1. Introduction

Worldwide, and even within some countries, the fundraising industry is a multi-billion dollar business (Giving USA, 2004; Salamon et al., 1999). Its basic function is to persuade potential donors to give generously to nonprofits to finance their operations. This may happen directly when the nonprofit's fundraising operation is in-house, or indirectly when the fundraising operation is a foundation that mediates the process of giving by collecting funds and distributing them to appropriate nonprofits. In the following, we do not concern ourselves with the specifics of the channels through which donations flow from donors to the entities that spend them. Rather, we are interested in understanding the problem of asymmetric information, or principal-agent problem, between donors and the charities that are the recipients of their generosity. Below we refer to this problem as the *fundraising problem*: Donors often know little about the entities that they have decided to give money to (e.g. the recent tsunami relief efforts), thus opening the door for potential abuses.<sup>1</sup>

Numerous well-documented scandals (e.g. Ortmann and Schlesinger, 2003; Wyatt, 2004; Panel on the Nonprofit Sector, 2005; Bullain and Marshall, 2005) continue to emphasize the importance of the problem that has found starkly diverging institutional solutions in different countries. In the U.S.A., for example, the interested parties have relied mostly on Form 990 which the Internal Revenue Service requires all nonprofits (including foundations) above a given revenue hurdle to fill out. This public document has become the key input in a new decentralized monitoring system called GuideStar that allows interested parties to search through millions of IRS 990 forms, and to do so (in return for a modest fee) in a highly structured search environment. The problem with this system is that all the data are self-reported and, in addition, not well-standardized (Froelich, Knoepfle, and Pollak, 2000), leaving considerable room for abuses. In contrast, especially in Europe the interested parties have relied on various forms of certification systems whose common denominator is that fundraising entities submit voluntarily, and for a fee, to the investigations of an independent agency that will issue a seal of approval assuring donors that the applicant has met some standard of quality.

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<sup>1</sup> Some argue that the severity of the problem depends on the donor's size, the argument being that a large donor surely will give large amounts only if she can control the outcome. There is something to that argument in that in principle a donor could send his own "investigators" to evaluate whether the charity spent the donation in line with its promises. But this we typically see rarely, suggesting that it is costly, and/or that there are economies of scale in assessing charities.

The extant certification systems all exist, albeit in a surprising variety (e.g. Guet, 2002; Ortmann, Svitkova, and Krnacova, 2005), in countries such as Germany, the Netherlands, Switzerland, Sweden, Austria, and the U.S.A./Canada. Notably, such systems do not presently exist in transition and developing countries. This may be for the simple reason that the nonprofit sector is not developed enough to warrant quality assurance mechanisms. Some have argued that the typically weaker enforcement of laws and regulations makes certification not a viable solution in such environments. However, below we show that it is exactly the twin conditions of an embryonic nonprofit sector in a society where laws and regulations are weakly enforced that allow certification systems to have the most beneficial impact. Be that as it may, in light of the existing, starkly diverging realizations that we find in Europe, and in light of the fact that some attempts to start certification mechanisms (such as the English one; see Ortmann, Svitkova, and Krnacova, 2005) have been prominent failures and, lastly, in light of the growing importance of the nonprofit sector in transition and developing countries (Salamon et al., 1999; Brhlikova, 2004; Svitkova, 2004), pondering the incentive properties of certification mechanisms under those circumstances seems worthwhile. Indeed, our interest in the topic was triggered by the question of whether, and if, what kind of certification system would be viable in the transition economy that we live in.

We note that, even though here we use the fundraising problem as our running example, our theoretical considerations below apply to all problems of asymmetric information of a similar make: To the extent that commercial nonprofits, or even for-profits, produce experience and credence products (goods or services), they face, at least in principle, the same kind of problems that donative nonprofits face. It is important to note that despite the fact that the listed facts describe the fundraising problem, it is straightforward to extend the consideration to other industries (both for- and nonprofit) facing the asymmetric information problem (typically markets with experience and credence goods, such as provision of social services or child care, education).

The literature that is most closely related to our work is theoretical research on intermediaries whose task is to mitigate the asymmetric information problem in product (Peyrache and Quesada, 2004, 2002; Lizzeri, 1999; Biglaiser, 1993; Biglaiser and Friedman, 1994) or labor markets (Spence, 1973). None of these papers, however, captures the specific features of the fundraising industry, namely the nonprofit

status of the certification agency itself or the specific welfare consequences of trustworthiness of the individual nonprofits and the nonprofit sector as a whole. In fact, some of these models (e.g. Lizzeri, 1999; Peyrache and Quesada, 2002) lead to rather counterintuitive results that are empirically difficult to verify, such as the certification agency capturing all surplus. Some of these papers suggest that competition may be beneficial but nowhere – at least in Europe – do we see competing certification agencies.

The second section of the manuscript details the stylized facts about the certification systems that we can observe. The third section lists assumptions for the model based on the observed facts and describes the setup and timing of the basic and extended games. The fourth section provides results, while the fifth lists future extensions, policy implications and concludes.

## 2. Stylized facts

The aim of this study is to build a model that allows us to study the fundraising problem and the viability of a particular solution to this problem, certification. Towards that goal we first enumerate the stylized facts that a more institutionally oriented companion study of such certification systems has produced (Ortmann, et al., 2005; see also Guet, 2002).<sup>2</sup> Since our basic model is a signaling game, we often use game-theoretic terminology even in the description of the stylized facts.

F1. [Game, players, their actions, and their objectives] As mentioned, we focus on the fundraising problem and hence the strategic interaction of three types of “players”: fundraising organizations (charities), donors, and certifiers. Fundraising organizations raise funds, or donations, for various charitable purposes. Their aim is to collect as many donations as possible. Toward that end they typically make promises about how they will spend the funds raised. Donors are the providers of donations. Their motivations can be rather diverse.<sup>3</sup> For present purposes, a relevant fact is that a significant portion of donors seems to care about what happens with their funds and hence about the

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<sup>2</sup> The facts enumerated in this section provide the ‘suggestive evidence’ that certification may help to solve the fundraising problem. We call it suggestive as it is based on a small set of real-life cases that have some commonalities but also differ in important aspects such as whether they farm out the substance of their evaluations or do them in-house, or the kind of charities that they admit as candidates, or their reliance on public subsidies.

<sup>3</sup> A number of studies suggest that donors differ in their motives to give (Andreoni, 1990; Glazer and Konrad, 1996; Harbaugh, 1998a, 1998b); it is, however, not the aim of the current paper to analyze these motives further.

quality of charities (Bekkers, 2003). The certifier provides a seal of approval, or certificate, that guarantees that fundraising organizations that ask for it do in fact meet some minimal quality requirement.<sup>4</sup> A certifier, too, may be motivated by various objectives. Interestingly, all certifiers of charitable organizations that we observe (Guet, 2002) are nonprofit organizations.<sup>5</sup>

F2. [Quality of charities] The charities (fundraising organizations) differ in their quality (representing administrative costs, quality of project management, and, hence and most importantly, the fraction of donations that reaches those in need).

F3. [Observability of quality of charities] The quality of charities is typically not observed by donors.<sup>6</sup> The fundraising problem arises because typically donors do not observe the ‘quality’, or type, of the charity, i.e. they do not have enough information (if any) to assess whether the charity keeps its promises.

F4. [Donors that care about quality will redirect towards certified charities, and adjust upward, their donations] Donors appreciate quality – if there is a certificate, donors that care about quality shift their giving to the certified charities only (because their quality is on average higher than that of the noncertified charities). Also, donors increase their giving to certified charities, and they do so increasingly with higher quality. Thus, aggregate giving also increases (Bekkers, 2003).

F5. [Certification is a costly signal; the two components of the cost] The certifier provides a seal of approval, or certificate, that guarantees that fundraising organizations that obtain it do in fact meet some minimal quality requirement. This certificate is a costly signal because compliance with the minimal quality standard is more expensive for bad types than for good types. Specifically, charities asking for

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<sup>4</sup> It is important to realize that a certifier is different from an auditor, the main difference being the extent of requirements on the charity’s operation. Certifiers do check the financial operations of charities, but they also check many other aspects such as governance or management. More details in Ortmann, Svitkova, and Krnacova (2005).

<sup>5</sup> However, this is true only for certifiers of charitable organizations. Other seal-of-approval systems (e.g., ISO) typically have profit maximizing certifiers.

<sup>6</sup> Empirically, in every country there are some large charities that have established reputations on their own and do not seem to need the certifier, especially initially, to guarantee that they meet some minimal quality requirement. Interestingly, experience has shown that many of these large charities do end up asking for certification (Ortmann, Svitkova, and Krnacova, 2005). The reason for this will be become clear in the discussion of our model.

certification incur external and internal costs:<sup>7</sup> As regards the former, charities have to pay fees (initial fees, annual fees, recertification fees) set by the certifier. These fees typically vary with the size of the evaluated fundraising organization. As regards the latter, charities have to incur some costs related to the process of certification within the organization. These are mostly administrative costs (wages, preparation of documents), and are likely to be higher if the organization tries to misrepresent its type.

F6. [Cost of detection technology] While the signal may be costly, the certifier is not necessarily able to judge organizations without mistake. Detection is costly. The certifier chooses among detection technologies that produce different probabilities of detection (e.g., the Dutch-German model on the one hand and the Austrian model on the other hand; see Ortmann, Svitkova, and Krnacova, 2005). Detection technologies differ in their costs, and these costs increase with the quality of the detection the certifier wants to attain; it is not possible, however, to obtain a detection technology with no mistakes at all – the costs of such a technology are prohibitive.

F7. [Disclosure rules] The certifier announces only whether the organization has obtained a certificate or not – he does not disclose additional information about the quality of the certified organizations, nor does he rank the organizations.<sup>8</sup>

### 3. Model: Assumptions and timing

We now map the stylized facts into assumptions that lay the foundations for our model.

A1. [Game, players, their actions, and their objectives] The game is sequential and involves three types of players: charities, donors and a certifier. The timing of the game is described below. We assume that charities and donors are of measure 1. The certifier is a single player. Charities maximize donations obtained from donors that care about what happens to their funds (quality). The certifier provides a seal of approval (a “certificate” that guarantees some minimal quality requirement, or “standard” which is

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<sup>7</sup> This is true for all cases considered in Ortmann, Svitkova, and Krnacova, 2005: Austria, Germany, Netherlands, and Switzerland. Certification is free in Sweden (the system is supported by state subsidies); the charities must pay the costs of investigation only in case of special inquiry. Nevertheless, the internal costs apply to all cases.

<sup>8</sup> We note that other disclosure rules have been observed in other industries. For example, JD Power ranks brands of cars according to their quality (Peyrache and Quesada, 2002). We conjecture that the easier comparability of output in the car

denotes  $s$  below) and may have one of the following optimization functions: maximization of profit, maximization of standards ('Money to Africa'), and maximization of detection probability. The last two objectives are our measure, for now, of maximization of welfare. (As we will see, they lead to different results)

A2. [Quality of charities] The quality of the charity (fundraising organization) is represented by  $t$ ; we assume  $t$  is distributed according to a uniform distribution on the unit interval,  $F(t) \sim U[0,1]$ . Higher  $t$  represents higher quality, which can be interpreted, for example, as a higher fraction of donations reaching their purpose. Quality is fixed for now.<sup>9</sup>

A3. [Observability of quality of charities] Donors do not observe  $t$ , the quality of individual charities. They observe only the cumulative distribution function,  $F(t)$ .

A4. [Donors that care about quality will redirect towards certified charities, and adjust upward, their donations] Donors that care about quality give  $t$  to a charity of quality  $t$ .<sup>10</sup> If certification is not available, these donors give to all organizations according to the quality of the average organization,  $E[t]$ ; if certification is available, these donors adjust their giving accordingly. Specifically, all their giving flows to certified charities only and increases to  $E[t | t > s]$ .<sup>11</sup> The expected donation of a certified charity is therefore  $E[t | t > s] / (1 - s)$  and the expected donation of a noncertified charity is 0. This giving function reaches its maximum at the maximum standard (when the total giving is  $I$ ), with total giving going to the "best" charity. In order to rule out this implausible scenario (which is brought about by our assumption of a continuum of charities), we restrict our standards to be strictly less than 1. This threshold is called  $e$  below. Note that in our setup, the difference between giving to a certified charity and a non-certified charity is the lowest (but still positive) at a standard of zero, i.e. donors appreciate

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industry might drive that result. The easier comparability of output is likely to induce a differentiated demand response. Because of non-comparability of the output of fundraisers, such a differentiated demand response seems not possible.

<sup>9</sup> We realize that a certification mechanism may well affect, and hopefully does affect, the distribution of types. But the evidence in the organization and management literature suggests that organizations, and their corporate cultures, are rather difficult to build or turn around. In addition, a model endogenizing the distribution of types would have to look much more complex (and probably use other tools). Hence, for now, we stick to our assumption.

<sup>10</sup> Other donors may give for other reasons (such as the act of giving itself). These donors do not care about certification. In our model they make possible the continued existence of organizations of inferior quality. However, we do not need to consider these donors in our analysis because certification (as they do not learn about it) does not affect their giving in any respect.

identification of the "worst" charity (or the small number of charities that would remain without certification) and give nothing to them while giving some positive amount to the certified ones.<sup>12</sup>

A5. [Certification is a costly signal; the two components of cost] The certifier provides a seal of approval, certifying that a charity that was awarded it has met a standard,  $s$ .

Two types of costs are related to certification:

The external costs (the fee for, or price of, certification) are denoted  $P$ . For the sake of simplicity, we assume that large organizations are aggregates of several small ones. In fact, we assume that all fundraising organizations have the same size and hence face the same  $P$ .<sup>13</sup>

The internal costs are assumed to take two forms:

A5i.  $c(t), c'(t) < 0$ , a decreasing function of  $t$ . This form of the cost function is used for our basic model that will help us fix the basic ideas of certification.

A5ii.  $c(t,s), c_t(t,s) < 0, c_s(t,s) > 0$ , is a function of both quality,  $t$ , and standards,  $s$ . We assume that  $c(t, s)$  is decreasing in quality and increasing in standards: if the standards are low the costs of preparing for certification are also low, independent of the quality of the organization; in contrast, if the standards are high then preparing for certification is costly, and indeed it is especially costly for those fundraising organizations which do not meet the standard and which therefore might have to misrepresent themselves.<sup>14</sup>

A6. [Costs of detection technology] While the signal is costly, the certifier is not necessarily able to judge organizations without mistake. Detection is costly because detection technology is not for free; its costs are denoted  $c_{CF}(p_{min})$ , where the subscript denotes certifier and  $p_{min}$  denotes the minimum detection probability that occurs at standard ( $t = s$ ). The basic idea here is two-fold. First, a certifier in

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<sup>11</sup> The aggregate and individual giving is equal as we assume donors in measure 1. The differences occur in the number of donors attracted by individual foundations.

<sup>12</sup> If we were to assume that donors keep giving to the noncertified charities as well, we would avoid the problematic result observed in Lizzeri (1999) or Peyrache and Quesada (2002) where the certifier collects all the surplus from the market without providing any additional information. However, this giving function is reasonable, keeping in mind the group of uninformed donors who give to the noncertified charities no matter what happens with certification.

<sup>13</sup> Indeed, several of the companies that we have studied in Ortmann, Svitkova, and Krnacova (2005) charge as an annual fee a per mill of revenues (e.g., Swiss certifier ZEW). All certifiers studied in more detail in Ortmann, Svitkova, and Krnacova (2005) have similar schemes.

<sup>14</sup> Throughout this study we work with costs that are linear both in  $t$  and  $s$ ; however, it should be possible to consider functions that are convex in both,  $t, s$ , with negative cross-derivative (representing opposite effects of  $t$  and  $s$  – the negative impact of  $t$  on costs may be mitigated by increasing  $s$ ). The robustness of our results to different specifications of our cost functions, or demand shifts induced by certificates, are obviously important topics for future research.



principle can (and will have to because of whatever budget constraint he faces) choose the detection probability of a firm at  $t = s$ . For example, a certifier may choose to detect a good type at  $t = s$  correctly with  $p_{min} = .7$ . Intuitively, this implies that a certifier will increase the probability of identifying a good type and a bad type correctly the further away  $t$  gets from  $s$ . This intuition is formalized below.

We assume that costs increase, at an increasing rate, in the minimum detection probability: it is very costly to implement very good detection technologies. In fact, perfect detection is not possible,  $\frac{1}{2} \leq p_{min} < 1$ . (The minimum detection probability must be at least  $\frac{1}{2}$ , i.e. probability of a correct identification must be higher than probability of a false identification.)

Below we assume that the probability of detection,  $p = p(t, s, p_{min})$ , is a linear function of the distance between  $t$  and  $s$ ,  $|t-s|$ , perfect detection ( $p(t, s, p_{min})=1$ ) is reached at point  $e$ ; above  $e$  charities are assumed to be of the good type ( $e$  represents a threshold above which charities are considered good and their specific quality is no longer of concern. Below  $e$  is assumed to be .95.) The probability of detection for types  $t < s$  is also an increasing linear function of the distance between  $|t-s|$  although in fact any increasing function will do, as we shall see presently.

A7. [Disclosure rules] The certifier announces only whether the organization has obtained a certificate or not – he does not disclose additional information about the quality of the certified organizations, nor does he rank the organizations.

A.8. [What donors observe] Donors observe certificates only. Specifically, they observe neither the internal nor the external costs of certification. Donors, for now, believe that the certifier is committed to being honest or, alternatively, values his reputation.<sup>15</sup>

A9. [Commitment of the certifier] We assume that the certifier is honest and does not misrepresent the standard or quality of the certified organizations.

We proceed with the formalization of the full game which will then be solved for several specifications.

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<sup>15</sup> An alternative assumption may be that the donors are able to observe the conditions of certification themselves – they may control the work of the certifier. However, we think this assumption is very unrealistic.

The timing of the game is as follows:

1. The charity learns its type,  $t$ .
2. The certifier sets standards,  $s$ , fee,  $P$ , and the minimum probability of detection (investment in technology),  $p_{min}$ .
3. The charity observes the conditions of certification,  $s$ ,  $P$ , and  $p_{min}$ ; based on this information it infers the probability of detection  $p(t, s, p_{min})$ , computes its internal costs  $c(t, s)$ , and decides whether to ask for certification or not (in order to maximize expected “profits” = expected donations – minus costs of certification).
4. The certifier examines the charities that ask for certification and awards certificates to those that pass his standards (making mistakes with probability  $1 - p(t, s, p_{min})$ ).
5. Donors make a decision based on  $s$  (as communicated by the certifier) and whether a charity is certified or not.

We solve the game by backward induction. Our aim is to determine a pure-strategy sequential equilibrium separating good and bad types (types above and below a given standard).

We solve a simplified basic game and the full game. For the full game we solve variants of the game for two cost configurations and three objective functions of the certifier. For the basic game, we identify the optimal decision of the charity: we solve the basic game  $G_B$  (and its simplified version  $G_B^-$ ) to fix ideas. In the basic game, and its simplified version as well, we omit the decision problem of the certifier; the certifier in these games is simply a mechanistic provider of the certificate that does not incur any costs. (The simplified game furthermore omits the probability of detection and employs a simplified cost function.) For the full game  $G_F$ , we add the choice of the certifier (using different optimization functions).

#### 4. Model: Results

##### 4.1 Simplified basic game, $G_B^-$

We first solve the simplified basic game,  $G_B$ . This game is a signaling game similar to the one in Spence (1973). We assume that the internal costs are a function of type  $t$  only,  $c(t)$  (A5i), and that the costs of detection are – in contrast to A6 used below – prohibitively high, thus the certifier does not evaluate at all. His role is mechanical – he is the provider of a certificate, i.e. he gives the charities a tool to separate themselves.<sup>16</sup>

The decision of a charity to apply for a certificate or not has to satisfy its incentive compatibility constraints (ICC) so that charities of quality above (below) standard are better off (not) asking for certification:

$$d_C - P - c(t) < d_{NC} \text{ for } t < s;$$

$$d_{NC} < d_C - P - c(t) \text{ for } t > s.$$

Where  $d_C$  is the expected donations to a certified charity,  $E[t|t>s]/n_C$ ,  $n_C$  is the fraction (“number”) of charities with a certificate, in this case  $1-s$ ;  $d_{NC}$  is the expected donations to a non-certified charity (by A4 we assume that the expected donations to a non-certified charity are 0),  $P$  is the fee paid for certification (external costs), and  $c(t)$  are the internal costs of charity of quality  $t$ .

We consider only solutions where separation occurs at the standard,  $s$ , specified by the certifier (assuming A9). In other words, the certifier behaves honestly in order to preserve his reputation, or is otherwise committed; therefore the separating equilibrium and standard coincide.

If a separating equilibrium exists, there must exist a standard  $s^*$  satisfying both IC constraints with equality:

$$d_C - P - c(s^*) = d_{NC} \Leftrightarrow c(s^*) + P = d_C - d_{NC}.$$

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<sup>16</sup> As a matter of fact, this is an important distinction to the Spence model. There, educational institutions somehow exist: the Spence model is silent on the issue of their existence, but assumes that they could force different types to internalize the different costs of an education (which of course the bad types won't do because it is too costly for them). Likewise, in our simplified model the certifier somehow exists and manages to force them to internalize these costs of being certified (which of course the bad types won't do because it is too costly for them).

From the rearranged condition we see that for the type at the separating equilibrium,  $s^*$ , internal and external costs are equal to the additional donations it can expect, i.e. what it pays for certification is covered by the expected increase in donations induced by certification. The expected profit of the type at the separating equilibrium,  $s^*$ , is therefore 0 (types above  $s^*$  are left with a surplus, as their costs are lower).

The difference in donations is known: with our giving function, as defined by A4, (and no mistakes in detection), the difference in donations is  $(I+s)/(2-2s)$ , an increasing function of standards. The solution of  $c(s^*) + P = (I+s)/(2-2s)$  depends on  $c(s^*)$ , the shape of the cost function. Assuming linear costs,  $c(t) = I - t$ , we get the separating fee as an increasing function of standards, as depicted in Figure 1.<sup>17</sup>

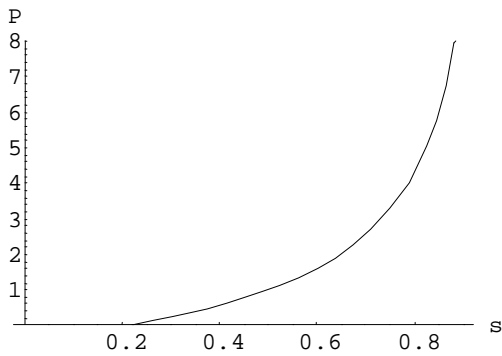
Charging a higher fee,  $P$ , leads to separation at higher standards. Note that even charging no fee at all induces separation at  $s = .2$ . This is intuitive: for types below this threshold, the payoffs from certification are too low to entice them to participate. In terms of the rearranged condition, even with  $P = 0$ ,  $c(s^*) > d_C - d_{NC}$ .

In the separating equilibria identified by the rearranged conditions, types with  $t > s^*$  (which from here on we shall call “good types”) come to ask for certification, pay the separating fee,  $P^* = c(s^*) - (I+s^*)/(2-2s^*)$ , incur  $c(t)$ , obtain the certificate, and then receive donation  $d_C$ . Types with  $t < s^*$  (which from here on we shall call “bad types”) do not apply and do not receive donations. Thus, in order to induce a higher standard (and possibly to increase the welfare of society), the certifier has to increase the fee,  $P$ .

Figure 1: Separating fee,  $P$ , as a function of standards  $s$  (for  $c(t) = I-t$ ).

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<sup>17</sup> All computations and figures in this paper were done in Mathematica v. 4.1.



Assuming that the internal costs,  $c(t)$ , are a function of type only, rules out a pooling equilibrium at  $s = 0$ , as the internal costs reach their maximum at this point and thus prevent the low types from participating.

Similar solutions exist for the family of cost functions that are decreasing in  $t$  and are convex ( $c'(t) < 0$ ,  $c''(t) > 0$ ) (such as  $c(t)=1/t$ , or  $c(t)=(1-t)/t$ ). The identified solutions all determine a one-to-one relationship between an optimal standard and the fee that needs to be charged to reach this standard.

Given a particular cost function, and assuming that the certifier is honest (A9), the certifier announces a standard at which he wants to induce separation and the fee that corresponds to this standard. Note that in this simplified basic game (which we have introduced to fix ideas), the certifier can select any such standard/fee combination he chooses: they all lead to separation. Also, he does not need to evaluate the charities himself; he is sure that only charities above  $s^*$  ask for certification as the fee  $P^*$  bans the bad charities from applying. However, as in Spence (1973), no guidance is given by the simplified basic game as to which of these combinations would be optimal in some yet to be defined sense.

#### 4.2 Basic game, $G_B$

We now start to address the drawbacks of the simplified basic game by solving the basic game  $G_B$ . Specifically, we now assume that the internal costs are a function of both type,  $t$ , and standards,  $s$  (A5ii). We also assume that the certifier does evaluate charities and in this evaluation makes mistakes (A6).

Specifically, we assume an internal cost function,  $c(t, s) = (1-t)s$ ; i.e. we assume that costs decrease in type and increase in standards. The decrease in type captures our intuition that it will be less costly for better types to provide the required certification materials, and therefore also more costly for worse types to misrepresent themselves. The increase in standards captures our intuition that the (internal) costs of compliance with standards depends on the chosen standard: if the standard is close to zero, almost everyone will be able to fulfill it. But as standards are tightened, costs of compliance will increase albeit less so for the better types. This is reflected in the cross-derivative which is negative for the cost function that we have chosen. Again, there exists a family of internal cost functions for which costs decrease in type and increase in standards that lead to similar qualitative results such as  $c(t, s) = (1-t)s^2$ , or  $c(t, s) = (1-t)s/t$ .

As in the simplified basic game, we assume for now that the certifier behaves honestly (A9), and that the separating equilibrium therefore occurs at the announced standard,  $s$ . The ICCs of charities then look as follows:

$$\begin{aligned}
(1-p(s, t, p_{\min})) d_C + p(s, t, p_{\min}) d_{NC} - P - c(t,s) &< d_{NC} && \text{for } t < s; \\
d_{NC} < p(s, t, p_{\min}) d_C + (1 - p(s, t, p_{\min})) d_{NC} - P - c(t,s) &&& \text{for } t > s \\
\Leftrightarrow \\
(1-p(s, t, p_{\min})) d_C < P + c(t,s) &&& \text{for } t < s && \text{ICC for the bad types;} \\
p(s, t, p_{\min}) d_C > P + c(t,s) &&& \text{for } t > s && \text{ICC for the good types;}
\end{aligned}$$

To recall,  $p(t, s, p_{\min})$  is the probability of detection of an organization of type  $t$  (A6), and the expected donations to non-certified charities are 0 (and therefore do not appear in the rearranged conditions) (A4).

We note that, strictly speaking,  $d_C = d_C(s, p_{\min}, e)$  and  $d_{NC} = d_{NC}(s, p_{\min}, e)$  where  $e$  represents the threshold above which charities are assumed to be of the good type (A6); to simplify notation we omit the arguments.

It is important to remember, however, that expected donations are a function of detection probability: if mistakes are not possible, the number of charities with certificate is  $1-s$ , i.e. all charities above the

threshold have the certificate. If mistakes are possible, the number of charities with certificate is lower (and the expected donation therefore higher). Some charities are wrongly assessed to be of a quality below the standard and hence do not obtain the certificate; this number depends on the detection probability, i.e. the frequency of mistakes.

This can be seen from the original ICCs: the good types receive donations with probability  $p(s, t, p_{min})$ , i.e. they are assessed correctly, while they receive nothing with probability  $1 - p(s, t, p_{min})$ , i.e. they are assessed incorrectly. Because  $1 - p(s, t, p_{min}) > 0$ , and since both internal costs,  $c(t, s)$ , and external costs,  $P$ , are bounded away from zero, some good types have, ex ante, the incentive to apply even though ex post they may fall through the cracks. This can also be seen from the re-arranged ICC which demonstrates that the expected revenue is greater than the costs. In contrast, the bad types receive donations only in the case of mistakes (induced by the imperfect detection technology) but the expected value of these donations is swamped by the internal costs,  $c(t, s)$ , and external costs,  $P$ , both of which are bounded away from zero. Because the expected value of these donations is swamped by the costs, the bad types will not apply in the first place.<sup>18</sup>

As one can see from the re-arranged ICCs, (contrary to the simplified game) it is not possible to find a fee that would satisfy both conditions with equality except for the limit case where the probability of detection is .5. A probability of detection,  $p = p(s, t, p_{min}) > .5$ , shifts the constraints apart for the good types and the bad types.<sup>19</sup> Note that in separating equilibrium we are interested in what happens at the separating point  $t = s$ , where the detection probability is  $p(s, t, p_{min}) = p_{min}$ . Thus from now on we talk about detection probability  $p_{min}$  only.

A separating equilibrium arises if both constraints hold. In fact, with the exception of  $p_{min} = .5$ , there will be many separating equilibria with two boundary cases defined by one of the constraints being

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<sup>18</sup> This assumes that an applicant will have to pay the fee,  $P$ . (They will have to pay the internal costs anyway.) Indeed, as the example of German certification agency DZI demonstrates, unsuccessful applicants do have to pay the application fee. This affects nearly one third of the applicants, with these costs becoming sunk for about one fifth of the applicants. Qualitatively, this fact strengthens the incentives of applicants to reveal their type. If unsuccessful applicants would not have to pay the application fee, the argument in the text would be affected only quantitatively but not qualitatively, as long as the internal costs would swamp the expected value of getting donations that one does not deserve.

<sup>19</sup> The gap between the ICCs is due to the detection done by the certifier. If the certifier were able to assess the charities perfectly, he would award the certificate only to charities that are good, i.e. these would get the certificate with certainty, while the bad charities would not be able to obtain it at all. Thus, the gap would be maximum,  $I$ .

satisfied with equality. (Note that for  $p_{min} > 1/2$ , if one of the constraints holds with equality, the other is satisfied with strong inequality. Note also that the ICCs are satisfied for all fees between the two boundary cases, i.e. the problem has infinity of solutions.)

Below, we describe the two boundary solutions only;<sup>20</sup> as before for the simplified game, we solve for the optimal fee that must be charged to induce separation at  $s$  (see Figure 1). We denote the two boundary solutions as the upper boundary fee (labeled  $P_H$ , it arises when the constraint for the good types binds) and the lower boundary fee (labeled  $P_L$ , it arises when the constraint for the bad types binds). As the names suggest, the lower boundary fee is always below the upper one (for all  $p_{min} > 1/2$ ). This results from the fact that the expected donations to the good types are always above those expected by the bad types, as explained above.

The lower boundary fee,  $P_L$ , is a function of technology,  $p_{min}$ , and standards,  $s$ . As Figure 2 demonstrates, the equilibrium exists for all  $p_{min}$  and standards  $s$ . However, analogous to what we saw in Figure 1, some  $(p_{min}, s)$  pairs induce separation without charging any fee – this is the flat part in Figure 2. For those  $(p_{min}, s)$  pairs that induce separation without charging any fee, charities separate into good types and bad types simply on the basis of their internal costs.

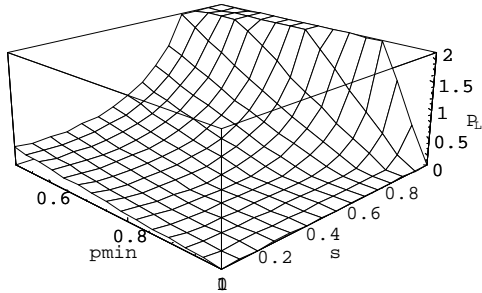
The lower boundary fee increases in  $s$ : the higher the standards the certifier wants to induce, the higher a fee he must set to restrict bad types from applying for certification. The fee decreases in quality of detection technology,  $p_{min}$ ; the effect, however, is small (but increasing in  $s$ ). This results from the fact that the incentive constraint of the bad types binds: increasing the detection probability decreases their expected payoffs (and lowers the probability that they will be awarded the certificate by mistake). Consequently, the fee needed to induce separation can be lower.

Figure 2: Lower boundary fee

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<sup>20</sup> It is sufficient to describe the boundary solutions for two reasons: first, they define all solutions in between, and second, we will see later (solving the full game,  $G_F$ ) that the certifier always chooses a boundary solution.

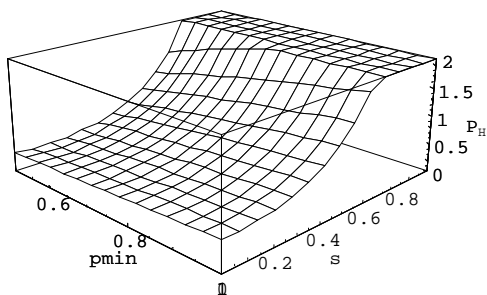




The upper boundary fee,  $P_H$ , is also a function of technology,  $p_{min}$  and standards,  $s$ . As Figure 3 demonstrates, the equilibrium exists for all  $p_{min}$  and standards  $s$ . However, in contrast to what we saw in Figures 1 and 2, it is always necessary to charge a fee – there is no flat part in Figure 3.

The upper boundary fee also increases in  $s$ : the higher the standards the certifier wants to induce, the higher a fee he must set to restrict bad types from applying for certification. In contrast to the lower boundary fee case, the fee decreases in quality of detection technology,  $p_{min}$ ; but the effect again is small (and also increasing in  $s$ ). This results from the fact that now the incentive constraint of the good types binds: increasing the detection probability increases their expected payoffs (and lowers the probability that they will not be awarded the certificate by mistake). Consequently, the fee needed to induce separation must be higher.

Figure 3: Upper boundary fee



Note that the identified solutions also include a pooling equilibrium: setting  $s = 0$  effectively means that the certifier pools all charities and that he awards the certificate without additional restrictions. The internal costs at this point are zero. The certifier realizes that there is no need to evaluate the charities

asking for certification as, in the end, the certificate shall be awarded to all. In order to maintain this equilibrium he must charge a fee below (or equal to)  $E[t]$ , the expected donation of a certified charity. This is observed in Figure 3 at the point where  $p_{min} = 1$ , i.e. where the certifier is assumed to evaluate all charities correctly as being above standard and to give them the certificate.<sup>21</sup>

#### 4.3 Full game, $G_F$

In this section we solve the full game,  $G_F$ , by adding to the basic game,  $G_B$ , various assumptions about the objective function that the certifier might have; all assumptions of the basic game are maintained in what follows in this section. Guided by an objective function, the certifier now chooses among the separating equilibria identified in section 4.2. As before, he does so by choosing simultaneously the technology,  $p_{min}$ , the standard,  $s$ , and a fee,  $P$  (that lies within the boundaries – lower and upper boundary fee). He also considers the pooling equilibrium where all charities have the certificate.

We consider two types of certifiers: A profit maximizing certifier (4.3.A below), and a nonprofit certifier, for which we analyze two specifications: a certifier maximizing the welfare of society defined either as the maximum amount of donations reaching those in need, referred to as ‘Money to Africa’ (4.3 B),<sup>22</sup> or as maximum detection probability, referred to as ‘Tech detect’ (4.3 C). These three cases are all analyzed for two parametrizations of the certifier’s cost function  $c_{CF}(p_{min})$ , high and low.<sup>23</sup> Needless to say, all our results below depend on the particular functional specification; the robustness of our results is subject to further research.

In addition, we assume that the certifier will not set standards above a threshold  $e$ , a minimum number of charities that he will identify as ‘good’ in the market. As noted above, perfect detection ( $p(t, s, p_{min})=1$ ) is reached at point  $e$ ; above  $e$  charities are assumed to be of the good type. Below  $e$  is assumed to be .95.

##### A.) profit maximization

<sup>21</sup> In Figure 2 we see the problem from the bad types’ perspective: with perfect detection they do not have any chance to obtain the certificate, thus the maximum fee the certifier may charge is 0.

<sup>22</sup> Results in this case are similar to results we obtain if the certifier maximizes standards; given our assumptions, the certifier that maximizes standards will thus *uno actu* maximize giving to ‘Money to Africa’.

<sup>23</sup> We assume the cost function  $c_{CF}(p_{min}) = a (.25/(p_{min} - 1)^2 - 1)$ . This functional form meets the requirements from A6: costs are infinite for perfect detection,  $p_{min} = 1$ , and 0 for no detection,  $p_{min} = 1/2$ . Costs are high with  $a = 1/2$ , and low with  $a = .1$ .

The certifier maximizes:

$$\text{Max}_{P,s,p_{min}} (1-s)P^* - c_{CF}(p_{min})$$

where  $P^*$  is the fee inducing the separating equilibrium identified in section 4.2, and hence the first term denotes the certifier's income from certification and the second term denotes his costs of technology.

While the certifier maximizes this function simultaneously, we analyze his optimal choice sequentially.

We start with the determination of the optimal fee: Clearly, the charged fee increases profit *ceteris paribus*, therefore the optimal fee of a profit maximizing certifier is the upper boundary fee  $P_H$  (arising from the good types' constraint, as depicted in Figure 3). This ensures the highest possible profit for all the  $(s, p_{min})$  pairs. (This is the highest possible fee ensuring separation at  $s$ ; fees above would shift the separating point  $s$  further up, violating A9 [commitment of the certifier to being honest].)

The impact of standards is two-fold: first, an increase in standards decreases participation in certification and thus lowers the certifier's income from fees; second, an increase in standards increases the maximum possible fee that may be charged (Figure 3). The optimal choice of  $s$  depends on the interplay of these two effects. For the functional specification we have chosen, the negative effect of decreasing participation ultimately overpowers the positive effect of increasing the fee. The optimal standard – computed from the first-order conditions of the certifier's profit maximization problem – is therefore slightly below the maximum possible standard, .95, at .87 for high costs and .88 for low costs. The optimal standard does not directly depend on the cost function, but is affected indirectly through the optimal choice of detection technology.

The impact of detection technology on profits is both direct and indirect. It is direct through the costs of technology. It is indirect through its effect on the fee that may be charged for certification: increasing detection probability increases the fee that may be charged (recall Figure 3). The optimal investment – again computed from the first-order conditions of the certifier's profit maximization problem – is a function of standards as illustrated in Figure 4 for the low cost case. For the high cost case, the costs are

prohibitive, resulting in zero investment in detection technology, i.e.  $p_{min} = 1/2$ . The case with low costs and standards .88 (optimal as identified above) leads to detection technology with  $p_{min} = .61$ .

The case with high costs, however, still assigns the certifier a role: the certifier will not invest in detection technology which induces a noisy form of separation of bad guys from good guys, with bad guys not applying but with a number of good guys falling through the cracks.

The profit maximizing certifier also needs to take into account the pooling equilibrium with all charities obtaining the certificate, implying that the minimum quality is zero ( $s = 0$ ). Donors now expect charities with a certificate not to be of zero quality; therefore they give  $E[t]$  (as in the case without certification). Nonetheless, the (few) charities of zero quality will in any event apply for certification since the costs of certification to them will be counteracted by the donations they will receive.  $E[t]$  is also the maximum fee that can be (and thus is) charged by a profit maximizing certifier resulting in profit  $E[t]$ ; thus the profit of the certifier is  $1/2$ .

Since the profit ensured by the optimal choice identified above is .56, the certifier prefers the separating equilibrium to the pooling equilibrium. Interestingly, and importantly, this result differs from that of Lizzeri (1999). This result is due to the different giving behavior of the donors, which in turn is due to their appreciation of quality and a demand shift benefiting certified organizations only. The profit can be high in the separating equilibrium because, in line with the higher standards, higher fees can be charged for certification, which ensures sufficient profits to the certifier even if participation is low. However, it is necessary to keep the pooling equilibrium in mind, as it may become the most profitable one if the behavior of donors changes ever so slightly.

B.) nonprofit certifier – ‘Money to Africa’ maximization

The certifier maximizes welfare:

$$\text{Max}_{p,s,p_{min}} E[t/t>s](1+s)/2 - (1-s)P^* - c_{CF}(p_{min}).$$

Since the results for ‘Money to Africa’ maximization are qualitatively similar to maximization of standards only, we analyze this latter case (which turns out to be more easily trackable<sup>24</sup>). Hence,

$$\text{Max}_{P,s,p_{min}} s - (1-s)P^* - c_{CF}(p_{min}).$$

In the first equation we model welfare as the amount of funds reaching the target group (assuming that type,  $t$ , represents the fraction of funds reaching its goal), while in the second we model welfare as maximum standard. In both cases we subtract costs related to certification (fees paid by charities and the costs of technology incurred by the certifier).

We follow the logic of our preceding analysis and first identify the optimal fee. The impact of the fee on welfare is negative ceteris paribus: an increase in the fee increases the costs of certification having a negative impact on the welfare. A welfare maximizing certifier, therefore, chooses the lowest possible fee inducing separation, which is the lower boundary fee,  $P_L$ .

The impact of standards is again two-fold: first, an increase in standards has two direct positive effects, an increase in welfare and a decrease in participation (i.e. decrease in losses due to fees paid); second, an increase in standards has an indirect negative effect through an increase in the maximum fee that can be charged. Nevertheless, the positive effects prevail and it is always optimal to set the standards as high as possible – in our case it means reaching the threshold  $s = e = .95$ . (Of course, our earlier caveat about the validity of this claim maintains.)

The impact of detection technology is two-fold as well: a direct negative effect due to costs of technology incurred by the certifier; and an indirect positive effect through the impact on the fee that can be charged for certification. The lower boundary fee charged in the latter case is decreasing in detection probability (Figure 2). The positive effect of detection probability is stronger in this case than in the case of profit maximization, as now the detection probability not only decreases the maximum fee that may be charged but also decreases the expected donations of the certified charities (this was an argument against  $p_{min}$  in the profit maximizing case). The optimal detection technology is .64 for the low costs; for

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<sup>24</sup> We are on ‘the safe side’ as the importance of standards in this case is lower than it is in the case of ‘Money to Africa’ maximization.

the high cost case, the costs are – again – prohibitive, resulting in zero investment in detection technology, i.e.  $p_{min} = 1/2$ .

A welfare maximizing certifier will never choose the pooling equilibrium, as the welfare in this case is 0 and he is able to ensure positive welfare by setting nearly any other standard.

Analyzing the behavior of any welfare maximizing certifier (both those maximizing standards and detection probability) opens space for an additional consideration: keeping a balanced budget, we need to make sure that the certifier covers his costs, at least after subsidies (which for now we do not consider). (We may further require that the certifier spends all his revenue on related businesses.) We analyze welfare maximizing certifiers who always choose the lower boundary fee,  $P_L$ . Thus, below we use  $P_L$  only. The constraint looks as follows:  $c_{CF}(p_{min}) = (1-s) P_L \Leftrightarrow P_L = c_{CF}(p_{min})/(1-s)$ .

Interestingly, a welfare maximizing certifier is always able to cover his costs; he needs to charge a high fee to induce high standards, therefore the income is sufficient to cover the corresponding costs of technology. In the optimal case identified above, the certifier even makes a profit (.28). Implementing the constraint requiring zero profit in the end would, therefore, force the certifier to invest more in technology (which would increase the detection and shift the equilibrium from the maximum welfare case).

C.) nonprofit certifier – ‘Tech detect’ maximization

The certifier maximizes:

$$\text{Max}_{p,s,p_{min}} b p_{min} - (1-s)P^* - c_{CF}(p_{min}),$$

where  $b$  is the parameter representing how much the society cares for correct detection. (Below we assume  $b = 1$ ; the other parts of the welfare function are as in B.)

The certification fee has, similar to the case above, a negative impact on welfare only; thus a welfare-maximizing certifier chooses the lower boundary fee,  $P_L$  (Figure 2).

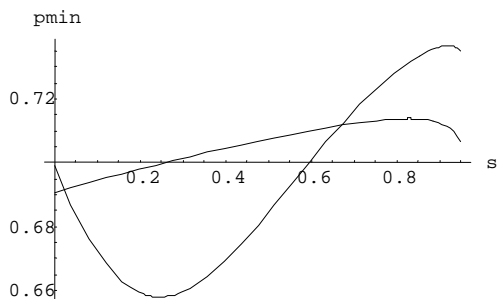
The impact of standards is two-fold (as in the previous cases): first, increasing standards has a direct positive impact through decreasing participation (decreasing losses due to the fees paid); second, increasing standards has an indirect negative impact through increasing the optimal fee (increasing losses due to fees). The first-order condition on optimal standards is similar to that of the standards maximization case, except for the missing direct influence of standards, which was very important in the standards maximization case – its pretermission leads to a significantly different result – the negative impact prevails, and the resulting optimal standards are very low: in the low cost case .26, and in the high cost case .2.

The effect of detection probability is also similar to the case of standards maximization (positive effect on welfare due to a decrease in the optimal fee, negative effect due to costs), but in addition, we now have the direct positive impact on welfare, pushing the investment higher for all the choices of standard. Thus, the optimal investment is the highest (as expected) from all the considered cases. It is still not possible to sustain investment in detection for the high costs, i.e.  $p_{min} = 1/2$ . The optimal detection for the low costs is  $p_{min} = .7$ .

A technology maximizing certifier does not even consider the pooling equilibrium with  $s = 0$  as in that case technology plays no role; it becomes redundant.

Again, we need to take into account that the certifier needs to cover his costs; in this case the budget constraint binds as the certifier choosing the optimal solution identified above incurs losses (-.1). The certifier covering costs chooses the maximum possible detection he can afford (according to the condition described in section 4.3.B); in Figure 4, both welfare-maximizing detection (optimal detection identified from the FOC, the curve that oscillates less) and the maximum possible detection that the certifier can afford (cost covering detection) as a function of standards are shown.

Figure 4: Optimal detection and cost-covering detection



The cost-covering detection follows the behavior of revenues, as these determine how much can be invested; it reaches its minimum at  $s = .26$ . This minimum is also the welfare maximizing standard (as losses due to the certification fee play an important role in determining welfare): to maintain this standard but cover his budget the certifier would have to decrease his investment in detection technology to  $p_{min} = .66$  (from the original optimal  $p_{min} = .7$ ). Such a decrease, however, might not lead to a separating equilibrium. Thus, the technology maximizing certifier keeps in mind the binding constraint ( $p_{min}$  being defined by the budget restriction). The solution under this constraint is similar to the original one: standards are .245, the investment in technology is .66. The welfare decreases from .45 to .43, and profit is zero.

D.) Numerical summary of results

Table 1: Numerical results

	Profit maximization	Money to Africa	Tech detect
$P$	$P_H$ 5.29	$P_L$ 6.97	$P_L$ .1
$s$	.88	.95 (max)	.26
$p_{min}$	.61	.64	.7

Table 1 summarizes the results explained in sections (4.3.A-C): We see that the profit maximizing certifier does not set the highest possible standard although he sets the standard quite high. This



behavior is profitable for him due to the demand shift of consumers who give all the donations to certified charities only, and the certifier is consequently able to charge a high fee, ensuring himself high profit. He still invests something in technology; he does so because technology has a positive effect on the size of the fee he may charge. This result is in stark contrast to some of the results in Lizzeri (1999).

The certifier who maximizes ‘Money to Africa’ cares strongly about the standard. Since maximization of standards, in our model, also means maximization of the fraction of donations reaching Africa, the certifier sets the standard as high as possible – at threshold  $e$ . To induce separation at this point, he needs to charge a correspondingly high fee which – despite the fact that he chooses the lowest possible fee – is still higher than that from the profit maximizing case. The certifier invests in detection, as detection decreases the fee he must charge to induce separation (Figure 2).

The certifier who maximizes ‘Tech detect’ cares about the quality of his detection technology, but also about the costs of detection technology on welfare. Thus, he minimizes the costs of detection by setting the standard very low. This implies that he charges a rather low price to induce separation. Investment in detection helps to decrease the fee even further and, moreover, increases the welfare directly; thus the investment is the highest from all the considered cases.

## 5. Conclusion: future work and policy implications

We have built a model which illustrates how, and under what conditions, an independent certifier might mitigate the principal-agent problem in fundraising, or the *fundraising problem*. In contrast to previous literature, we studied both for- and non-profit organizational forms of the certifier. Our results (in particular, those assuming the ‘Money to Africa’ welfare function) seem to rationalize the stylized facts of certification systems that we have identified.

Specifically, certification agencies that deal with variants of the fundraising problem that we observe in various West-European countries and the U.S.A. and Canada (and that we have discussed in more detail in Ortmann, et al., 2005) are all nonprofits, impose relatively high standards on applicants, and indeed certify only a fraction of the (potential) applicants.

It is the nature of modeling to abstract. The model introduced in this paper, too, is a simplification of real-world institutions. But, by enumerating explicitly the stylized facts on which we draw, and by enumerating the assumptions on which we build our model (and how these assumptions are related to the stylized facts), we make our modeling efforts transparent and open to critique. In fact, we welcome a critique of our reading of the stylized facts that we identified and the assumptions that we use.

Some avenues that we could take in future work are self-evident:

First, although relatively simple, our model is not analytically tractable. It would be desirable to build a model that could be tracked analytically (although that may come at the cost of having to simplify the model even further).

Second, given that we were not able to solve the model analytically – it is too complicated for that – we had in various places (e.g., the cost functions, or the detection technology) to make do with functional specifications that are constrained only by our intuition of what appropriate functional specifications are. Since trusting intuition is something that economists are hesitant to do, testing the robustness of these specifications is desirable.

Third, there is very little work out there (the notable exception being Bekkers, 2003) that would allow us to calibrate our model and hence rationalize our choice of particular functional specifications. For example, the Austrian model of certification on the one hand and the Dutch and German models of certification on the other hand, differ in a key aspect: the former relies heavily on external “investigators” (using, however, its quality assessment instrument) while the latter use internal investigators. This difference is very likely to affect the interplay of detection probability and welfare effects of bad types being, mistakenly, certified as good types. Unfortunately, we have no inkling about this relationship (although we suspect that the Austrian model is tempting fate).

Fourth, we have assumed (A9) that the certifier is honest and does not misrepresent the standard or the quality of the certified organizations (for, say, for-profit maximizing reasons). This is, quite likely, a heroic assumption, especially in transition and developing countries where concepts of accountability and transparency, or reputational enforcement, often seem rather alien concepts. A certifier, in other words, might have an incentive to cheat (as self-regulatory systems are prone to do; e.g. Nunez 2001,

2002) and it is important to understand what exactly these incentives are and how they could be undermined.

Fifth, and relatedly, there is the question of whether one should force the certification agency to make ends meet, or whether it should be supported by state subsidies. This, too, ought to be modeled and, in fact, we have made first steps towards a better understanding within the strictures of our model already.

What are the policy implications of our model so far?

Clearly, certification systems are viable quality assurance mechanisms in transition and developing countries. But getting the particular realization of such a system right is an endeavor that takes reflection. Our results suggest that a certification agency ought to be a non-profit itself<sup>25</sup> and that such an organization has to be both accountable and transparent. Our results so far also suggest that, to the extent that they allow for the choice of a better detection technology, public subsidies for a certification system might be desirable.

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<sup>25</sup> Of course, we understand well that nonprofits are often afflicted with their own sets of incentive problems.

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### List of Variables:

$t$	type (quality) of charity/fundraiser, distributed according to $F(t) \sim U[0, 1]$
$s$	standards – choice of the certifier, requirement on charities to obtain certification
$P^*(s, p_{min})$	optimal fee – fee ensuring separation (given standards and detection probability)
$P$	external costs of certification – fee charged by the certifier for the service
$p_{min}$	minimum detection probability at standard ( $t=s$ )
$p(t, s, p_{min})$	the probability of detection of an organization of type $t$
$c(t)$	internal costs of certification; here function of $t$ only – this type is used only in the simplified version of the basic game, $G_B$ ; the usually assumed form is $(1-t)$
$c(t, s)$	internal costs of certification; function of $t$ and $s$ – used throughout the game; the usually assumed form is $(1-t)s$
$c_{CF}(p_{min})$	costs of detection probability – function of the minimum detection probability $p_{min}$ that applies in case $t = s$ (organization is exactly of the quality as the required standards); the assumed form is $a(p_{min})^2$ , alternative assumed form is with costs going to infinity
$a$	cost parameter (from $c_{CF}$ from above), we assume values, high – 1, medium – $\frac{1}{2}$ , or low – .1
$d_C$	expected donation of a certified organization
$d_{NC}$	expected donation of a noncertified organization
$b$	parameter expressing donors' valuation of either standards (case B) or detection probability (case C)
$w$	weight of welfare in certifier's optimization function ( $(1 - w)$ is the weight of profit)