The dark side of NGOs competition
Very preliminary

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Abstract

In this paper, we investigate how competition among NGOs affects employees' moral behavior. Employees can engage in constructive and destructive effort, where only the former benefits the NGOs. The NGOs need to monitor the employees as their destructive effort is non-contractible. We find that competition may reduce monitoring intensity, thereby leading to more destructive effort. We also show that NGOs may end up paying too much to hire talented employees. Therefore, the availability of talented employees may hurt NGOs and this is particularly the case when NGOs' competition is severe.

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1 Introduction

Sadly, there are several examples that illustrate the relevance of anti-social behavior in mission-oriented organizations. In 2006 "Save the Children" exposed the United Nations sex-for-food scandal.[1] Oxfam Haiti scandal, uncovered in 2018, in which some members of the staff were accused of sexual misconduct, is also notorious.[2] These scandals have tremendously affected the reputation of these organizations, impacting on their finances. After the Oxfam Haiti scandal, about 7.000 people have stopped making regular donations to Oxfam.[3]

As NGOs have to raise funds to finance their activities, it is in their best interest to avoid these scandals by punishing these antisocial behaviors or rewarding workers for their good behavior. To attract donors, NGOs compete among each other offering differentiated activities. The quality of these activities depends on the effort exerted by the employees. We build a model in which horizontally differentiated NGOs hire workers to develop these activities. Employees can engage in constructive and destructive effort. While constructive effort is desirable as it increases the quality of the activity offered by the NGOs, the destructive effort represents an undesirable behavior on the part of the worker, e.g., bribes, sexual misconduct. As this destructive effort is non-contractible, NGOs need to monitor their employees.

In this paper, we investigate how NGOs' competition affects monitoring decision and bonus payment, as well as employees' constructive and destructive effort. We find that competition may reduce monitoring intensity, thereby leading to more destructive effort. This is indeed the case when the constructive and destructive effort are either independent or complementary. We also find that competition may lead to an increase in monitoring which is nonetheless accompanied by an increase in destructive effort. Moreover, we show that NGOs may end up paying too much to hire talented employees. Therefore, the availability of talented employees may hurt NGOs and this is particularly the case when NGOs' competition is severe.

Related literature Our paper brings together four different strands of theoretical literature: moral hazard and multitasking, work ethics in mission-oriented firms, NGOs' competition in the market for donations, and horizontal differentiation in a circular space.

First, our paper is related to the strand of literature that examines incentive contracts

[1] See the report by Save the Children in 2006 that showed that aid workers were systematically abusing minors in a refugee camp in Liberia, selling food for sex. In 2008, there was another report showing similar cases also in Southern Sudan, Burundi, Ivory Coast, East Timor, Congo, Cambodia, Bosnia and Haiti (see the report by Save the Children in 2008).

[2] See "Oxfam was told of aid workers raping and sexually exploiting children in Haiti a decade ago", Independent, February 16, 2018.

[3] See "Oxfam Haiti scandal: Thousands cancel donations to charity", BBC News, February 20, 2018.

in the framework of moral hazard and multitasking. The seminal paper is Holmstrom and Milgrom (1991), which shows that, when agents are required to perform different tasks, linear incentive pay serves two different purposes: (*i*) to induce hard work (and, eventually, to allocate risks across tasks); (*ii*) to direct the allocation of agents' attention towards different tasks. It is often the case that agents' performance in different tasks can be measured with varying degrees of precision and that the agents' costs of providing effort depend on the total amount of effort devoted to all tasks. Therefore, an increase in incentive pay in the task whose performance can be more easily measured induces agents to reallocate their attention away from other activities that are more difficult to measure. Building on these insights, Bénabou and Tirole (2016) analyze the screening problem for workers' talent and examine the optimal incentive contracts that two competing firms offer to their prospective workers, who are required to engage in two different activities. When the tasks are substitutes, increased competition bids up the level of compensation for the most talented workers, but also alters the structure of incentive pay towards high-powered incentives. Bénabou and Tirole (2016) conclude that intense competition in the labor market has detrimental effects on social welfare.

As for employees' work ethics, a growing body of theoretical literature has examined the relationship between incentives in mission-oriented organizations and workers' motivation to work. The focus has been primarily put on pro-social motivation, i.e. on employees' enjoyment of their personal contribution to the employer's mission or goals (as in Besley and Ghatak, 2005, 2017, 2018, or Barigozzi and Burani, 2016, 2019). These papers highlight the importance of matching the mission preferences of mission-oriented firms and motivated workers in order to save on monetary incentives. Nonetheless, mission-oriented organizations lend themselves easily to be the target of bad workers, who derive pleasure from destructive behavior and take advantage of the fact that often NGOs and other non-profit organizations operate in remote locations with little control from the outside. This is precisely the framework analyzed by Auriol and Brilon (2014). They consider a moral hazard framework and analyze the optimal incentive contracts offered by profit-oriented or mission-oriented organizations to their potential employees, who can be good (motivated to do the right thing), regular, or bad (enjoying destructive behavior). Given that neither constructive nor destructive effort exerted by workers are observable or contractible, employers have to resort to both monitoring and bonus payment to induce the desired behavior on the part of their employees. In equilibrium, bad workers are only employed in the profit-oriented sector, where they behave like regular workers and do no perform any destructive action. Conversely, good workers are only employed in the mission-oriented sector, where both monitoring and bonus payment are lower. Notice that, as in Bénabou and Tirole (2016), constructive and destructive effort are considered as substitutes and could potentially be performed simultaneously by the same worker. Nonetheless, the focus on workers' self-selection between profit-oriented or mission-oriented organizations, allows Auriol and Brilon (2014) to disregard the problem of multitasking and, in particular, of how the technological interaction between tasks affects incentives. Furthermore, Macchiavello (2008) provides a theoretical analysis of the relationship between workers' motivation and sorting, focusing attention on the public vs the private sector of a developing economy. In the public sector, workers produce a public good and are heterogeneous in terms of public sector motivation. Moreover, public sector employees cannot be compensated on the basis of their individual contribution to the production of the public good and they can engage in opportunistic behavior, diverting the resources they control for private uses. Public sector wage premia have two opposite effects: a low premium helps screen motivated workers into the public sector, while a high premium induces workers to be honest. Thus, an increase in the public sector wage may not improve the quality of governance and multiple equilibria might arise.

Third, our model is related to the literature on NGOs' competition in the market for donations. Two papers are mostly relevant in this area: Aldashev and Verdier (2010) and Aldashev et al. (2020). Aldashev and Verdier (2010) analyze a model of competition through fundraising among horizontally differentiated NGOs. Each NGO can run a single project and it is endowed with a fixed amount of resources (time). NGOs have to decide how to allocate these resources between fundraising activities and implementation of the project. They find that, in the free-entry equilibrium, the optimal number of NGOs in the market increases with their altruism and decreases with the fixed cost of entry. They also consider the case in which NGOs can behave badly and divert received donations for private uses. In this circumstance, for each NGO, fundraising effort and diversion of funds are strategic complements, whereby each NGO's fundraising effort increases with the number of NGOs in the market and with the amount of funds that it diverts. With free-entry, there exist multiple equilibria with no diversion or high diversion of funds. Aldashev et al. (2020) further develop this idea that good and bad equilibria can emerge, although in a different framework, where a key role is played by selection, as in Auriol and Brilon (2014). Aldashev et al. (2020) consider agents who can become private or social entrepreneurs and who can be either selfish or pro-socially motivated. Social entrepreneurs collect donations which can be allocated either to cover the organization's expenses or to accomplish the organization's mission. In equilibrium, two different configurations might arise: (i) all mission-oriented firms are managed by selfish entrepreneurs and some motivated agents run private organizations; (ii) all mission-oriented firms are managed by motivated entrepreneurs and some selfish agents run private organizations. They also consider a rise in foreign aid (represented as an exogenous increase in the amount of donations available for the mission-oriented sector) and find that it enlarges the set of parameter configurations under which an equilibrium of bad type (i) arises and that it has a non-monotonic effect.

Finally, our modelling strategy, which considers firms' decisional problems at two different layers, i.e. on the final product market and also on the factor markets, is reminiscent of Raith (2003), Manna (2017), and Heyes and Martin (2017). In Raith (2003) incentive contracts are analyzed under moral hazard but no multitasking and are related to product market competition. Firms compete on the final product market selling horizontally differentiated goods and, at the same time, provide incentives to managers to reduce their marginal costs. With endogenous market structure, it is shown that firms offer stronger incentives to their managers in response to an increase in the substitutability of their products (a decrease in transport costs). Similarly, in our paper, NGOs compete for donations by offering projects that are differentiated both horizontally and vertically, and they also provide incentives to their workers in order to increase their constructive effort (thus increasing project quality) while refraining from some kind of anti-social behavior. Heyes and Martin (2017) provide a model of competition between NGOs in the provision of labelling services. Firms rely on NGOs to certify that certain pro-social attributes are embodied in their products and consumers are willing to pay a premium for labelled products, because they care about the social impact of their consumption decisions. Heyes and Martin (2017) find that, with a fixed number of NGOs, labelling schemes are too stringent, in the sense that they apply to too a narrow set of issues; conversely, with free-entry, the stringency of labelling schemes is decreasing in the number of labels.

Outline The remainder of the article proceeds as follows. In Section 2 the model is presented and in Section 3 the equilibrium of the model is characterized; in Section 3.1 the results in the case in which activities are independent are illustrated, whereas in Section 3.2 the general case in which activities are either substitutes or complements are studied; concluding remarks and discussion of the results are given in Section 5.

2 The model

We build a model where there are three main actors: NGOs, workers, and donors. Each NGO (it) decides whether to enter the market, which project to carry out, and which kind of worker to hire. A risk-neutral worker (he) provides his effort to the NGO and, by doing so, influences the quality of the NGO's project. Donors (they) make donations to finance NGO's activities. In what follows, we describe the three actors in detail.

NGOs Theoretical and empirical papers argue that NGOs try to differentiate the services and activities they offer from those of other NGOs (see among others Pepall et al., 2006, Aldashev and Verdier, 2010). To incorporate this aspect and model competition, we consider a Salop model where n NGOs are located equidistantly around a circle (see Salop, 1979), whose perimeter is normalized to 1. The equilibrium number of firms competing in the market is determined by the zero-profit condition. The fixed cost of entry is F.

Each NGO's project is differentiated along two qualitative dimensions. The first is a horizontal dimension, as we consider each NGO as a mission-oriented organization whose target consists of a particular social problem, such as disaster relief, fighting child malnutrition or child labor, providing education and so on. The second is a vertical dimension, since, given its mission, each NGO can enhance the beneficiaries' well-being of its services with high quality. The quality of each NGO's project is determined by the amount of effort that workers employed by the NGO exert. NGO i can incentivize effort provision by setting a bonus payment equal to $q_i b_i$, where b_i is the unit payment for the incentivized activity. In addition, it sets a fixed payment denoted by z_i. In other words, NGO i offers its workers a linear contract of the form $w_i = z_i + \theta e_i b_i$.[4]

Workers Workers hired by NGO i can engage in two activities, E and D, exerting effort levels e_i and d_i, respectively, where e_i stands for *constructive* effort, whereas d_i denotes *destructive* effort. Activity E is measurable and contractible. When exerting effort e_i a worker's productivity is $\theta\, e_i$, where θ is a talent parameter. A worker's productivity in activity E determines the quality of NGO i's project which, for simplicity, is assumed to be such that $q_i = \theta\, e_i$. In contrast, activity D is not directly observable and hence not contractible. It represents an undesirable behavior on the part of the worker. Examples abound and range from diversion of donations received by the NGO for private uses to anti-social behavior like sexual misconduct. A worker's contribution to activity D is driven by internal determinants, such as his anti-social motivation $v\, d_i$, which is linear in the destructive effort d_i exerted in this activity. Being activity D not observable, NGOs need to monitor their employees as they may pursue their own private benefit to the detriment of the organization they work for. It is assumed that NGO i only observes the agent's destructive effort d_i with probability m_i, where m_i is the monitoring level chosen by NGO i. Conditional on being caught to exert effort d_i, the employee suffers a fixed cost k, representing the exogenous punishment that a Court of Justice can impose on the worker if such a destructive effort is observed.[5] Given the monitoring level m_i, the worker accepts any bonus payment b_i and any fixed salary z_i that provide him with an expected utility of at least his reservation utility, which is assumed to be fixed and equal to zero.

[4]Carroll (2015) shows that the optimal contract is linear and this result is robust for several extensions and variations of a basic moral hazard model.

[5]Auriol and Brilon (2014) also study a setup with bad workers and introduce a similar utility function for employees, but their emphasis on the selection of workers into different sectors of the labor market allows them to exclude multitasking.

Donors All NGOs receive donations from a continuum of small donors whose aggregate measure is S and who are uniformly located on a circle of circumference 1. Donors simultaneously decide which NGOs are going to benefit from their funding depending on both vertical and horizonal dimensions, as well as the NGOs' reputation. More specifically, let us denote by Y_i the *potential donations* destined for NGO i, which depends on both vertical and horizontal dimensions of NGO i's project quality relative to the neighbouring NGOs. Actually, Y_i does not represent the total amount of funds that NGO i is going to receive, because such amount is weighed according to NGO i's reputation, which is represented by the monitoring effort $m_i < 1$ that NGO i undertakes. Indeed, a high monitoring level m_i serves to persuade donors that NGO i's overall project quality is not undermined by the fact that NGO i's employees might engage in some destructive behavior. Hence, the *actual funding* received by NGO i is given by $y_i \equiv m_i Y_i$.[6] This assumption is necessary in order to have competition between NGOs in attracting donors. The remaining fraction $(1 - m_i) Y_i$ remains in the donors' hands and can be converted into consumption with utility is normalized to zero.

The timing of the game The timing of the model is as follows. In Stage 1, each NGO must decide whether to enter the market and incur an entry cost $F > 0$, or stay out. In Stage 2, each NGO hires an employee offering him a contract (b_i, z_i), and deciding the level of the monitoring activities m_i. Each employee accepts any contract which yields an expected utility of at least his reservation utility. In stage 3, employees undertake the project exerting effort e_i and, eventually, destructive effort d_i, so that quality is realized. In stage 4, donors decide which NGO to donate to on the basis of NGOs' observed project quality and monitoring activity.

The solution concept is subgame perfect Nash equilibrium and the game is solved by backward induction. Only symmetric equilibria are considered.

2.1 The Objective Functions

A donor k funding NGO i enjoys a utility:

$$U_{ik} = u + q_i - t\, x_{ik}^2.$$

[6] Such a distinction between potential and actual funding is reminiscent of Aldashev and Verdier (2010), as for the extension of the basic model to endogenous market size (see Section 3). Indeed, fundraising effort in their model serves the same purpose as monitoring effort in ours, namely it activates potential donors to giving. In addition, consider the difference between potential and actual demand facing two hospitals that compete in quality in Brekke et al. (2011), Brekke et al. (2012), and Siciliani et al. (2013).

A donor decides to make a donation if he obtains a non-negative utility. The donor's utility is positively related to the quality q_i of the project carried out by NGO i. Moreover, each donor has a most preferred variety of development project, the one corresponding to his own location on the circle, and the further NGO i is located on the circle, the less the project of the NGO corresponds to this preferred variety. The distance between NGO i and donor k is denoted by x_{ik}. Hence, the donor incurs a quadratic transportation or mismatch cost tx_{ik}^2 from adhering to the mission of NGO i, and a cost of $t\left(\frac{1}{n}-x_{ik}\right)^2$ from funding the next NGO $i+1$, where $1/n$ is the distance between any two NGOs. Parameter t captures the weight that the donor attaches to the congruence between the most preferred variety of development project and NGO i's mission. Since the marginal utility of quality is set equal to one, t can also be interpreted as the measure of the importance of the horizontal relative to the vertical dimension of quality. Finally, u is a positive constant utility from giving, independent of project quality and location. As in most papers in the literature (see, for example, Aldashev and Verdier, 2010, Manna, 2017), we assume that u is sufficiently high so that all donors prefer to donate to some NGO. In this way, the market for donations is fully covered by NGOs.

NGO i maximizes the following objective function:

$$\pi_i\left(b_i, m_i\right) = y_i + \left(E - b_i\right)\theta e_i - z_i - Dd_i - \frac{m_i^2}{2} - F. \tag{1}$$

On top of labor costs, represented by contract (b_i, z_i), NGO i incurs a quadratic cost of monitoring $m_i^2/2$; moreover, it suffers a damage Dd_i proportional to the destructive effort d_i that its employee chooses to exert, with $D > 0$. A positive entry is represented by E which denotes the non-monetary benefit that NGOs derive from pursuing a development project that embodies positive social attributes, which are pinned down by project quality $q_i = \theta e_i$. Finally, NGO i finances its operations through funds y_i collected from donors.

An employee working for NGO i obtains the following quasi-linear utility:

$$V_i\left(e_i, d_i\right) = w_i + (v - km_i)d_i - C(e_i, d_i). \tag{2}$$

Notice that, in order for activity D to be utility-enhancing for the worker and for $d_i > 0$ to be satisfied, it must be that $(v - km_i) > 0$. We assume that this inequality is violated when monitoring takes its maximal value, i.e., $m_i = 1$.

Assumption 1. $v < k < 1$. *This implies that full monitoring deters destructive behavior.*

The worker's total cost of effort provision $C(e, d)$ is strictly increasing and strictly convex in both effort levels. To obtain explicit analytical solutions, we assume that such effort cost takes the quadratic specification:

$$C(e_i, d_i) = \frac{e_i^2 + d_i^2}{2} + \gamma e_i d_i,$$

with $\gamma \in (-1, 1)$, similarly to Bénabou and Tirole (2016). It is worth noting that this formulation allows us to consider the case in which effort levels are independent, i.e., $\gamma = 0$, as well as the cases in which the two activities can be either complements or substitutes. Effort levels are complements when $\frac{\partial^2 C(e,d)}{\partial e \partial d} < 0$ and $-1 < \gamma < 0$, whereas they are substitutes when $\frac{\partial^2 C(e,d)}{\partial e \partial d} > 0$ and $0 < \gamma < 1$. We allow for both specifications since they are both plausible, depending on the context we are considering. Complementarity between effort levels seems natural when an increase in the constructive effort that a worker is required to do also increases the possibilities that are opened up to him for behaving badly, and thus decreases the additional cost of destructive action. Conversely, substitutability can be justified by the fact that each worker is endowed with a total amount of time to be allocated to the two activities E and D. Thus, there is an increasing cost involved in exerting effort d when a high amount of (time-consuming) effort related to task E has already been performed.[7]

3 Characterization of the equilibrium

The equilibrium is determined by backward induction. In the last stage of the game, donors take their funding decisions. A donor k who is located between NGO i and NGO $i+1$ at distance x_{ik} from NGO i, and consequently at distance $\left(\frac{1}{n} - x_{ik}\right)$ from NGO $i+1$, is indifferent between donating to either NGO if and only if:

$$u + q_i - t x_{ik}^2 = u + q_{i+1} - t\left(\frac{1}{n} - x_{ik}\right)^2.$$

This implies that $x_{ik} = \frac{t + n^2(q_i - q_{i+1})}{2nt}$. A similar reasoning applies to a donor who is located between NGO i and NGO $i-1$. Since the aim is to characterize a symmetric equilibrium, let all NGOs but i choose the same quality, denoted as q. Then, potential donations received by NGO i amount to:

$$Y_i = \frac{S\left[t + n^2\left(q_i - q\right)\right]}{nt}.$$

They are increasing in the (vertical) quality differential between NGO i and its neighbours and decreasing in the transportation cost t. Indeed, the latter affects the degree

[7] See Holmstrom and Milgrom (1991) and the more recent article by Bénabou and Tirole (2016) for multitasking principal-agent analyses with linear contracts and technological interactions among tasks.

of competition among NGOs. Markets with higher values of t are those in which NGOs' projects are less substitutable. Such markets are less competitive since donors are less sensitive to changes in the horizontal dimension of project variety than in markets with lower t. Finally, the size of the market for donations S also affects its competitiveness: markets with a large measure of donors S are more competitive because, *ceteris paribus*, a larger number of NGOs will be attracted.[8]

In stage 3, all workers simultaneously choose their effort levels. Given the monitoring level m_i and the incentive scheme (b_i, z_i) offered by NGO i, an agent chooses the effort levels that maximize his utility (2), which are given by:

$$e_i\left(b_i, m_i\right) = \frac{\theta b_i - \gamma\left(v - km_i\right)}{1-\gamma^2} \quad \text{and} \quad d_i\left(b_i, m_i\right) = \frac{v - km_i - \gamma\theta b_i}{1-\gamma^2}. \tag{3}$$

It is immediate to see that the constructive effort is always increasing in the bonus payment, whereas the destructive effort is decreasing in the monitoring level. Furthermore, the constructive effort is increasing (respectively, decreasing) in monitoring when efforts are substitutes (respectively, complements). Conversely, the destructive effort is decreasing (respectively, increasing) in the bonus payment for substitutable (respectively, complementary) efforts.

When efforts are substitutes, monitoring and bonus achieve the same goal: they both decrease the destructive effort and increase the constructive one. Besides representing a cost for the NGOs, monitoring also increases donations, whereas bonus is only costly to the NGO. Therefore, one should expect that monitoring is the preferred instrument. When efforts are complements, the use of the bonus payment to increase constructive effort has the side-effect of increasing destructive effort and vice-versa: the use of monitoring to decrease destructive effort has the unintended consequence of decreasing constructive effort too. In this case, the two instruments have to be balanced. As a result, we expect that monitoring should be higher in the case of substitutability.

The worker accepts any bonus payment b_i and monitoring level m_i which provide him with an expected utility of at least his reservation utility, which is normalized to zero for simplicity (similarly see Raith, 2003, and Manna, 2017). Therefore, in stage 2, NGO i can set the fixed (negative) payment z_i as a function of decision variables b_i and m_i:

$$z_i\left(b_i, m_i\right) = -\frac{\left(v - km_i\right)^2}{2} - \frac{\left[\theta b_i - \gamma\left(v - km_i\right)\right]^2}{2\left(1-\gamma^2\right)}.$$

Substituting the fixed wage, the donations y_i, and effort levels e_i and d_i into Equation (1), NGO i determines the optimal values of bonus payment and monitoring that maximize its

[8] Similarly, markets with lower entry costs F are also more competitive since, ceteris paribus, a larger number of NGOs will be attracted.

payoff function. In the next subsection, we derive them in the case in which effort levels are independent, whereas the general case in which effort levels are either substitutes or complements will be analyzed in Section 3.2. The analysis of independent effort levels will already provide us with useful insights about our model, that can be extended to the general case.

3.1 Independent effort levels

When effort levels are independent, i.e., $\gamma = 0$, the constructive effort e_i is directly affected by an increase in the bonus payment (see Equation 3). However, as b_i positively depends on the monitoring level, the latter ultimately also has a positive impact on e_i. Conversely, an increase in m_i decreases the destructive effort d_i, while the bonus payment does not impact on it. Proposition 1 illustrates the optimal monitoring level, the bonus payment, and the constructive and destructive efforts, where the subscript I denotes independence.

Proposition 1. Optimal contracts under independence. *When effort levels are independent, there exists a symmetric equilibrium in contract choices in which each NGO optimally sets the following monitoring level and bonus payment:*

$$m_I^* = \min\left\{\frac{S + kn\,(D-v)}{n\,(1-k^2)}, 1\right\}; \quad b_I^* = E + \frac{S}{t}\left(\frac{S + kn(D-v)}{1-k^2}\right) > 0. \tag{4}$$

Equilibrium effort levels are:

$$e_I^* = \theta\left[E + \frac{S}{t}\left(\frac{S + kn(D-v)}{1-k^2}\right)\right] > 0; \quad d_I^* = \max\left\{v - k\left[\frac{S + kn\,(D-v)}{n\,(1-k^2)}\right], 0\right\}. \tag{5}$$

The results in Proposition 1 are valid when the second-order condition of a NGO's maximization problem is satisfied, namely when the inequality in Assumption 2 holds.

Assumption 2. *Second-order condition under independence:* $t^2\,(1-k^2) > (nS\theta)^2$.

This inequality is easier to satisfy when competition is not too severe (n and S are low, whereas t is high), and when k and θ are sufficiently small. Notice also that, when $m_I^* < 1$, its numerator is always positive provided that $D > v$. Throughout the paper, we assume that this condition is satisfied.

Assumption 3. *Sufficient condition for positive monitoring:* $D > v$.

This condition implies that the damage NGOs suffer from the destructive activity is sufficiently large so that NGOs find it beneficial to choose a positive monitoring level.[9]

[9]Note that $m_I^* < 1$ if and only if $S < n\left[\left(1-k^2\right) - k\,(D-v)\right] \equiv S_I^0$ and that $d_I^* > 0$ provided that

Proposition 1 shows that monitoring and bonus payment move together: an increase in monitoring leads to a higher bonus and, consequently, a higher constructive effort. It is worth noting that this positive interaction between bonus payment and monitoring is increasing in the number of firms in the market.[10] It is worth emphasizing that, when effort levels are independent, the constructive effort e_I^* is increasing in both incentive pay and monitoring, whereas the destructive effort d_I^* is decreasing in monitoring and independent of bonus. These relationships are crucial to understand the impact of the different exogenous parameters on the optimal contracts under independence, that is studied below.

Impact of competition We start analyzing how competition affects monitoring, bonus payment, fixed wage, and effort levels. It is immediate to see that, if competition increases (because of an increase in n, and/or an increase in S, and/or a reduction in t), the employer has to pay a higher bonus and, as a consequence, the constructive effort is higher. When we consider monitoring, while a change in t does not affect it, an increase in n has a negative impact on the monitoring level, leading to a higher destructive effort. This key result is illustrated in the next Corollary.

Corollary 1. *When effort levels are independent, an increase in the number of NGOs n has a positive impact on antisocial behavior.*

Akin to the experimental paper by Goette et al. (2012), we highlight a dark side of competition. In our model, a higher number of NGOs in the market decreases their incentives in the monitoring activity, as reputation is more difficult to establish. As a consequence, employees are more willing to spend time on the destructive activity.

Note also that an increase in t reduces both the bonus payment and the constructive effort, whereas it does not affect monitoring and the destructive effort. An increase in the mass of consumers S has instead a positive impact on both monitoring and bonus payment, leading to a higher constructive and a lower destructive effort.

When we consider the impact of an increase in the number of NGOs on the fixed salary paid to the employee, we find two opposing effects. On the one hand, as the bonus payment increases, the employer decreases the fixed wage. On the other hand, as the monitoring level decreases, the employer needs to increase the fixed wage to incentivize the employee to do a good job.

$v > k^2 D$ and if and only if $S < \frac{n(v-k^2 D)}{k} \equiv S_I^1$, where $S_I^1 < S_I^0$ if and only if $v < k$. As a result, when market size is such that $S < S_I^1$, we have that both $m_I^* < 1$ and $d_I^* > 0$ hold, when $S_I^1 \leq S < S_I^0$, we have that $m_I^* < 1$ but $d_I^* = 0$ and, finally, when $S \geq S_I^0$, both $m_I^* = 1$ and $d_I^* = 0$ attain. Relatedly, notice that, when $k \to 1$, NGOs' profits are always increasing in monitoring and thus $m_I^* = 1$ always holds. This also implies that $d_I^* = 0$, given that $v < 1$.

[10]Note that if $k = 1$, monitoring would always be set as high as possible.

We finally study the impact of competition on NGOs' profits and we summarize our results in the next proposition.

Proposition 2. *When effort levels are independent, NGOs' profits at equilibrium are decreasing in the number of NGOs n and increasing in the transportation cost t. They are also decreasing in the market size S if and only if:*

$$S \geq \frac{1}{4}\left(\frac{\sqrt{k^2 n^4 \theta^2 (D-v)^2 + 8t^2(1-k^2)}}{n\theta} - kn\,(D-v)\right) \equiv S_I.$$

We find that NGO i's profits are decreasing in n and increasing in t. This is a standard result in the literature (see, for instance, Raith, 2003). The impact of an increase in S on NGO i's profits is instead ambiguous as there are two opposing effects. On the one hand, an increase in the mass of donors has a positive impact on effective donations as it increases monitoring and, subsequently, has a positive impact on the constructive effort and a negative impact on the destructive one. On the other hand, NGO i's costs are higher as both monitoring and bonus payment increase in S. The latter effect dominates when the market size is above the threshold S_I.

Competition for talented workers In the current manuscript, we have not explicitly considered the NGOs' hiring decision of employees who differ in terms of ability. However, it is simple to show that, if there is perfect competition in the labor market so that there is a sufficient supply of talented workers, all NGOs would end up hiring them. This is because if only one NGO does so, it would obtain a comparative advantage with respect to the others in terms of project quality, donations, and consequently profits. Therefore, it is a dominant strategy for this NGO to hire a talented worker. But, then, it is in the best interest of its competitors to follow suit. There is a "cascade effect" which leads to a unique Nash Equilibrium in which every NGO hires a talented worker. As all NGOs end up hiring the talented workers, it is worth analyzing the impact of talent on NGO i's profits, that is $\frac{\partial \pi_i}{\partial \theta} = (2E - b_I^*)\theta b_I^*$. Substituting the optimal bonus payment, we find that its impact is negative if:

$$E < \frac{S[S + kn(D-v)]}{t(1-k^2)}. \tag{6}$$

Interestingly, if inequality (6) holds, NGOs do not benefit from hiring more talented workers. The reason is the following. As in equilibrium all NGOs follow the same hiring decision, they share the donations in the market. Each NGO's amount of effective donations is given by the ratio $\frac{Sm_I^*}{n}$. As m_I^* is not affected by θ, by hiring talented workers, NGOs cannot attract additional donors. Moreover, even if a higher θ implies a higher quality project, these more talented workers also receive a higher bonus and this leads to higher labor costs for the NGOs. Which effect dominates depends on the values of the parameters. It is interesting to notice that it is more likely that an increase in θ has a detrimental effect on NGOs' benefits when competition in the market is severe (high n, high S, and/or low t), as the employees' monetary compensation increases in this case. This result is illustrated in the next corollary.

Corollary 2. *Hiring talented workers is more likely to be detrimental when competition among NGOs is intense.*

This theoretical result is confirmed by the large evidence on managerial compensation showing that competition for the best workers increases incentive pay (see among others Fabbri and Marin, 2016, and Frydman, 2019). In this regard, our paper is also closely related to the one by Bénabou and Tirole (2016). The authors theoretically show how competition for the most productive workers in the market escalates their performance pay, creating severe distortions and long-run welfare losses in the sectors where it occurs.

We can also observe that inequality (6) is easier to be satisfied when E is small and/or D is large. In other words, the impact of θ on NGO i's profits is negative if the benefits NGOs obtain from the constructive activity are sufficiently small and/or the damage from the destructive effort is sufficiently high.

Impact of competition on donors' well-being Let us compute the overall surplus of donors who finance an NGO:

$$\begin{aligned} DS_I^* &= m_I^* S \left[2n \int_0^{\frac{1}{2n}} (u + q_I^* - tx^2) dx \right] \\ &= m_I^* S \left(u + q_I^* - \frac{t}{12n^2} \right). \end{aligned} \tag{7}$$

Both m_I^* and q_I^* depend on the number of firms in the market. Therefore, by deriving the overall surplus of the donors who finance NGO i with respect to n:

$$\frac{\partial DS_I^*}{\partial n} = m_I^* S \left(\frac{t}{6n^3} + \frac{\partial q_I^*}{\partial n} \right) + S \left(u + q_I^* - \frac{t}{12n^2} \right) \frac{\partial m_I^*}{\partial n}. \tag{8}$$

Consider that an increase in n increases project quality (through a higher constructive effort of workers) and, at the same time, reduces the distance between donors and NGOs. However, an increase in n has a negative impact on monitoring, leading to a decrease in donors' effective donations and in their well-being. Which effect dominates depends on the degree of horizontal differentiation of the NGOs. When t is high, namely when NGOs have highly differentiated missions, donors are less interested in the loss implied by the reduction in monitoring and in effective donations. Therefore, they choose to donate to an NGO that is closer to their location. When this is the case, an increase in the number of NGOs n has a positive impact on donors' utility. We get the opposite result when, instead, θ and/or E are large. In particular, we find that an increase in n has a negative impact on the donors' well-being, if workers' talent θ is sufficiently high.

Obviously, an increase in t has always a negative impact on donors' surplus as it reduces project quality and increases the distance between the donors and their preferred NGO, whereas it does not affect monitoring. In contrast, an increase in S has a positive effect on donors' well-being as it increases both project quality and monitoring.

3.2 Complementary or substitutable effort levels

In this section, we consider the general case in which tasks can be either complements or substitutes. The next proposition illustrates the bonus payment and monitoring, as well as the deriving efforts, for the general case. We use the subscript G to indicate the general case, or specifically consider $G = S, C$ to indicate substitutable or complementary tasks.

In order to avoid confusion, when it will be necessary to distinguish between the two cases of complementary and substitutable tasks, we will introduce the following notation: if tasks are substitutes and $\gamma > 0$, nothing will change, whereas if tasks are complement and $\gamma < 0$, we will instead consider $\lambda = -\gamma > 0$.

Proposition 3. Optimal contracts when tasks are either complements or substitutes. *When effort levels are either complements or substitutes, there exists a symmetric equilibrium in contract choices in which each NGO optimally sets the following monitoring level and bonus payment:*

$$m_G^* = \frac{t}{n}\left[\frac{S\left(1-\gamma^2\right)+kn\left(D-v+E\gamma\theta\right)}{t\left(1-\gamma^2-k^2\right)-knS\gamma\theta}\right]; \quad b_G^* = \frac{\left(\theta E+\gamma D\right)}{\theta}+\frac{Sn}{t}m_G^*. \tag{9}$$

Equilibrium effort levels are:

$$e_G^* = \frac{\theta E+\gamma(D-v)}{\left(1-\gamma^2\right)}+\left[\frac{Sn\theta+t\gamma k}{t\left(1-\gamma^2\right)}\right]m_G^*; \quad d_G^* = \frac{v-\gamma\left(\theta E+\gamma D\right)}{\left(1-\gamma^2\right)}-\left[\frac{kt+Sn\theta\gamma}{t\left(1-\gamma^2\right)}\right]m_G^*. \tag{10}$$

Again, the results in Proposition 3 are valid when the second-order condition is satisfied, namely when the inequality in Assumption 4 below holds.

Assumption 4. *Second-order condition in the general case:* $t^2\left(1-\gamma^2\right)\left(1-k^2\right) > \left(nS\theta+kt\gamma\right)^2$.

Note that Assumption 4 implies that the denominator of monitoring m_G^*, namely the quantity $t\left(1-\gamma^2-k^2\right)-knS\gamma\theta$, is always strictly positive. As for the numerator of m_G^*, we require that it is strictly positive as well.

Assumption 5. *Sufficient condition for positive monitoring:* $D > v - E\gamma\theta$.

Thus, monitoring is always positive if the damage caused by the destructive activity is sufficiently large. Observe that, under substitutable tasks Assumption 5 is implied by the corresponding Assumption 3 that holds when tasks are independent, whereas under complementary tasks it is Assumption 5 which implies 3.

Akin to the case of independent tasks, monitoring and bonus payment move together. When tasks are substitutes, an increase in monitoring always has a positive impact on the constructive effort and a negative impact on the destructive one. When tasks are complements and $\lambda = -\gamma > 0$, we obtain the same result if the following two conditions are satisfied: $Sn\theta - t\lambda k > 0$ and $kt - Sn\theta\lambda > 0$. Note that if $tk > Sn\theta$ the second condition implies the first, or the opposite in the case in which this inequality does not hold. It can be shown that condition $kt - Sn\theta\lambda > 0$, which guarantees that destructive effort d_C^* is decreasing in monitoring, is implied by Assumption 4, provided that $k > \lambda > 0$, which we assume to be the case.

Assumption 6. $1 > k > \lambda > 0$.

Hence, Assumptions 4 and 6 together imply that both conditions $Sn\theta - t\lambda k > 0$ and $kt - Sn\theta\lambda > 0$ are satisfied, so that e_C^* and d_C^* are increasing and decreasing (respectively) in monitoring.

There is yet another assumption that we introduce when tasks are complements.

Assumption 7. $Skn\theta > \lambda t$.

Assumption 7 further implies that second-order condition 4 is more restrictive under independence of tasks than when tasks are complements. In turn, second-order condition 4 is more restrictive under task substitutability than under independence. Assumption 7 also allows to rank the equilibrium contract choices and the optimal effort levels in the different regimes. One can show that m_C^*, b_C^*, e_C^* and d_C^* are not monotonic in λ; nonetheless, under Assumption 7, $m_C^* < m_I^* < m_S^*$, $b_C^* < b_I^* < b_S^*$, $e_C^* < e_I^* < e_S^*$ and $d_C^* > d_I^* > d_S^*$ all hold.

Impact of competition Similarly to the previous section, we study the impact of competition on both effort levels, that can be rewritten as functions of the optimal monitoring level. To achieve this objective, we start considering the impact of an increase in the number of NGOs n, in the degree of horizontal differentiation t, and in the mass of consumers

S on monitoring, finding that:

$$\frac{\partial m_G^*}{\partial n} = -\frac{St\Big[t(1-\gamma^2)(1-k^2-\gamma^2) - kn\gamma\theta[2S(1-\gamma^2)+kn(D-v+E\gamma\theta)]\Big]}{n^2[t(1-k^2-\gamma^2)-knS\gamma\theta]^2};$$
$$\frac{\partial m_G^*}{\partial t} = -\frac{kS\gamma t\Big[S(1-\gamma^2)+kn(D-v+E\gamma\theta)\Big]}{[t(1-k^2-\gamma^2)-knS\gamma\theta]^2};$$
$$\frac{\partial m_G^*}{\partial S} = \frac{t[t(1-\gamma^2)(1-k^2-\gamma^2)+k^2n^2\gamma\theta(D-v+E\gamma\theta)]}{n[t(1-k^2-\gamma^2)-kn\gamma\theta S]^2}.$$

The denominators of the previous expressions are always positive. Furthermore, if tasks are complements, *i.e.* $\gamma < 0$, an increase in competition, represented by a higher n and/or a lower t, impacts negatively on the monitoring level. Observe that monitoring m_C^* is non-monotonic in S and that it is decreasing in S if and only if

$$t\left(1-\lambda^2\right)\left(1-\lambda^2-k^2\right) \leq k^2n^2\theta\lambda\left(D-v-\theta\lambda E\right) \tag{11}$$

holds.

If tasks are substitutes, *i.e.* $\gamma > 0$, the monitoring level m_S^* increases with a reduction in t and an increase in S. So, an increase in competition always has a positive impact on m_S^*. Nonetheless, monitoring m_S^* is non-monotonic in n and an increase in n has a positive effect on m_S^* if and only if:

$$\left(1-\gamma^2\right)\left(t\left(1-\gamma^2-k^2\right)-2Skn\theta\gamma\right) \leq k^2n^2\theta\gamma\left(D-v+\theta\gamma E\right) \tag{12}$$

or

$$n \geq \frac{-S\theta\gamma\left(1-\gamma^2\right)+\sqrt{\theta\gamma(1-\gamma^2)(\theta\gamma S^2(1-\gamma^2)+t(D-v+\theta\gamma E)(1-\gamma^2-k^2))}}{k\theta\gamma(D-v+\theta\gamma E)} = n_S^0,$$

that is when k and/or S are sufficiently high.

These observations are all important to determine whether competition leads to a higher destructive effort. Corollary 3 summarizes the main results of the analysis.

Corollary 3. *We find that:*

(i) more intense competition (represented by an increase in n, and/or a reduction in t) has a positive impact on antisocial behavior, when tasks are complements;

(ii) more intense competition (represented by an increase in S, and/or a reduction in t) has a negative impact on antisocial behavior, when tasks are substitutes.

Corollary 3 shows that, as the market is more competitive, employees exert a higher destructive effort if tasks are complements. This is due to a lower monitoring level and is in line with the case in which tasks are independent. The opposite result is obtained when tasks are substitutes, as an increase in competition has a positive impact on monitoring, leading to a lower destructive effort.

Similarly to what happens to monitoring, destructive effort d_C^* is non-monotonic in S when tasks are complements. Moreover, if m_C^* is decreasing in S then d_C^* is always increasing in S. In other words, both m_C^* and d_C^* can be increasing in S, but they cannot be both decreasing in S. As for substitutable tasks, we find that d_S^* is non-monotonic in n. And when n is sufficiently low, then both m_S^* and d_S^* decrease with n; when n is intermediate, m_S^* decreases whereas d_S^* increases with n; and when n is sufficiently large, both m_S^* and d_S^* are increasing in n.

When we compute the impact of the parameters that affect the degree of competition in the market for donations on NGOs' profits, we obtain the results summarized in the next proposition.

Proposition 4. *Irrespective of whether tasks are complements or substitutes, NGOs' profits at equilibrium are decreasing in the number of NGOs n and increasing in the transport cost t.*

Similarly to the case of independence, the impact of n on NGOs's profits is always negative, irrespective of whether tasks are substitutes or complements. When tasks are complements, an increase in n reduces the monitoring level. As a higher level of monitoring is costly for the principal, there is an additional positive effect due to an increase in the number of NGOs in the market, which is nonetheless not high enough to reverse the result.

We also find that profits are increasing in t for any $\gamma \in [-1, 1]$. To see this, note that:

$$\frac{\partial \pi_G^*}{\partial t} = -\left(\frac{\theta n S m_G^*}{t(1-\gamma^2)}\right)\frac{\partial b_G^*}{\partial t} - \gamma\left(\frac{kS\theta[S(1-\gamma^2) + kn(D - v + E\gamma\theta)]}{(1-\gamma^2)[t(1-\gamma^2-k^2) - knS\gamma\theta]}\right)\frac{\partial m_G^*}{\partial t} > 0.$$

The first term is positive for any $\gamma \in [-1, 1]$, as $\frac{\partial b_G^*}{\partial t} < 0$. The second term is also positive, as $\frac{\partial m_G^*}{\partial t}$ is positive when $\gamma < 0$ and negative when $\gamma > 0$.

The impact of an increase in S on NGOs' profits is instead ambiguous.

Competition for talented workers We first study the impact of an increase in θ on monitoring and bonus payment:

$$\frac{\partial m_G^*}{\partial \theta} = \frac{kt\gamma[knS(D-v) + S^2(1-\gamma^2) + tE(1-k^2-\gamma^2)]}{[t(1-k^2-\gamma^2) - knS\gamma\theta]^2};$$
$$\frac{\partial b_G^*}{\partial \theta} = -\gamma\left(\frac{D}{\theta^2}\right) + \frac{Sn}{t}\left(\frac{\partial m_G^*}{\partial \theta}\right).$$

It is immediate to show that the sign of the derivative $\frac{\partial m_G^*}{\partial \theta}$ only depends on the sign of γ. This is because the terms in the parentheses are all positive and the denominator is positive. Therefore, an increase in the employees' talent parameter has a positive (resp., negative) impact on monitoring if tasks are substitutes (resp., complements).

Regarding its impact on the bonus paid to the employee, there are two countervailing effects. Note that, if θ has a positive impact on monitoring because tasks are substitutes, this also leads to a higher bonus. This effect is increasing in the degree of competition. However, in this case, the first term in the right-hand side is negative and proportional to the damage caused by the destructive activity. Which effect is larger depends on the values of the parameters. Exactly the opposite result is obtained in the case in which task are complements.

When we finally consider the impact of an increase in θ on profits, our results are ambiguous for the case of substitutes, whereas we find that its impact on NGOs' profits is negative when tasks are complements if E is not too large. This result is similar to the one obtained when tasks are independent and illustrated in Corollary 4.

Corollary 4. *The presence of talented employees may hurt NGOs when tasks are complements.*

Impact of competition on donors' well-being Equation (8) represents the impact of an increase in the number of NGOs on the donors' overall surplus. Recall that, when tasks are substitutes, an increase in n increases monitoring when k and S are sufficiently high. In that case, an increase in n always has a positive impact on the donors' well-being. In contrast, when tasks are complements, there are two countervailing effects, similarly to the case in which tasks are independent. In particular, an increase in the number of NGOs has a positive impact on project quality and reduces the distance between donors and NGOs, but it has a negative impact on monitoring. This leads to a decrease in donors' well-being and in their effective donations. Similarly to the case in which tasks are independent, the negative effect dominates when θ and E are high.

An increase in the degree of product differentiation t on donors' overall utility is always negative irrespective of whether tasks are complements or substitutes, whereas the impact of S is always ambiguous.

4 Endogenous number of NGOs

In stage 1, each NGO decides whether to enter the market and incur an entry cost $F \geq 0$, or stay out. The entry cost F affects the degree of competition among NGOs and through this channel the donors' utility. The equilibrium number of NGOs competing in the market is determined by the zero-profit condition.

Given that NGOs' profits are always decreasing in n, there exists an equilibrium number of NGOs which makes it exactly equal to zero and that makes further entry of NGOs unprofitable. The following proposition illustrates how the optimal number of NGOs is affected by the different parameters. All the results of this analysis hold irrespective of whether tasks are independent, substitutes or complements.

Proposition 5. Endogenous market structure. *The equilibrium number of NGOs n^* increases with the transport cost t, decreases with the entry cost F, and it is non-monotononic in market size S, but when it increases in S it does so less than proportionally. .*

The results obtained in Proposition 5 are directly derived from the impact of these parameters on NGOs' profits, as they are increasing in t and decreasing in F.

In light of the results displayed in Proposition 5, we now consider how the parameters affecting the degree of competition in the market for donations influence the optimal contracts.

Proposition 6. *With endogenous market structure:*

(i) monitoring m^* and bonus payment b^* increase with market size S and decrease with transportation cost t (the effect of entry cost F is unambiguously positive on m_I^* and m_C^* and negative on b_S^*);

(ii) destructive effort d^* decreases with market size S and increases with transportation cost t (the effect of entry cost F is unambiguously negative on d_I^* and d_C^*);

(iii) constructive effort e^* increases with market size S and decreases with transportation cost t (the effect of entry cost F is unambiguously negative on e_I^* and e_C^*).

When market structure is endogenous, S, and t (the variables that affect the degree of competition in the market for donations) have the same effect on the results irrespective of whether effort levels are independent, substitutes or complements. It is important to observe that, under complementarity (and, similarly, under independence), monitoring m_C^* and destructive effort d_C^* might move in opposite directions as a response to changes in S, t according to whether market structure is exogenous or endogenous. Indeed, monitoring m_C^* increases with market size, but it decreases with transportation cost when market structure is endogenous, whereas under exogenous market structure, monitoring is always increasing in t and decreases with S if and only if condition (11) holds. Seemingly, the equilibrium level of destructive effort d_C^* increases with transportation cost and decreases with market size when market structure is endogenous. However, the opposite result is obtained under exogenous market structure.

What effectively characterizes the equilibrium with endogenous market size is the quality of the project, which is given by $q^* = \theta e^* = \theta^2 b^*$, and the actual amount of donations that each NGOs receives which is equal to $y^* = \frac{S}{n} m^*$. Both outcomes increase with competition (a higher market size S and/or a lower transportation cost t). Finally, effective donations always increase with entry costs F, whereas project quality decreases with entry costs F under independent and complementary tasks.

5 Conclusions

This theoretical analysis calls for empirical studies to investigate how market competition affects moral behavior. The result that market competition interacts with moral behavior has been borne out by the laboratory experiment of Falk and Szech (2013). The authors find that participants are more likely to accept the killing of a mice in a competitive double-auction market compared to an individual decision situation. They conclude that markets erode moral values. In another laboratory experiment, Bartling et al. (2014) study whether product market competition affects socially responsible behavior. They find that individuals incur additional production costs to mitigate a potential negative externality imposed on a third party, and that competition does not erode this concern. In a related paper, Bartling and Özdemir (2017) analyze whether a conscientious employee decides to forgo a profitable business opportunity for ethical reasons when there is the possibility that a competitor will rush in and conclude the deal. The authors find that individuals hardly take the selfish action: They do so only if it does not exist a social norm that classifies the selfish action as immoral.

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Proof of Proposition 1

We substitute Equation (3) into Equation (1) and we derive NGOs' benefits with respect to m_i and b_i. $\square$

Proof of Corollary 1

It is immediate to see that, when tasks are independent, t does not affect monitoring and, consequently, has no impact on the destructive effort. An increase in n instead reduces monitoring. This leads to a higher destructive effort. $\square$

Proof of Proposition 2

By substituting the equilibrium values of monitoring, bonus and effort levels into Equation (1), we obtain NGO i's profit function, which is given by the following expression:

$$\pi_I^* = \frac{\left[t^2\left(1-k^2\right) - S^2 n^2 \theta^2\right]\left[S + kn\left(D-v\right)\right]^2}{2n^2 t^2 \left(1-k^2\right)^2} - \frac{1}{2}v\left(2D - v\right) + \frac{1}{2}\theta^2 E^2 - F. \tag{A1}$$

We compute the impact of an increase in n and t on NGO i's utility:

$$\begin{aligned}
\frac{\partial \pi_i}{\partial n} &= -\theta^2(b_i - E)\frac{\partial b_i}{\partial n} + \left[\frac{S + kn(D-v)}{n}\right]\frac{\partial m_i}{\partial n} < 0;\\
\frac{\partial \pi_i}{\partial t} &= -\theta^2(b_i - E)\frac{\partial b_i}{\partial t} > 0.
\end{aligned}$$

As $b_i > E$, monitoring is decreasing in n, and the bonus is decreasing in t, we find that NGO i's profits are decreasing in n and increasing in t. The impact of an increase in S on NGO i's profits is instead ambiguous as there are two opposing effects. More specifically, we find that:

$$\frac{\partial \pi_i}{\partial S} = \frac{[S + kn(D-v)]\Big[t^2(1-k^2) - Sn^2\theta^2[2S + kn(D-v)]\Big]}{(1-k^2)^2 n^2 t^2}.$$

From the previous equation, it is immediate to see that an increase in S has a positive impact on NGO i's profits if:

$$t^2(1-k^2) > Sn^2\theta^2[2S + kn(D-v)].$$

Solving for S, we find the threshold value of S below which NGO i's profits are increasing in S. $\square$

Proof of Corollary 2

An increase in θ has a negative impact on NGOs' profits when Inequality (6) is satisfied. This inequality is easier to satisfy when n and S are high, and t is low, that is competition in the market is severe. $\square$

How do optimal effort levels change with the degree of competition?

How do optimal effort levels change with the degree of competition and the other parameters of the model? It is easy to check that constructive effort e_C^* is always increasing in n, S, E, θ and it is also increasing in D if and only if $Skn\theta > t\lambda$. It is always decreasing in t, and also in v if and only if $Skn\theta > t\lambda$. In addition, e_C^* is decreasing in k if and only if:

$$S\lambda t^2\left(1-\lambda^2-k^2\right)+2S\lambda t^2k^2-nt\left(D-v-\theta\lambda E\right)\left(Sn\theta-2kt\lambda+Sk^2n\theta\right)+S^2n\theta\left(-2kt+Sn\theta\lambda\right)>0$$

Finally, destructive effort d_C^* is always increasing in n, E, v and θ and it is decreasing in t, D and k. It is also increasing in S if and only if:

$$\left(kt-Sn\theta\lambda\right)\left(t\left(1-\lambda^2-k^2\right)+Skn\theta\lambda\right)<n\theta\lambda t\left(S\left(1-\lambda^2\right)+kn\left(D-v-E\lambda\theta\right)\right).$$

The above inequality can be rewritten as a second-degree polynomial in S, i.e.

$$-kn^2\theta^2\lambda^2S^2-2nt\theta\lambda\left(1-\lambda^2-k^2\right)S+kt\left(t\left(1-k^2-\lambda^2\right)-n^2\theta\lambda\left(D-v-\theta\lambda E\right)\right)<0. \tag{A2}$$

The sufficient condition for inequality (A2) to be satisfied is that the last term be non-positive, i.e. that

$$t\left(1-k^2-\lambda^2\right)\leq n^2\theta\lambda\left(D-v-\theta\lambda E\right). \tag{A3}$$

Therefore, destructive effort is increasing in S when either sufficient condition (A3) is satisfied or when it is violated and yet the necessary condition

$$S>\frac{-t\left(1-\lambda^2-k^2\right)+\sqrt{t(t(1-\lambda^2)(1-\lambda^2-k^2)-k^2n^2\theta\lambda(D-v-\theta\lambda E))}}{kn\theta\lambda}=S_C^0$$

is satisfied. Observe that the quantity under square root and inside the parenthesis in S_C^0 corresponds precisely to condition (11) guaranteeing that m_C^* be increasing in S. Therefore, if sufficient condition (A3) fails, then $S_C^0>0$, m_C^* is always increasing in S and d_C^* is also increasing in S if and only if $S>S_C^0$ or d_C^* is decreasing in S if and only if $S < S_C^0$. Conversely, when sufficient condition (A3) holds, then d_C^* is always increasing in S and m_C^* can be either increasing or decreasing in S according to whether condition (11) is satisfied or not. However, notice that condition (11) being violated, implies that sufficient condition (A3) is satisfied, whereby if m_C^* is decreasing in S then d_C^* is always increasing in S. In sum, both m_C^* and d_C^* can be increasing in S, but they cannot be both decreasing in S.

Proof of Corollary 3

To prove the result in Corollary 3, note that we can write the derivative of d_i with respect to n as follows:

$$\frac{\partial d_i^G}{\partial n} = \frac{-S\gamma\theta}{t(1-\gamma^2)}\left(m_i^G + n\frac{\partial m_i^G}{\partial n}\right), \tag{A4}$$

where

$$m_i^G + n\frac{\partial m_i^G}{\partial n} = \frac{kt[t(1-\gamma^2-k^2)(D-v+E\gamma\theta)+S^2\theta\gamma(1-\gamma^2)]}{[t(1-k^2-\gamma^2)-knS\gamma\theta]^2}.$$

It is immediate to see that if tasks are substitutes, i.e., $\gamma > 0$, the first ratio of Equation (A4) is negative, whereas the term in parenthesis is positive. As a result, an increase in the number of firms always reduces the destructive behavior when tasks are substitutes. We achieve the opposite result when tasks are complements. In this case, the first ratio of Equation (A4) is positive and the term in parenthesis is positive too, unless γ is very close to -1.

We now study the impact of an increase in t on d_i:

$$\frac{\partial d_i^G}{\partial t} = \frac{nS\gamma\theta}{t^2(1-\gamma^2)}\left(m_i^G - t\frac{\partial m_i^G}{\partial t}\right), \tag{A5}$$

where

$$m_i^G - t\frac{\partial m_i^G}{\partial t} = \frac{t^2(1-\gamma^2-k^2)[S(1-\gamma^2)+kn(D-v+Ev\theta)]}{n[t(1-k^2-\gamma^2)-knS\gamma\theta]^2}.$$

If tasks are substitutes, the first ratio of Equation (A5) is positive, as well as the term in parenthesis. As a result, an increase in the degree of product differentiation has a positive impact on d_i when tasks are substitutes. Conversely, when tasks are complements, the first ratio of Equation (A5) is negative, while the term in parenthesis is positive. Therefore, $\frac{\partial d_i}{\partial t} < 0$ when tasks are complements. In other words, an increase in competition because of a reduction in t (NGOs offer more similar services) has a positive impact on the destructive effort.

We show in the text that an increase in t has a positive impact on NGO i's profits whenever tasks are either complements or substitutes. An increase in n has a negative impact on π_i if tasks are substitutes, while its impact is more ambiguous when tasks are complements. To see this:

$$\frac{\partial \pi_i}{\partial n} = -\frac{\theta n S^2}{t}\left(m_i^G + \frac{\partial m_i^G}{\partial n}\right) - \frac{S}{n^2}\left(m_i^G - \frac{\partial m_i^G}{\partial n}\right) \\ -\left[\frac{S[t(1-\gamma^2-k^2)(1-\gamma^2)+k^2n^2\theta\gamma(D-v+E\gamma\theta)]}{(1-\gamma^2)}\right]\frac{\partial m_i^G}{\partial n}.$$

Note that the first two terms are negative irrespective of whether tasks are complements or substitutes. The last term is also negative if $\gamma > 0$ as in the case of substitutes $\frac{\partial m_i^G}{\partial n} > 0$, whereas it is positive when $\gamma < 0$ as in the case of complements an increase in n reduces monitoring. □