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# Elite Capture Through Information Distortion: Uniformly Distributed Signal

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**Abstract**

Common wisdom as well as well-grounded analytical arguments suggest that stronger punishment of deviant behavior meted out by a principal typically prompts the agents to better conform with his objectives. Addressing the specific issue of donor-beneficiary relationships in the context of participatory development programs, we nevertheless show that greater tolerance on the part of donors may, under certain conditions, favor rather than hurt the interests of the poor. Also, greater uncertainty surrounding the donor's knowledge regarding the poor's preference may have the same paradoxical effect.

Critical features of our framework are: (i) communities are heterogeneous and dominated by the local elite in dealing with external agencies, (ii) the elite choose the project proposed to the donor strategically, knowing that the latter has a certain amount of tolerance toward elite capture and an imperfect knowledge of the poor's priorities.

Keywords: community-driven development, aid effectiveness, elite capture, corruption, preference targeting.

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# 1 Introduction

Common wisdom as well as well-grounded analytical arguments suggest that stronger punishment of deviant behavior meted out by a principal typically prompts the agents to better conform with his objectives. Tolerance or laxity therefore appears as an inadequate behavior for principals to adopt. In the specific instance of aid relationships, this means that more tolerant donors are less able to achieve their objectives, such as poverty alleviation of marginal groups, than more strict donors. On the other hand, following the realization that a top-down relationship, between donor and beneficiaries yields adverse incentive effects (see Kanbur 2006 for an overview), there has been growing emphasis on ownership of aid budgets and decisions in recent literature and practice. This is exemplified by the drastic move toward decentralized or participatory development that has taken place during the last decades. The donor community, bilateral and multilateral agencies alike, have thus given more importance to participation in the design of their development assistance programs, and have channeled substantial amounts of aid money through local partner associations and municipalities or through Non-Governmental Organizations (NGOs).[1]

Of course, the adoption of this new approach to development aid dos not mean that donors can dispense with monitoring, but it does imply that beneficiary groups should at least be granted more say in the identification and selection of aid projects so as to better use their informational advantage. In the presence of powerful local elites, however, participatory mechanisms can be easily distorted as a result of preference divergence between these elites and the common people whom donors are targeting. Hence the need for the latter, in a context of imperfect information, to somehow assess these people's needs, and to act upon such an assessment with a view to mitigating the effect of preference divergence. One key finding of this paper, in which the above situation is modeled, is the critical role of the degree of tolerance of the donor compared with the degree of uncertainty (in the minds of the local elite) regarding the donor's idea of the poor's preference. If the former is smaller than the latter, the following paradoxical outcome may arise: a greater tolerance on the part of the donor favours, rather than hurts, the interest of the poor. Analogously, if the latter is smaller than the former, a greater uncertainty of the above type may yield the same paradoxical effect.

The outline of the paper is as follows. In section 2, we discuss some relevant literature and further specify the framework of analysis that we are going to use. In Section 3, the model is presented and solved assuming that the donor's idea regarding the poor's preference, as perceived by the local elite, follows a uniform probability distribution, and that its unpredictability is larger than the donor's tolerance. Section 4 then derives detailed analytical results from this specific model. In addition to the paradoxical outcome underlined above, the effects of key parameters such as the fuzziness of the elite's

[1] The World Bank, in particular, has made the so-called Community-Driven Development (CDD) approach one of the cornerstones of its Comprehensive Development Framework, as reflected in the World Development Report 2000/2001 devoted to poverty alleviation. The share of World Bank's projects with some degree of "civil society" involvement thus increased from 6 percent in the late 1980s to over 70 percent in 2006 (cited from Werker and Ahmed, 2008, p. 75).

perception of the donor's knowledge, the extent of his tolerance toward elite capture, the degree of heterogeneity of the beneficiary community (measured in terms of preference), and the value attached by the elite and the poor to obtaining their preferred project, are analyzed and discussed. In Section 5, we successively consider (i) the case where the donor's tolerance exceeds the degree of uncertainty surrounding his knowledge of the poor's preference and (ii) the possibility for him to choose whether to reveal or not this knowledge or to introduce noise into the signal sent to the elite. In section 6, the robustness of our most important result is verified by writing a general version of the model in which the probability distribution and the utility functions of the two social groups are no more restricted to specific forms. Section 7 concludes.

## 2 Our Contribution in the Perspective of the Existing Literature

Among the advantages generally associated with participatory forms of development is the possession of private information by the beneficiary communities. Since communities are better aware of their own needs and the skills locally available to implement projects on the ground, involving them in decisions regarding the choice and design of local projects should yield more effective development outcomes. In the recent literature, however, there has been growing emphasis on the risk of overplaying the informational advantages, particularly the preference targeting potential, of beneficiary groups (Conning and Kevane, 2002; Mansuri and Rao, 2004; Platteau, 2009). There are actually two strands in this literature. They belong to different disciplines and draw attention to two different aspects of the problem of preference revelation in decentralized development setups.

The first strand, in which social scientists other than economists clearly dominate, stresses the strategic behavior followed by community representatives when they deal with donor agencies. The central idea is that these representatives tend to propose or submit development projects that match the perceived preference of the donor and, therefore, depart from their true order of priorities. Abundant field evidence actually confirms that, in effect, communities introduce project proposals deemed to conform to the donor's wishes so as to secure access to the resources on offer.

Based on his observations in Malawi, Tembo (2003) provides us with an elaborate account of the concrete mechanisms of information distortion that can arise in participatory development programs. His main contention is that people and communities tend to profess the objectives, and adopt the style, methods, and language of the NGOs so as to obtain access to their support. In his own words: "*People's preoccupation was to align their requests with what an NGO was providing, in a sense of defending their position for assistance even when the critical problem was something else... in most cases, people were co-operative, in terms of giving appropriate answers to fieldworkers, in order to please them and have access to NGO assistance*" (pp. 93-94, 125; in the same vein, see Mosse, 1997, 2001; Laurent and Singleton, 1998; Chabal and Daloz, 1999; Bierschenk et al., 2000; Eversole, 2003).

Clearly, the problem of preference distortion arises here from the existence of divergence between the community's preference and the preference of the donor, at least as it is being perceived by the community. A striking illustration of such a possibility is supplied by the experience of Kerala, a southern Indian state which embarked upon an ambitious program of decentralized development in 1996. There, indeed, some local governments (called panchayats) thought that a project would be more likely to be financed by the central government if it was identical to those previously implemented by the state or to the sort of projects presented as models by the State Planning Board, the office in charge of decentralization (Gopinathan Nair, 2000; Harilal and Sanu George, 2000).

It bears noting that for the authors cited above community representatives are induced to distort their preference declarations because of pervasive enforcement problems: they know they will somehow be able to divert the aid funds to their own preferred purposes after the money has been disbursed. However, even in the absence of enforcement problems, preference distortion can conceivably arise for the obvious reason that it is better to receive a gift and use it for a second-best purpose than forsaking it altogether. In the words of a village chief from Burkina Faso: *"if I give you a hen free, you won't start examining the ass to determine whether it is fat or thin. You just accept it."* (Guéneau and Lecomte, 1998, p. 100).

The second strand of literature examines the impact of decentralized development in the context of heterogeneous communities. The main idea is that the village elite is in a position to subvert the participatory process thanks to their disproportionate weight in the local decision-making mechanisms (Abraham and Platteau, 2002, 2004; Bardhan, 2002). To illustrate, in many of the World Bank's Social Funds -a major instrument for the financing of participatory development projects by the Bank-, "prime movers" of projects, such as village headmen or school teachers, often decide which project to choose and implement before any community meeting ever takes place, and it is only later that they take the step of informing community members of their project choice (White and Eicher, 1999; Alsop et al., 2000; Blair, 2000; de Haan et al., 2002). The sheer presence of the poor in local assemblies and meetings does not guarantee that their voices will be heard. As pointed out by Behera and Engel (2006) on the basis of the experience of the Joint Forestry Management (JFM) program in India (one of the most comprehensive attempts at decentralization in the country), "*minority groups, although they may be formally given some authority in the JFM process, are still de facto kept out of the decision-making process, which is likely to have serious repercussions on the distribution of benefits from the JFM forests*" (p. 30). If they participate in JFM, it is just to "*state their loyalty to the village leadership*" (Kumar, 2002, p. 776).

Since all negotiations with the external world take place through local leaders or intermediaries, in the absence of genuine empowerment of marginal groups, the interests of the elite are likely to be conveyed to donors, albeit under a garb that makes the proposal acceptable to them (Tembo, 2003; Nygren, 2005).

When addressing this issue, economists often represent the local decision mechanism as a form of representative democracy with (probabilistic) voting in which the poor, who have different preferences from the rich, have a relatively small weight (see Bardhan and

Mookherjee, 2000, 2005, 2006, for purely theoretical expositions). In many cases, the predictions following from the theory are then tested against the facts. There is no clear-cut conclusion from this quickly expanding literature (see Mansuri and Rao, 2004 and Platteau, 2009 for recent surveys). Differences in results may be partly explained by methodological difficulties and partly by genuine variations between local environments. None the less, a general conclusion that appears to emerge from many rigorous studies is that in more socially and economically unequal village communities the participatory mechanism tends to unduly favor the rich (Rosenzweig and Foster, 2003; Galasso and Ravaillon, 2005; Rao and Ibáñez, 2005; Bardhan et al., 2008; Araujo et al., 2008; Labonne and Chase, 2009). On the other hand, economists have recently analyzed the impact of participation (and information) on the effectiveness of project outcomes and the distribution of benefits, leading to sometimes very contrasted conclusions (Chattopadhyay and Duflo, 2004; Khwaja, 2004, 2009; Besley et al., 2005; Reinikka and Svensson, 2005; Banerjee et al., 2008; Bjorkman and Svensson, 2009).

The present contribution aims at helping to bridge the gap between the two above strands of the literature, by combining the strategic approach implicit in the first with the assumption of differentiated communities typical of the second. More specifically, we consider heterogeneous communities in which an elite dominate the decision-making process, yet are simultaneously subject to the donor's discipline because the donor is eager to alleviate poverty and has an (imprecise) idea of the nature of the poor's priorities. Moreover, the donor exhibits a certain degree of tolerance in accepting projects that somewhat depart from his idea about the poor's preference. In deciding which project to propose, the elite behave strategically, taking into account the donor's level of tolerance as well as the fuzziness of their knowledge regarding the donor's information about the poor's priorities. The framework is that of a modified version of the traditional ultimatum game in which the donor accepts or not to finance a project proposed by the community.

In consonance with intuition and the above-mentioned literature, the elite will generally not propose the project preferred by the poor, and the more heterogeneous the community the greater the distance between that project and the proposal submitted to the donor (that is, the greater the amount of elite capture). For obvious reasons, special attention will be devoted to the role of the donor's tolerance level, which is conceivably influenced by the prevailing intensity of donor competition. The commonsense prediction that less tolerant donors are better able to discipline local elites and thus contribute to poverty alleviation is called into question in our framework. This is because explicit recognition is given to the role of the elite's perception regarding the donor's imperfect idea of the poor's preference. The possibility then arises that the elite have an incentive to refrain from "exploiting" the donor's greater tolerance by proposing a project better matching their own preference.

We assume away all enforcement problems because allowing for them would make our model more complex without bringing new interesting insights. It is evident that the amount of elite capture resulting from the information gap between the donor and the beneficiary community would increase in the presence of serious enforcement problems. At the limit, if the donor is unable to monitor the use of the disbursed funds, the elite would propose the project that stands the best chance of being accepted by the donor. Therefore, there would be no trade-off between considerations of probability of project acceptance and considerations of project preference.

# 3 The Model

## 3.1 The intervening agents and their utilities

Since we are interested in the effect of preference divergence in decentralized development programs, we focus our attention on heterogeneous communities. More precisely, we assume that a community is comprised of two groups, the target group (called $t$), which the donor agency wants to support through an aid flow, and the elite group (called $l$). In fact, the term elite needs not necessarily be understood in a restrictive sense. It may thus stand for the median voter while the target group represents minority groups or marginal sections of the population, such as women, low-caste people, strangers, herders, etc. In line with the objective of poverty reduction or emancipation of weak groups, the donor's utility function duly reflects the interests of the target group. Toward that end, the donor relies on a participatory process aimed at determining the nature of the needs of the target group. However, because the elite may interfere with the consultation mechanism, an information gap subsists and prevents him from assessing with certainty the genuine needs of this group. What the donor therefore maximizes is the expected utility derived by the target group from the aid flow. The decision to be taken is simply to accept or refuse to finance a project submitted by the community (in fact, by the elite group). A rejection of the project proposal occurs if the expected utility of the donor is smaller than a reservation utility, $\bar{U}$, reflects alternative uses of the available funds. An interesting interpretation of this parameter is in terms of competition among donor agencies: the stronger such competition the lower $\bar{U}$.

The elite influence the participatory process in a decisive manner, and choose the project to submit to the donor's approval with the purpose of maximizing their own, selfish utility. Involved here is a trade off between two kinds of considerations: on the one hand, the elite would like a project that is as close as possible to their own preference but, on the other hand, by proposing a project differing from what the donor believes to be the target group's preferred project, the elite causes a fall in the probability that the donor will approve the proposal.

In order to keep our focus on the issue of strategic manipulation of preferences, we abstract from any problem arising at the level of enforcement of the project once approved. In other words, the elite have no possibility to embezzle the aid fund or to modify the nature or the destination of the project. However, given the importance of the enforcement problem in reality, we discuss in a non-formal manner its interaction with the problem of information distortion. It must also be noted that the situation considered is a one-period game in which the donor decides whether to allocate a given amount of resources to a particular community in order to support target populations.

Although numerous types of projects can obviously be carried out in the community, we keep our analysis as simple as possible by assuming that the aid fund is to be split between only two projects, named $A$ and $B$. Preference heterogeneity is translated into the fact that the elite and the target groups prefer different mixes of the two projects. The project proposal emanating from the community (the elite) also consists of proportions of aid resources that are allocated to projects $A$ and $B$. We assume, without loss of generality, that compared to the elite group the target group prefers a mix in which project $B$ receives a larger proportion of the aid fund.

Let us define the proposed project mix (henceforth called simply the project) as $\theta$, measuring the share of the aid fund allocated to project $A$, so that $\theta \in [0,1]$. The project preferred by the target group is $\theta^t$, while that preferred by the elite is $\theta^l$. In agreement with the above convention, we have that $\theta^l > \theta^t$. We can now write the utility functions of all the intervening agents. Thus, the utility functions of the elite and the target groups are, respectively: $U^l(\theta) = L - \lambda \left|\theta - \theta^l\right|$ and $U^t(\theta) = T - \tau \left|\theta - \theta^t\right|$. We posit that, if the donor refuses to support the community, the value of the utilities of both groups is zero. Moreover, $L, T, \lambda, \tau \in \mathbb{R}_0^+$; and $L > \lambda, T > \tau$, so that $U^l > 0$ and $U^t > 0$ $\forall$ $\theta, \theta^l, \theta^t \in [0;1]$.

### 3.2 The informational and time structure of the game

The utility functions of the elite and the target group are assumed to be known by all community members. The latter also know the value of $\bar{U}$. As for the donor, he ignores all the arguments of the utility function of the elite, yet does need to know the parameters $T$ and $\tau$ in the utility function of the target group. He nevertheless ignores the preferred project of this group, $\theta^t$. Indeed, if he knew $\theta^t$, he would simply invest the proportion $\theta^t$ of the available aid fund in project $A$, and the remaining proportion $(1-\theta^t)$ in project $B$. The utility of the target group would thus be maximized and equal to $T$. The problem of participatory development would then be trivial. In short, participatory development does not make sense if the donor knows too little or too much. If he knows too much, his objective is best achieved by adopting a centralized mechanism, and if he knows too little, he has no means to discipline the elite who may manipulate the decentralized mechanism.

The precise assumption that we make is that the donor receives an unbiased signal $\theta^d = \theta^t + \varepsilon$, where $\varepsilon$ is a random variable with $E(\varepsilon) = 0$. The underlying idea is that the donor is able to gather information about the needs of the target group, yet is never in a position to ascertain them in a completely reliable manner. For instance, he has a correct perception of what the poor need in general, but cannot assess accurately how the nature of such needs varies from one community to another. Such an assumption is warranted since it is precisely when the needs of the poor or marginal groups are community-specific that participatory or decentralized development programs are justified. The realized value of $\theta^d$ is known by the donor only, but community members believe that $\theta^d \sim U\left[\theta^t - \frac{1}{2\varphi}; \theta^t + \frac{1}{2\varphi}\right]$. In words, we assume that the elite form an expectation about what the donor regards as the poor's preferred project, which implies that either the donor has not told them the realized value $\theta^d$, or that the elite do not trust his statement.

Note that, since $E(\theta^d) = \theta^t$, a donor imposing on the target community his view about the project to be implemented would, on an average, meet the poor's preference. This is not sufficient, however, to make such imposition desirable since there is always a risk that $\theta^d$ deviates from $\theta^t$ in particular instances. As we shall see, if the project proposed by the elite in the participatory mechanism typically differs from $\theta^t$, there is no attendant risk insofar as the amount of elite capture through information distortion is constant. The decentralized mechanism is therefore not necessarily inferior to the centralized solution.

We can now describe the timing of the game which comprises the following stages:

1) Nature picks up $\theta^d$, the donor's idea about the best project for the target group.

2) The elite group chooses $\theta$, the project (mix) proposed to the donor by the community.

3) After having received that proposition, the donor compares it to $\theta^d$, and chooses to either accept it, in which case he carries out $\theta$, or reject it.

4) If the donor follows the community's proposition, the payoffs are $L - \lambda \left|\theta - \theta^l\right|$, $T - \tau \left|\theta - \theta^t\right|$, and $E\left[T - \tau \left|\theta - \theta^t\right|\right]$, for the elite group, the target group, and the donor respectively, bearing in mind that $E$ stands for the expectation operator. If the donor rejects the community's proposal, the payoffs of all community members are zero, whether they belong to the elite or the target group, while the payoff of the donor is equal to $\bar{U}$.

The question arises as to why, once nature has picked up $\theta^d$, the donor does not make a decision about what to reveal about this information. As a matter of fact, we cannot rule out the possibility that the donor would be better off by either revealing $\theta^d$ to the community or by choosing the degree of fuzziness that he may leave around $\theta^d$ than by keeping $\theta^d$ as a purely private information. This decision of strategic communication of private information has been discussed in a very general fashion by Crawford and Sobel (1982), and more recently, in a framework more similar to our model, by Banerjee and Somanathan (2001). The problem, here, is that the donor is not able to make such a decision unless he knows the parameters of the elite's utility function, and, if this were true, his position would be actually closer to that of a well-informed centralized planner. For example, he could choose to reveal $\theta^d$, anticipating that the elite would then propose a project as close to $\theta^d$ as his tolerance permits.

To avoid this situation in which the idea of participation of the community and the possibility of its manipulation by the elite are losing most of their practical meaning, we assume that the donor is completely ignorant about the elite's utility function and the game moves directly from stage 1 to stage 2 as described above. However, we are interested in knowing how our results would be affected by assuming a better informed donor who strategically reports information to the target community. As we will see in section 5.2., this exercise will prove useful to put all our results into perspective.

### 3.3 Resolution of the model

Solving the game backwards, we first examine the decision of the donor. He will choose to allocate his available aid fund to the community if his expected payoff from doing so is higher than his reservation utility:

$$\begin{aligned} E\left[T - \tau\left|\theta - \theta^t\right|\right] &\geq \bar{U} \\ E\left[\left|\theta - \theta^t\right|\right] &\leq \frac{T - \bar{U}}{\tau} \\ \left|\theta - \theta^d\right| &\leq \frac{T - \bar{U}}{\tau} = k \end{aligned}$$

where $k$ can be conceived of as the donor's tolerance toward elite capture. Bear in mind that the community knows $\bar{U}$ and $U^t(\theta)$, and that the donor will accept $\theta$ if $E\left[U^t(\theta)\right] \geq \bar{U}$. Clearly, the elite group will make their decision not on the basis of the decision rule followed by the donor, but on the basis of the decision rule that it believes the donor follows. Note, moreover, that if $\bar{U} > T$, the donor always rejects the community's proposal. The case worth discussing is therefore when $T \geq \bar{U}$.

In order to proceed with the resolution of the model, we need two additional assumptions. First, we consider the case where the tolerance of the donor does not exceed the domain of uncertainty regarding his idea of the poor's preferred project, that is, we assume $\frac{T-\bar{U}}{\tau} \leq \frac{1}{2\varphi}$. And second, the preferred project of the elite, $\theta^l$, is distant enough from the target group's preferred project, $\theta^t$, to give rise to a positive amount of distortion in the elite's project proposal. More precisely, preference heterogeneity inside the community must be strong enough to have $\theta^l - \theta^t > \frac{1}{2\varphi} + k$.While the second assumption is necessary to make the problem interesting, the first assumption is not innocuous and actually conditions some of the key results obtained. We will therefore examine the case where $\frac{T-\bar{U}}{\tau} > \frac{1}{2\varphi}$, after having elucidated the first case.

The elite group chooses the project $\theta$ that maximizes their own expected utility :

$$\underset{\{\theta\}}{Max} E\left[L - \lambda\left|\theta - \theta^l\right|\right]$$

$$\begin{aligned} E\left[L - \lambda\left|\theta - \theta^l\right|\right] &= \Pr(\theta \text{ is accepted by the donor}) * \left(L - \lambda\left|\theta - \theta^l\right|\right) \\ &\quad + \Pr(\theta \text{ is rejected by the donor}) * 0 \end{aligned}$$

Given that $\theta$ is accepted if $\left|\theta - \theta^d\right| \leq k$, and that the community knows that $\theta^d \sim U\left[\theta^t - \frac{1}{2\varphi}; \theta^t + \frac{1}{2\varphi}\right]$, the probability that $\theta$ will be accepted by the donor is equal to :

$$\begin{aligned} P(\theta) &= \Pr\left(\left|\theta - \theta^d\right| \leq k\right) \\ &= \Pr\left(\theta - k \leq \theta^d \leq \theta + k\right) \end{aligned}$$

$$
= \begin{cases} 2k\varphi & \text{if} \quad \theta \in \left[\theta^t - \frac{1}{2\varphi} + k; \theta + \frac{1}{2\varphi} - k\right] \\ \varphi\left(\frac{1}{2\varphi} + k + \theta^t - \theta\right) & \text{if} \quad \theta \in \left[\theta^t + \frac{1}{2\varphi} - k; \theta^t + \frac{1}{2\varphi} + k\right] \\ \varphi\left(\frac{1}{2\varphi} + k - \theta^t + \theta\right) & \text{if} \quad \theta \in \left[\theta^t - \frac{1}{2\varphi} - k; \theta^t - \frac{1}{2\varphi} + k\right] \\ 0 & \text{otherwise} \end{cases}
$$

The above expressions can be easily derived in the light of Figure 1 below, which has been drawn under the aforementioned assumption that $\theta^l \geq \theta^t$.

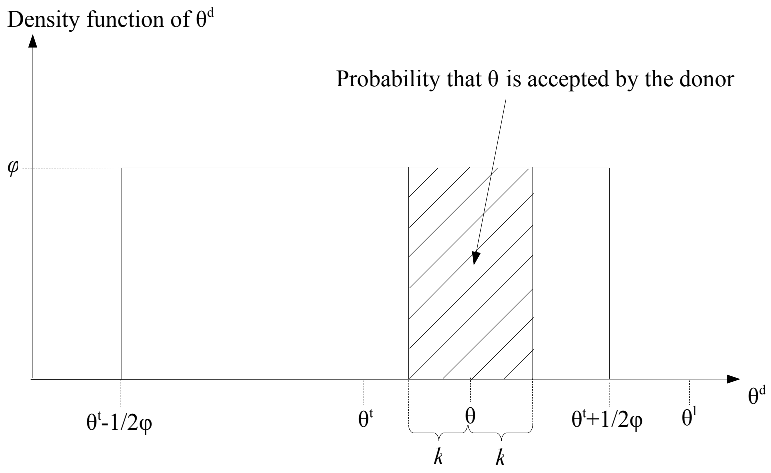



Figure 1: The distribution of the donor's idea of the poor's preferred project, as perceived by the elite.

To solve the elite maximization problem, four different cases must be distinguished depending on the position of $\theta$ on the horizontal axis.

The first case corresponds to the domain in which the probability that the project is accepted is constant (equal to $2k\varphi$), which happens when $\theta^t - \frac{1}{2\varphi} + k \leq \theta \leq \theta^t + \frac{1}{2\varphi} - k$. Within this domain, there is actually no trade-off between the acceptance probability and the distance between the project proposed by the elite and their own preferred project. Therefore, the elite chooses the maximum accessible value for $\theta$, which is the upper bound of the domain, $\theta = \theta^t + \frac{1}{2\varphi} - k$.

The second case obtains when the zone of the donor's tolerance is no more entirely contained within the zone of variation of the elite's perception (more precisely the elite's perception of the donor's idea of the poor's preferred project), that is, when $\theta^t + \frac{1}{2\varphi} - k < \theta < \theta^t + \frac{1}{2\varphi} + k$. Unlike in the previous region, the probability of project acceptance now decreases with $\theta$. Since the elite's utility obviously increases with $\theta$, they are now facing a trade-off. The first-order condition of the elite's expected utility maximization leads to the following solution: $\theta = \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right)$. We must check that this solution falls in the above-defined interval: $\frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) \in \left[\theta^t + \frac{1}{2\varphi} - k; \theta^t + \frac{1}{2\varphi} + k\right]$. Simple algebra shows that the upper bound will never be exceeded by the local optimum $\theta$. As for the lower bound, it will not be crossed as long as $k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right]$. When this condition is violated, the solution is again found in the first domain. It is useful to note, moreover, that if the distance between the preferred projects of the elite and the target groups is smaller than a certain threshold, the above-obtained solution for $\theta$ within the second domain is larger than the value of the elite's preferred project: Formally, $\theta^l - \theta^t < \frac{1}{2\varphi} + k - \frac{L}{\lambda} \Longrightarrow \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) > \theta^l$. In this case, the local optimum coincides with the elite's preferred project : $\theta = \theta^l$.

In the third case, the zone of the donor's tolerance is entirely located outside the zone of variation of the elite's perception: $\theta > \theta^t + \frac{1}{2\varphi} + k$. The probability of project acceptance is zero, and the elite chooses the value of $\theta$ that corresponds to the upper bound that defines the second domain (where this probability is falling).

In the last case, where $\theta \leq \theta^t - \frac{1}{2\varphi} + k$, the probability of project acceptance increases as $\theta$ becomes larger. Since the rise of $\theta$ also raises the elite's utility derived from the project if accepted, it will choose as high a value as possible, that is, the value that corresponds to the lower bound of the first domain (where this probability is constant).

We are now in a position to derive the optimal choice of the elite group. As the above discussion shows, there are only two possible optimum values for $\theta$, if we leave aside the special case in which $\theta = \theta^l$. In order to determine whether the global optimum is located in the first or in the second domain, we compute the value of the indirect expected utility of the elite group in the first domain and compare it to the value of the same in the second domain. After some algebraic manipulation, we find that the former exceeds the latter when $k \leq \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right]$. All the results are summarized below, where we have defined the conditions under which we arrive at particular optimal values not only for $\theta$but also for the distance between $\theta$ and $\theta^t$, which measures the amount of distortion obtained at equilibrium as a result of the participatory mechanism (see Appendix A for a detailed proof).

$$\theta^* = \begin{cases} \theta^t + \frac{1}{2\varphi} - k & \text{if} \quad k \leq \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \\ \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) & \text{if} \quad k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \end{cases}$$

Which can be written as:

$$\theta^* - \theta^t = \begin{cases} \frac{1}{2\varphi} - k & \text{if} \quad k \le \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \\ \frac{1}{2}\left(\theta^l - \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) & \text{if} \quad k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \end{cases}$$

By enabling us to get a visual picture of the main results, Figure 2 facilitates their discussion.

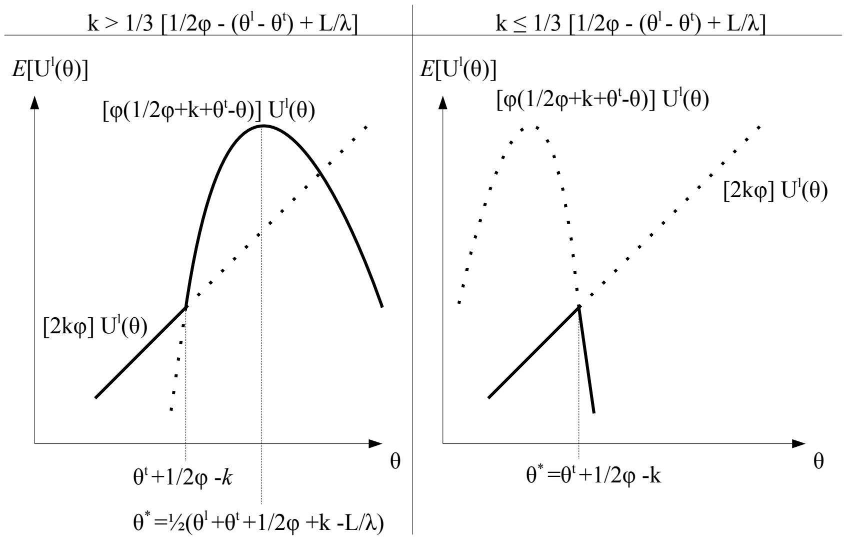



Figure 2: The expected utility of the elite

In the first domain, where the optimum is found when $k \le \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right]$, the expected utility of the elite group is a linear function of the value of the project proposal. The optimum, $\theta^*$, is the corner solution ensuring that $(\theta^* + k)$ coincides with the upper bound of this domain $\left(\theta^t + \frac{1}{2\varphi}\right)$: eager to maximize the probability of project acceptance, the elite makes a proposal that gets as close as possible to its preferred project without causing this probability to fall. When $k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right]$, and we exclude the particular case where $\theta^* = \theta^l$, the elite's expected utility has an inverted-U shape, and an interior solution exists in this second domain. The elite group trades a decline in the probability of project acceptance against the selection of a project closer to its ideal.

Note that under a special configuration of parameters the elite group is certain that its project proposal will be accepted by the donor. When this happens, the proposal coincides with the preferred project of the target group, and the distortion caused by the participatory process is nil. The conditions under which this special result obtains are straightforward: $k \leq \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right]$ and $k = \frac{1}{2\varphi}$. The first condition ensures that we are in the first domain while the second one yields $P(\theta) = 1$, from which it automatically follows that $\theta^* = \theta^t$. Thus, when the domain of variation of the elite's perception is exactly equal to the extent of the donor's tolerance, and this extent of tolerance is not too large, the first-best outcome may be achieved (the target group obtains its maximum utility, $T$, with certainty) although the elite group is in complete control of the project selection process.

The following proposition summarizes the above results.

**Proposition 1.** *When the amount of tolerance of the donor is not too high, the elite will choose a project in such a way that the probability of its acceptance is maximized. Only under very special conditions will this probability equal unity. When the donor's tolerance level exceeds a certain threshold, all other things being equal, the elite becomes ready to trade a fall in the acceptance probability against the selection of a project closer to its ideal.*

Note also that the amount of distortion is higher in the second than in the first domain where the probability of project acceptance is at its maximum level. Indeed, we have that: $k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \Longrightarrow \frac{1}{2\varphi} - k < \frac{1}{2}\left(\theta^l - \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right)$.

## 4 Results and discussion

Let us first look at the factors determining the level of distortion inside each domain. It is immediately apparent that the smaller the fuzziness of the elite's perception of the donor's knowledge regarding the target group's priorities (the higher the value of $\varphi$) the smaller the distortion in both domains. Inside the second domain, the amount of distortion increases linearly with the gap between the preferred projects of the elite and the target group (it remains constant inside the first domain). Conversely, the amount of distortion decreases linearly with this distance, implying that, as expected, when the community becomes more homogeneous the project proposed by the elite better answers to the needs of the target group. Inside the same second domain, the more sensitive the elite's utility to the distance between their preferred project and the actual proposal (the higher the value of $\lambda$), or the lower the maximum value which they attach to their preferred project ($L$), the larger the distortion of information . These results are summarized in the following proposition:

**Proposition 2.** *The less fuzzy the elite's perception of the donor's knowledge regarding the target group's priorities, the less heterogeneous the community (the smaller the preference divergence between the elite and the target group), the less sensitive the elite to the choice of a project different from their preferred one or the higher the maximum* *value which they attach to their preferred project, the smaller the amount of elite capture through information distortion.*

More unexpected is the inversion of the impact of the donor's tolerance level on the equilibrium distortion as one shifts from the first to the second domain: while this impact is negative in the first domain, it becomes positive in the second domain. There thus exists a domain in which, rather paradoxically increasing tolerance on the part of the donor reduces the distortion caused by the participatory mechanism, and therefore produces a favorable effect on the target group. Formally, we have that:

$$\frac{d\left(\theta^{*}-\theta^{t}\right)}{dk} < 0, \text{ if } k \leq \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^{l}-\theta^{t}\right) + \frac{L}{\lambda}\right] = \bar{k}$$

$$\frac{d\left(\theta^{*}-\theta^{t}\right)}{dk} > 0, \text{ if } k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^{l}-\theta^{t}\right) + \frac{L}{\lambda}\right] = \bar{k}$$

Here is an apparent paradox because one would have expected the elite to always respond to a relaxing of the donor's vigilance by making a proposal closer to their preferred choice. Understanding the odd outcome that occurs when $k$ is smaller than the above threshold value, $\bar{k}$, takes us to the heart of our model's logic. As a matter of fact, when making their decision about which project to propose, the elite do not only take account of the donor's tolerance level but also of the degree of uncertainty about what he thinks is the target group's preferred project, and the way these two parameters interact. As a result, it cannot be taken for granted that the elite will "exploit" the donor's greater tolerance. More precisely, when the donor becomes more tolerant while the uncertainty about his idea of the poor's preference remains unchanged, the elite worry about the fact that getting the project proposal closer to their own preference, thus "exploiting" the donor's greater tolerance, will cause the probability of project acceptance to fall. The problem arises because the donor tolerates greater variation not with respect to the poor's preferred project (which he ignores) but with respect to his own idea of the poor's preference, an idea that the elite can only figure out. As a consequence of this feature of our model, the effect of an increase in $k$ is to raise the maximum level of $P(\theta)$ yet over a narrower range than before.

The elite may therefore be prompted to reduce the information bias so as to achieve this new maximum. Assume that the elite initially make a proposal corresponding to the corner solution $\theta^{*} = \theta^{t} + \frac{1}{2\varphi} - k$. No reduction in $\theta$ can cause the probability of project acceptance to increase: $P(\theta)$ is at its maximum level. When the donor's tolerance margin is enlarged ($k$ rises), however, this is no more true: reducing the information bias (getting $\theta$ closer to $\theta^{t}$) so as to make the new value $(\theta^{*}+k)$ again coincide with the upper bound of the first domain, $\left(\theta^{t}+\frac{1}{2\varphi}\right)$, allows the elite to achieve the new, higher value of $MaxP(\theta)$.

The reason why this new maximum value extends over a narrower range than before becomes evident when one sees that, in Figure 1, the effect of an increase in $k$ is to stretch the hatched zone both below and above their initial limits. In particular, extending this zone both below and above their initial limits. In particular, extending this zone above the upper bound $\left(\theta^t + \frac{1}{2\varphi}\right)$ has the effect of causing the probability $P(\theta)$ to fall since there is now an area where, in the minds of the elite , the donor will never associate a project with the preference of the target group. There is thus a zone in which, owing to non-coincidence of donor's and elite's perceptions, the increased tolerance on the part of the former is not "exploitable" by the latter. If the elite would stick to their previous project proposal, therefore, the probability $P(\theta)$ would no more be at its maximum level, which also implies that the domain over which $P(\theta)$ takes on its maximum value is more restricted than before.

In Figure 3 where $\theta$ is measured along the horizontal axis and the probability of project acceptance, $P(\theta)$, (rather than the density of $\theta^d$) is measured along the vertical axis, the mechanics of the above effect comes out in a starker manner.

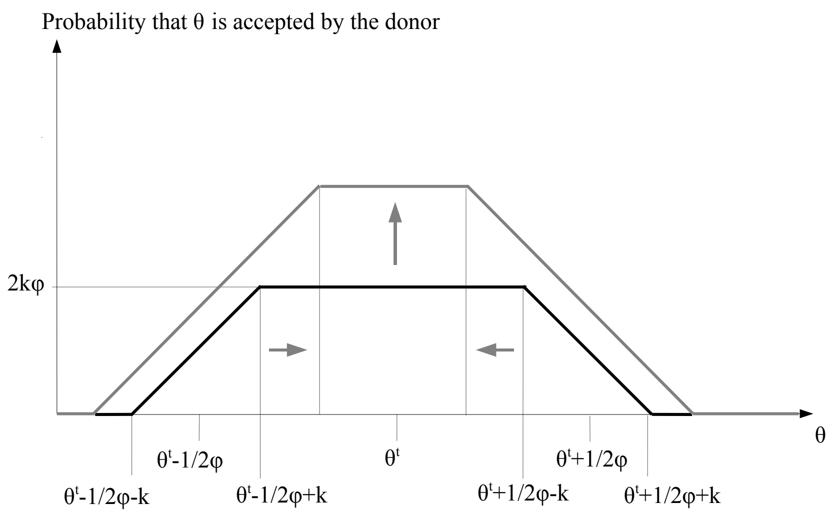



Figure 3: The effect of an increase in $k$ on the probability of project acceptance.

A higher value of $k$ manifests itself in both a leftward shift of the upper bound of the first domain and a raising of its ceiling corresponding to the maximum value of $P(\theta)$. If $k$ increases yet not enough to violate the condition $k \leq \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right]$, the upper bound which is now smaller remains the (corner) solution of the elite's maximization problem. Indeed, since the whole distribution of $P(\theta)$ has been raised as a result of a higher $k$, the elite want to remain in the domain where $MaxP(\theta)$ is accessible. If, on the other hand, the above condition is no more satisfied as $k$ increases, the solution will lie in the second domain where the elite is ready to accept a certain increase in the probability that their proposal stands rejected in order to get closer to their preferred choice.

Since the inverse relationship between the donor's tolerance and the equilibrium distortion holds only inside the first domain, a careful look at the parameter values satisfying the condition $k \leq \bar{k}$ allows us to identify the factors susceptible of yielding the odd outcome. The effects are straightforward and we state them in Proposition 3 below.

**Proposition 3.** *An increased level of donor's tolerance toward elite capture is susceptible of prompting the elite group to propose a project (mix) closer to, and not further away from, the preference of the target group. This odd outcome is more likely to be observed if, other things being equal, the donor's initial tolerance level is low; the variability of the elite's perception (of the donor's idea of the poor's preferred project) is large; the distance between the preferred projects of the elite and the target groups is small; the maximum utility achievable by the elite is large; and the sensitivity of the latter group to the distance between its preferred project and the actual project is small.*

Finally, since $k = \frac{T-\bar{U}}{\tau}$, a higher level of tolerance can be interpreted as being the result of three different factors. First, it can be seen as the result of a fall in the outside options available to the donor, which may itself follow from growing competition among the donors themselves (see supra). Whereas donor competition might be considered as detrimental to the poor, we have shown that, in our framework, this needs not be the case. Within a certain range of variation, an increase in donor competition has the effect of prompting the elite to take greater account of the preference of the target group. Outside that range, however, growing competition among donors promotes the interests of the elite.

Second, enhanced tolerance of the donor may be the result of a lower sensitivity of the target group to the distance between its preferred project and the realized project (a lower value of $\tau$). And, third, it may follow from a rise of the constant component in the target group's utility function (a higher value of $T$). Insofar as members of this group have a higher utility for a given distance between their preferred project and the realized project, the donor's vigilance is relaxed.

The variability of the elite's perception ($\varphi$), in the minds of the community in general and the elite in particular, obviously plays a key role in our model. It is a determinant of the probability of project acceptance (regardless of the domain) and the equilibrium distortion while it simultaneously influences the selection of the domain where the global optimum is located. A larger variability of the elite's perception (a smaller $\varphi$) decreases $P(\theta)$, increases $\left(\theta - \theta^t\right)$, and raises the likelihood that the global optimum is located in the first domain. All these effects will therefore take place if the donor is able to conceal the information about his preference so that $\varphi$ is reduced. An immediate implication of the above is that concealing information yields two opposite effects on the equilibrium distortion resulting from the participatory mechanism. On the one hand, it widens the gap $\left(\theta - \theta^t\right)$ within each domain, but, on the other hand, it raises the probability that the global optimum falls in the (first) domain where this gap is smaller.

Is it possible that, should the latter eventuality materialize, the increasing fuzziness of the elite's perception will eventually prompt the elite to propose a project closer to the preferred project of the target group? The answer is negative. Simple algebraic manipulation shows that the effect of increased distortion within the first domain outweighs the effect of the shift from the second to the first domain (see Appendix B). The conclusion is that it is never in the interest of the donor (nor the target group) to deliberately make information more fuzzy. In other words, it is essential that the donor preference for the poor is known as well as possible. Since $\varphi$ presumably varies not only with the community's perception but also with the extent of the donor's knowledge about the target group's preference, it is also in the interest of the donor and the target group, that the donor possesses as precise knowledge as possible about this preference.

# 5 Two variants

In this section, we depart from the main model in an important manner. First, we consider the case where the donor's tolerance exceeds the fuzziness of the community's perception of the donor's idea of the poor's preferred project. Second, we refine the game structure by adding a second stage in which the donor may choose between keeping his idea about the poor's preference secret, revealing it, or influencing the degree of unpredictability of this idea for the community.

## 5.1 The case of a relatively tolerant donor

When $\frac{1}{2\varphi} < \frac{T-\bar{U}}{\tau}$, the probability of project acceptance function, $P(\theta)$, is modified as follows:

$$P(\theta) = \begin{cases} 1 & \text{if} \quad \theta \in \left[\theta^t + \frac{1}{2\varphi} - k; \theta^t - \frac{1}{2\varphi} + k\right] \\ \varphi\left(\frac{1}{2\varphi} + k + \theta^t - \theta\right) & \text{if} \quad \theta \in \left[\theta^t - \frac{1}{2\varphi} + k; \theta^t + \frac{1}{2\varphi} + k\right] \\ \varphi\left(\frac{1}{2\varphi} + k - \theta^t + \theta\right) & \text{if} \quad \theta \in \left[\theta^t - \frac{1}{2\varphi} - k; \theta^t + \frac{1}{2\varphi} - k\right] \\ 0 & \text{otherwise} \end{cases}$$

and the solution of the elite becomes:

$$\theta^* = \begin{cases} \theta^t + k - \frac{1}{2\varphi} & \text{if} \quad \frac{1}{2\varphi} \leq \frac{1}{3}\left[k - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \\ \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) & \text{if} \quad \frac{1}{2\varphi} > \frac{1}{3}\left[k - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \end{cases}$$

Whereas in the previous case where $\frac{1}{2\varphi} > k$, the sign of $k$ in the definition of $\theta^*$ was changing when moving from the first to the second domain, the opposite happens in the case where $\frac{1}{2\varphi} < k$: the sign of $k$ remains unchanged but the sign of $\frac{1}{2\varphi}$ is now inverted.

The conditions delimiting the relevant domains are also affected. As a consequence of these changes, the results summarized in the three above propositions are partially or wholly modified. The critical factor determining the changes in the results arises from the fact that to maximize the probability of project acceptance the elite must propose a project such that $\theta^* - k = \theta^t - \frac{1}{2\varphi}$, implying that the lower bound of the interval around $\theta^*$chosen by the elite must coincide with the lower, and not any more with the upper bound of the fuzziness domain $\theta^t - \frac{1}{2\varphi}$.

To begin with, proposition 1 must be simply rewritten thus: When the amount of tolerance of the donor is not too low, the elite will choose a project in such a way that the probability of its acceptance is maximized, and equal to unity. When the donor's tolerance level is below a certain threshold, all other things being equal, the elite becomes ready to trade a fall in the acceptance probability against the selection of a project closer to its ideal.

Proposition 2 does not vary except for the part dealing with the relationship between the fuzziness of elite perception and the amount of elite capture. As a matter of fact, this relationship is now V-shaped: as the elite's perception of the donor's knowledge becomes more fuzzy, the amount of distortion decreases but only up to a certain threshold of fuzziness beyond which it starts increasing.

As for Proposition 3, it ceases to hold true.

When taken together, these results mean that the paradoxical finding has shifted from Proposition 3 to Proposition 2. Oddly, over a certain range, the elite is better disciplined when its perception of the donor's knowledge regarding the poor's preference becomes more fuzzy. What needs to be emphasized is that this fuzziness rather than the donor's tolerance is now the most constraining consideration in the minds of the elite. When it increases, there are two effects running into opposite directions. On the one hand, the elite is in a position to better exploit the large tolerance of the donor by moving to a project closer to its own preference. Yet, on the other hand, the project has the highest chance to be accepted (in fact, a 100% chance) if the elite respond to the increased fuzziness by proposing a project closer to the poor's preference. This is because maximum probability of project acceptance can be achieved only if the lower bound of the chosen interval of the tolerance domain, $\theta^* - k$, is adjusted in such a way as to remain confounded with the now diminished value of the lower bound of the fuzziness domain, $\theta^t - \frac{1}{2\varphi}$.

To understand the case $\frac{1}{2\varphi} < \frac{T-\bar{U}}{\tau}$ by analogy with the case where $\frac{1}{2\varphi} > \frac{T-\bar{U}}{\tau}$, it helps to refer again to Figure 3 in which the maximum probability of project acceptance is now a constant equal to unity rather than a value moving with $\varphi$.

For the sake of completeness, note that the impact of an increased variability of the elite's perception can no more be depicted by the monotonous relationship underlying the comments below Proposition 3.

### 5.2 The 5-stage model

We can now turn to the second variant, in which the donor is allowed more strategy space in the way depicted in the second stage of the adjusted game below:

1) Nature picks up $\theta^d$, the donor's idea about the best project for the target group.

2) The donor has to choose between three different strategies:

   – strategy $r$: to reveal $\theta^d$ to the community
   – strategy $s$: to keep $\theta^d$ secret, in which case the elite only knows that $\theta^d \sim U\left[\theta^t - \frac{1}{2\varphi}; \theta^t + \frac{1}{2\varphi}\right]$
   – strategy $x$: to reveal that $\theta^d \sim U\left[\theta^d - \frac{1}{2x}; \theta^d + \frac{1}{2x}\right]$ where $\frac{1}{2x}$ is chosen by the donor

3) The elite group chooses $\theta^i$, the project (mix) proposed to the donor by the community, $i = \{r, s, x\}$ and is related to the strategy chosen by the donor.

4) After having received that proposal, the donor compares it to $\theta^d$, and chooses to either accept it, in which case he carries out $\theta$, or reject it.

5) If the donor follows the community's proposition, the payoffs are $L - \lambda\left|\theta - \theta^l\right|$, $T - \tau\left|\theta - \theta^t\right|$, and $E\left[T - \tau\left|\theta - \theta^t\right|\right]$, for the elite group, the target group, and the donor respectively. If the donor rejects the community's proposal, the payoffs of all community members are zero, whether they belong to the elite or the target group, while the payoff of the donor is equal to $\bar{U}$.

Bear in mind that, to be able to take a decision at stage 2, the donor needs to know the parameters of the elite's utility function in addition to those of the poor's utility function. When this is the case, and a few other assumptions are made, we reach the conclusion that it is in the interest of the donor either to reveal its signal $\theta^d$ to the community (in which case the elite respond by proposing project equal to $\theta^d + k$) , or to set an optimal value for $x$, that influences the elite's perceptions regarding his knowledge about the poor's preferred project (see Appendix C, for a detailed proof). In other words, the donor is worse off by keeping his signal secret when he has the possibility to use this knowledge strategically. Such a conclusion is congruent with the finding by Crawford and Sobel (1982) that in a model of strategic communication the interest of the Sender is to introduce noise into the signal reported to the Receiver. Moreover, when the donor chooses $x$, he will always set its value so that the degree of fuzziness of the elite's perception does not exceed the degree of his own tolerance: $\frac{1}{2x} \leq k$. This is important since we know from the discussion above that in this case the paradox of Proposition 3 vanishes, yet the relationship between the fuzziness of elite's perception and the amount of elite capture through information distortion is not monotonous but V-shaped. We can now add that, if enabled to do so, the donor will choose the noise around the signal sent to the community in such a way as to minimize elite capture.

# 6 The model generalized

Before turning to the conclusion, we must check whether our results, in particular the ambiguous impact of the donor's tolerance on the project proposal by the community, have been achieved on the basis of restrictive assumptions regarding the utility functions of the agents involved and the exact form of the probability function for the elite's perception. As we show below, our results turn out to be quite general.

In the preceding sections, we have assumed that the community believes that $\theta^d \sim U\left[\theta^t - \frac{1}{2\varphi}; \theta^t + \frac{1}{2\varphi}\right]$. This uniform distribution takes on strictly positive values only on an interval of limited size. As a result, the probability that a project is accepted and the optimal choice of the community depend on some threshold values related to the support of the distribution. Such an approach enabled us to keep the algebra simple and to derive a number of precise and insightful results.

As before, we only discuss the case where $\theta^l > \theta^t$. The utility functions of the target group and the elite now have a general form, $U^t(\theta)$ and $U^l(\theta)$, and they are assumed to be always positive, continuous and twice differentiable. They depend negatively on the distance between the preferred project and the project that is implemented, which we write thus: $\left[U^t(\theta)\right]' > 0$ if $\theta < \theta^t$ and $\left[U^t(\theta)\right]' < 0$ if $\theta > \theta^t$. Likewise, we have: $\left[U^l(\theta)\right]' > 0$ if $\theta < \theta^l$ and $\left[U^l(\theta)\right]' < 0$ if $\theta > \theta^l$. Both utility functions are concave and they reach their maximum value when $\theta$ equals the preferred project: $\left[U^i\left(\theta^i\right)\right]'' < 0$ and $\left[U^i\left(\theta^i\right)\right]' = 0$, $i = \{t, l\}$. The donor receives a signal $\theta^d = \theta^t + \varepsilon$ where $E[\varepsilon] = 0$. In other words, the donor does not know the precise value of $\theta^t$, but knows that $\theta^t = \theta^d - \varepsilon$, implying that $E\left[\theta^t\right] = \theta^d$. Community members do not know $\theta^d$ but believe that it is distributed according to the density function $f\left(\theta^d\right)$. This function is assumed to be continuous, differentiable, and symmetric around $\theta^t$, the mean value. Moreover, $[f(\theta)]' > 0$ if $\theta < \theta^t$;$[f(\theta)]' < 0$ if $\theta > \theta^t$.

The donor accepts the project proposed by the elite ($\theta$) if, given the signal, the target group's expected utility is higher than his reservation utility ($\bar{U}$):

$$E\left[U^t\left(\left|\theta^t - \theta\right| \left|\theta^d\right.\right)\right] \geq \bar{U}$$

Since all elements of the function $U^t\left(\left|\theta^t - \theta\right| \left|\theta^d\right.\right)$ are known to the donor except $\theta^t$, and given that $E\left[\theta^t\right] = \theta^d$, this expression can be written as:

$$\begin{aligned} U^t\left(E\left[\left|\theta^t - \theta\right| \left|\theta^d\right.\right]\right) &\geq \bar{U} \\ U^t\left(\left|\theta^d - \theta\right|\right) &\geq \bar{U} \\ \left|\theta^d - \theta\right| &\leq \left[U^t\left(\bar{U}\right)\right]^{-1} = k \text{ with } k'_{\bar{U}} < 0 \end{aligned}$$

The elite knows that their proposition is accepted if $\left|\theta^d - \theta\right| \leq k \Longleftrightarrow \theta - k \leq \theta^d \leq \theta + k$, which happens with a probability equal to:

$$\begin{aligned} P(\theta) &= \Pr\left(\theta - k \leq \theta^d \leq \theta + k\right) \\ &= F(\theta + k) - F(\theta - k) \end{aligned}$$

where $F(\theta)$ stands for the cumulative probability function associated to the above defined density function, $f\left(\theta^d\right)$. The elite choose the project proposal that maximizes their own expected utility:

$$\theta^* \equiv \arg\max P(\theta)\, U^l(\theta) = \left[F(\theta+k) - F(\theta-k)\right] U^l(\theta)$$

The first order condition is:

$$\left[f(\theta+k) - f(\theta-k)\right] U^l(\theta) + \left[F(\theta+k) - F(\theta-k)\right] \left[U^l(\theta)\right]' = 0$$

It is easily shown that there exists no corner solution to this problem. Indeed, if $\theta = \theta^t$, then $f(\theta+k) = f(\theta-k)$ because $f(\theta)$ is symmetric around $\theta^t$. Therefore, the first term is nil, while the second term is obviously positive, causing the LHS of the above condition to be unambiguously positive. Since raising $\theta$ above $\theta^t$ would increase the expected utility, $\theta = \theta^t$ is not optimal. If $\theta = \theta^l$, on the other hand, the first term is negative because the first derivative of $f(\theta)$ with respect to $\theta$ is negative when $\theta > \theta^t$. As for the second term, it is nil since $U^l(\theta^l)' = 0$. The LHS of the condition is therefore negative, implying that $\theta = \theta^l$ cannot be an optimum.

It follows from the above proof that the elite's expected utility is necessarily concave in some relevant interval of $\theta^t < \theta < \theta^l$. We have indeed shown that at the lower bound, $\theta^t$, the slope of this function is unambiguously positive while at the upper bound, $\theta^l$, it is unambiguously negative. Since the function has positive values and is continuous and differentiable by assumption, this implies that it must be concave in at least some part of the interval comprised between these two bounds. Moreover, $\theta^*$, the maximum value of $\theta$, must necessarily lie on a concave portion of the function.

By using the first-order condition above and applying the implicit function theorem, we find:

$$\frac{\partial\theta^*}{\partial k} = -\frac{\left[f'(\theta^*+k)+f'(\theta^*-k)\right]U^l(\theta^*)+\left[f(\theta^*+k)+f(\theta^*-k)\right]\left[U^l(\theta^*)\right]'}{\left[f'(\theta^*+k)-f'(\theta^*-k)\right]U^l(\theta^*)+2\left[f(\theta^*+k)-f(\theta^*-k)\right]\left[U^l(\theta^*)\right]'+\left[F(\theta^*+k)-F(\theta^*-k)\right]\left[U^l(\theta^*)\right]''}$$

It is easy to see that the above expression cannot be signed unambiguously. Since the whole denominator, which corresponds to the second-order condition of the elite's optimization problem, is negative, and the expression is preceded by a minus sign, $\partial\theta^*/\partial k$ will have the same sign as the numerator. In other words, the odd case in which $\partial\theta^*/\partial k < 0$, -more laxity on the part of the donor, reflected in a larger $k$, is beneficial to the poor in the sense that $\theta^*$ gets nearer to their preferred project, $\theta^t$- will obtain if the numerator is negative. Since the second term of this numerator is obviously positive, we need to have that the first term has a negative sign and that its absolute value exceeds the value of the second term. The meaning of these conditions needs to be elucidated.

The donor's level of tolerance exerts two effects on the optimal decision of the elite, and they run into opposite directions. The positive direct effect, which is measured by the second term of the numerator, indicates that a higher level of tolerance increases the probability that the proposition is accepted, which induces the elite to propose a project better corresponding to their preference. As for the indirect effect, which is embodied in the first term, it reflects the fact that a variation of the tolerance level ($k$) modifies the marginal impact of the elite's proposition ($\theta$) on the probability of project acceptance.

Let us first consider the influence of an increase in $\theta$ on that probability. It is evident that it is lowered by $f(\theta - k)$ and increased by $f(\theta + k)$, and that the net effect is always negative when $\theta > \theta^t$, which necessarily obtains at equilibrium. Second, we must examine the impact of an increase in $k$ on the variation of the probability of project acceptance resulting from the induced change in $\theta$. Increasing the donor's tolerance ($k$) appears to have the effect of decreasing $f(\theta + k)$ and $f(\theta - k)$, provided that $\theta - k > \theta^t$. In short, a higher level of tolerance generally magnifies the fall in the project acceptance's probability when the elite raises $\theta$. However, this is not true if $\left|[f(\theta^* + k)]'\right| < [f(\theta^* - k)]'$. Such a special case, which may occur when $\theta^* - k < \theta^t$, actually corresponds to the situation in which the donor's tolerance domain is relatively large compared to the domain of fuzziness of elite's perception (see Section 5).

In order to better visualize the nature of the conditions involved, we have drawn Figure 4. It is apparent that moving $\theta$ closer to $\theta^l$ and further away from $\theta^t$ has the marginal effect of lowering the probability of project acceptance (the hatched zone) by $(a - b)$. If $k$ rises in the way indicated by the two horizontal arrows, this probability obviously increases. This is the first direct effect discussed above. However, a larger $k$ has the additional, indirect effect of increasing the marginal impact of $\theta$ on the probability of project acceptance. Indeed, because the slope of the density function decreases in its relevant portion, moving $\theta$ closer to $\theta^l$ causes a fall in this probability by $(a' - b') > (a - b)$.

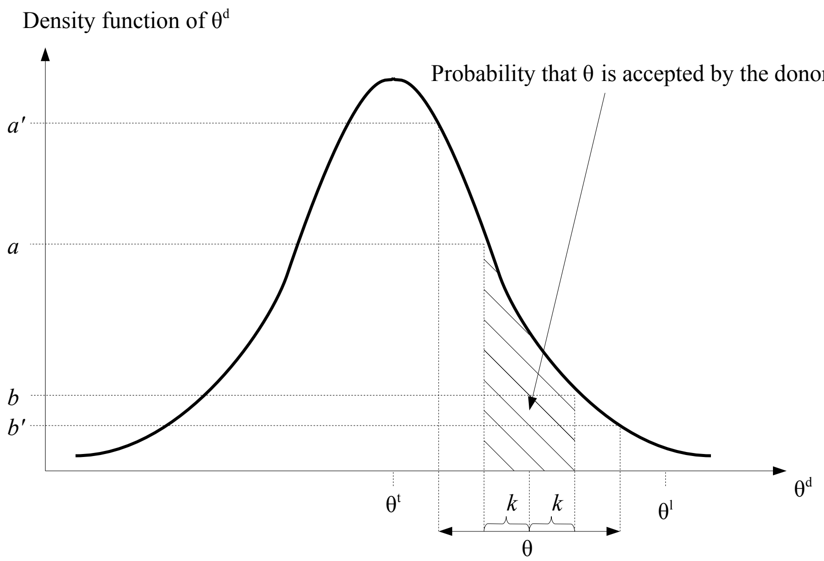



Figure 4: The direct and indirect effects of an increase in the donor's level of tolerance.

To conclude, for the odd effect to exist, it must be the case that the impact of a change in $k$ on the marginal effect of the project proposal on the acceptance probability is sufficiently important relative to its direct impact on the same probability. Whether the indirect effect outweighs the direct one clearly depends on the characteristics of the density function of $\theta^d$, and of the utility function of the elite. As we have seen in the preceding sections, this outcome occurs inside the first domain obtaining with the uniform distribution.

## 7 Conclusion

Participatory development is highly vulnerable to the risk of elite capture. Among the two main forms of elite capture, embezzlement and information distortion, the latter has been best documented empirically and worked out theoretically. However, the influence of the elite is typically assumed to exert itself through the local collective decision-making process without the donor being able to constrain it. In this contribution, we have followed a different approach in which the donor pursues the explicit objective of poverty alleviation and has an imprecise idea of what the priorities of the poor, his target group, look like. This is sufficient to somewhat discipline the elite by giving rise to a trade-off between considerations of probability of project acceptance and considerations of project preference.

A noteworthy result is that the less heterogeneous the community (the smaller the distance between the elite's and the poor's preferred projects), and the less sensitive the elite to the choice of a project different from their preferred one, the smaller the amount of elite capture through information distortion.

More unexpected is the key role played by the relative importance of the donor's tolerance compared with the degree of uncertainty regarding his knowledge of the poor's preference. When the former is smaller than the latter, the following paradox may arise: greater donor's tolerance toward elite capture may serve rather than hurt the interests of the poor. When the latter is smaller than the former, the possible paradox is different: greater fuzziness of the elite's perception may again be favourable to the poor.

Finally, if the donor had enough information about the elite's preference function, he would be able to choose what to do with his knowledge of the poor's preference. The main conclusion here is that in the equilibrium situation resulting from the donor's strategy, greater tolerance may not benefit the poor.

A complex pattern of effects thus emerges from our rather simple analytical framework, and they manifest the operation of important mechanisms that need to be taken into account when designing decentralized development programs. There are interesting, unexpected policy implications following from our analysis. Thus, to the extent that the donor's tolerance toward elite capture increases with the intensity of donor competition, we may expect this enhanced competition to yield beneficial effects for the poor if the elite cannot precisely assess the donor's idea of the poor's preference (and if the beneficiary communities are sufficiently homogeneous).

# Appendix A

In the elite's maximization problem, the discontinuity in the project acceptance probability function gives rise to the existence of different domains. The optimal value of $\theta$ in each domain has been derived. It is straightforward that the first-order conditions lead to two local optima: $\theta^t + \frac{1}{2\varphi} - k$ in the first domain, and $\frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right)$ in the second domain, leaving aside the special case where this last solution is larger than $\theta^l$.

In order to determine the condition under which the global optimum is located in the first domain, we compute the value of the indirect expected utility of the elite group in the first domain and compare it to the value of the same in the second domain:

$$E\left[U^l\left(\theta = \theta^t + \tfrac{1}{2\varphi} - k\right)\right] \geq E\left[U^l\left(\theta = \tfrac{1}{2}\left(\theta^l + \theta^t + \tfrac{1}{2\varphi} + k - \tfrac{L}{\lambda}\right)\right)\right]$$

$$\begin{aligned}&P\left(\theta = \theta^t + \tfrac{1}{2\varphi} - k\right)\left[L - \lambda\left(\theta^l - \left(\theta^t + \tfrac{1}{2\varphi} - k\right)\right)\right] \geq \\ &P\left(\theta = \tfrac{1}{2}\left(\theta^l + \theta^t + \tfrac{1}{2\varphi} + k - \tfrac{L}{\lambda}\right)\right)\left[L - \lambda\left(\theta^l - \tfrac{1}{2}\left(\theta^l + \theta^t + \tfrac{1}{2\varphi} + k - \tfrac{L}{\lambda}\right)\right)\right]\end{aligned}$$

$$\begin{aligned}&2k\varphi\left[L - \lambda\left(\theta^l - \left(\theta^t + \tfrac{1}{2\varphi} - k\right)\right)\right] \geq \\ &\varphi\left[\tfrac{1}{2\varphi} + k + \theta^t - \left(\tfrac{1}{2}\left(\theta^l + \theta^t + \tfrac{1}{2\varphi} + k - \tfrac{L}{\lambda}\right)\right)\right]\left[L - \lambda\left(\theta^l - \tfrac{1}{2}\left(\theta^l + \theta^t + \tfrac{1}{2\varphi} + k - \tfrac{L}{\lambda}\right)\right)\right]\end{aligned}$$

$$\begin{aligned}&2k\varphi\lambda\left[\tfrac{L}{\lambda} - \theta^l + \theta^t + \tfrac{1}{2\varphi} - k\right] \geq \\ &\varphi\lambda\tfrac{1}{2}\left(\tfrac{L}{\lambda} - \theta^l + \theta^t + \tfrac{1}{2\varphi} + k\right)\tfrac{1}{2}\left(\tfrac{L}{\lambda} - \theta^l + \theta^t + \tfrac{1}{2\varphi} + k\right)\end{aligned}$$

$$\begin{aligned}&8k(X-k) \geq (X+k)^2 \text{ where } X = \tfrac{L}{\lambda} - \theta^l + \theta^t + \tfrac{1}{2\varphi} \\ &9k^2 - 6Xk + X^2 \leq 0 \\ &k \leq \tfrac{1}{3}X = \tfrac{1}{3}\left[\tfrac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \tfrac{L}{\lambda}\right]\end{aligned}$$

Consequently, we can write that:

$$\theta^* = \begin{cases} \theta^t + \frac{1}{2\varphi} - k & \text{if } \; k \leq \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \\ \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) & \text{if } \; k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \end{cases}$$

# Appendix B

We prove that an increase in the elite's perception variability ($\frac{1}{2\varphi}$) can never prompt the elite to propose a project closer to the poor's preferred project. We know from the maximization of elite's utility that the optimal proposal is increasing in $\frac{1}{2\varphi}$ in all domains. However, a larger $\frac{1}{2\varphi}$ may cause the global optimum to shift from the first to the second domain. If this is the case, we have to check that the new equilibrium proposal located in the first domain cannot be smaller than the initial one.

Assume that, initially, the global optimum is located in the second domain:

$$\frac{1}{2\varphi} < 3k + \theta^l - \theta^t + \frac{L}{\lambda} = X \tag{1}$$

Also assume that the elite's perception variability rises and reaches a level $\left(\frac{1}{2\varphi}\right)' > \frac{1}{2\varphi}$ , such that the global optimum shifts from the second to the first domain

$$\left(\frac{1}{2\varphi}\right)' \quad \geq \quad 3k + \theta^l - \theta^t + \frac{L}{\lambda} = X \tag{2}$$

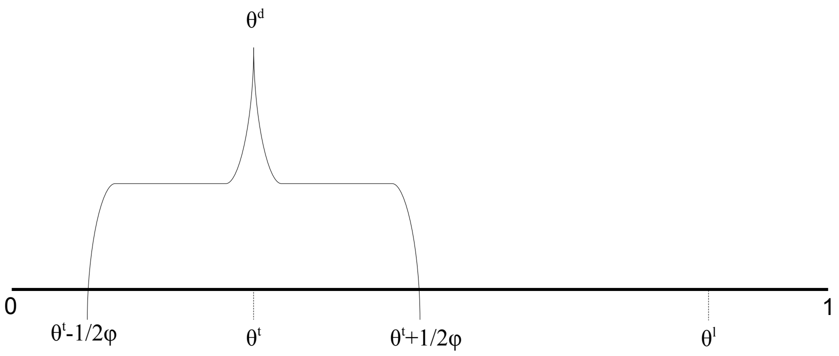
For the new equilibrium proposal located in the first domain to be smaller than the initial proposal, we need to have that: $\theta^t + \left(\frac{1}{2\varphi}\right)' - k < \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right)$, or:

$$2\left(\frac{1}{2\varphi}\right)' - \frac{1}{2\varphi} \quad < 3k + \theta^l - \theta^t + \tfrac{L}{\lambda} = \quad X \tag{3}$$

It is immediate that (2) and (3) imply $\frac{1}{2\varphi} > X$, which contradicts (1).

# Appendix C

For simplicity, we restrict the analysis to the case where $\theta^l - \theta^t > \frac{1}{\varphi}$, $\theta^t - \frac{1}{2\varphi} > 0$ and $\theta^t + \frac{1}{2\varphi} < 1$, graphically:




We also assume that $2k < \frac{1}{2\varphi}$ and that the donor knows all parameters of the elite and target groups utility functions except $\theta^t$.

We solve the new game by backward induction :

1. The donor accepts the proposal if:

$$\begin{aligned} E\left[T - \tau\left|\theta - \theta^t\right|\right] &\geq \bar{U} \\ E\left[\left|\theta - \theta^t\right|\right] &\leq \frac{T - \bar{U}}{\tau} \\ \left|\theta - \theta^d\right| &\leq \frac{T - \bar{U}}{\tau} = k \end{aligned}$$

   (Given that $\theta^d = \theta^t + \varepsilon$ and $E(\varepsilon) = 0$: $\theta^t = \theta^d - \varepsilon \Rightarrow E\left(\theta^t\right) = \theta^d$)

2. The elite group chooses the project $\theta$ that maximizes their own expected utility :

   (a) If the donor chooses strategy $r$ and reveals $\theta^d$ to the community, it is immediate that the elite's optimal response is to ask for project:

$$\theta^r = \theta^d + k$$

(b) If the donor chooses strategy $s$ and keeps $\theta^d$ secret, the elite only knows that $\theta^d \sim U\left[\theta^t - \frac{1}{2\varphi}; \theta^t + \frac{1}{2\varphi}\right]$. This is the case that we developed:

$$P(\theta) = \begin{cases} 2k\varphi & \text{if} \quad \theta \in \left[\theta^t - \frac{1}{2\varphi} + k, ; \theta + \frac{1}{2\varphi} - k\right] \\ \varphi\left(\frac{1}{2\varphi} + k + \theta^t - \theta\right) & \text{if} \quad \theta \in \left[\theta^t + \frac{1}{2\varphi} - k; \theta^t + \frac{1}{2\varphi} + k\right] \\ \varphi\left(\frac{1}{2\varphi} + k - \theta^t + \theta\right) & \text{if} \quad \theta \in \left[\theta^t - \frac{1}{2\varphi} - k; \theta^t - \frac{1}{2\varphi} + k\right] \\ 0 & \text{otherwise} \end{cases}$$

and

$$\theta^s = \begin{cases} \theta^t + \frac{1}{2\varphi} - k & \text{if} \quad k \leq \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \\ \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) & \text{if} \quad k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right] \end{cases}$$

$$\theta^s = \begin{cases} \theta^t + \frac{1}{2\varphi} - k & \text{if} \quad \left(\theta^l - \theta^t\right) \leq \frac{L}{\lambda} - 3k + \frac{1}{2\varphi} \\ \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) & \text{if} \quad \left(\theta^l - \theta^t\right) > \frac{L}{\lambda} - 3k + \frac{1}{2\varphi} \end{cases}$$

(c) If the donor chooses strategy $x$, he only reveals that $\theta^d \sim U\left[\theta^d - \frac{1}{2x}; \theta^d + \frac{1}{2x}\right]$ where he chooses $\frac{1}{2x}$. This case is solved with the same method as the previous one. If $\frac{1}{2x} > k$, the solution is (notice that unlike the previous case, the solution depends on $\theta^d$ and is unrelated to $\theta^t$):

$$\theta^x = \begin{cases} \theta^d + \frac{1}{2x} - k & \text{if} \quad k \leq \frac{1}{3}\left[\frac{1}{2x} - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right] \\ \frac{1}{2}\left(\theta^l + \theta^d + \frac{1}{2x} + k - \frac{L}{\lambda}\right) & \text{if} \quad k > \frac{1}{3}\left[\frac{1}{2x} - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right] \end{cases}$$

$$\theta^x = \begin{cases} \theta^d + \frac{1}{2x} - k & \text{if} \quad \frac{1}{2x} \geq 3k + \left(\theta^l - \theta^d\right) - \frac{L}{\lambda} \\ \frac{1}{2}\left(\theta^l + \theta^d + \frac{1}{2x} + k - \frac{L}{\lambda}\right) & \text{if} \quad \frac{1}{2x} < 3k + \left(\theta^l - \theta^d\right) - \frac{L}{\lambda} \end{cases}$$

Remark that

$$E\left[\theta^x\right] = \begin{cases} \theta^t + \frac{1}{2x} - k & \text{if} \quad \frac{1}{2x} \geq 3k + \left(\theta^l - \theta^t\right) - \frac{L}{\lambda} \\ \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2x} + k - \frac{L}{\lambda}\right) & \text{if} \quad \frac{1}{2x} < 3k + \left(\theta^l - \theta^t\right) - \frac{L}{\lambda} \end{cases}$$

$$E\left[\theta^x\right] = \theta^s \quad \text{if} \quad \frac{1}{2x} = \frac{1}{2\varphi}$$

Knowing this, the donor will choose the value of $x$ that minimizes the expected distance between $\theta^x$ and $\theta^t$. From this expression, $E[\theta^x] - \theta^t$ is strictly decreasing in $\frac{1}{2x}$. Note that, the solution changes if $\frac{1}{2x} < k$ because the probability of project acceptance function, $P(\theta)$, has changed:

$$P(\theta) = \begin{cases} 1 & \text{if} \quad \theta \in \left[\theta^d + \frac{1}{2x} - k, ; \theta - \frac{1}{2x} + k\right] \\ x\left(\frac{1}{2x} + k + \theta^d - \theta\right) & \text{if} \quad \theta \in \left[\theta^d - \frac{1}{2x} + k; \theta^d + \frac{1}{2x} + k\right] \\ x\left(\frac{1}{2x} + k - \theta^d + \theta\right) & \text{if} \quad \theta \in \left[\theta^d - \frac{1}{2x} - k; \theta^d + \frac{1}{2x} - k\right] \\ 0 & \text{otherwise} \end{cases}$$

$$\theta^x = \begin{cases} \theta^d + k - \frac{1}{2x} & \text{if} \quad \frac{1}{2x} \leq \frac{1}{3}\left[k - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right] \\ \frac{1}{2}\left(\theta^l + \theta^d + \frac{1}{2x} + k - \frac{L}{\lambda}\right) & \text{if} \quad \frac{1}{2x} > \frac{1}{3}\left[k - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right] \end{cases}$$

$$E[\theta^x] = \begin{cases} \theta^t + k - \frac{1}{2x} & \text{if} \quad \frac{1}{2x} \leq \frac{1}{3}\left[k - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right] \\ \frac{1}{2}\left(\theta^l + \theta^t + \frac{1}{2x} + k - \frac{L}{\lambda}\right) & \text{if} \quad \frac{1}{2x} > \frac{1}{3}\left[k - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right] \end{cases}$$

When $\frac{1}{2x} < k$ the bias in the proposal is not strictly decreasing in $\frac{1}{2x}$ any more. To find the optimal value of $\frac{1}{2x}$, we should consider two different cases:

i. When $\theta^l - \theta^d > \frac{L}{\lambda} - 2k$: $\frac{1}{3}\left[k - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right] < k < 3k + \left(\theta^l - \theta^t\right) - \frac{L}{\lambda}$:

$$\left(\frac{1}{2x}\right)^* = \frac{1}{3}\left[k - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right]$$

and

$$\theta^x = \theta^d + k - \frac{1}{2x} = \frac{1}{3}\left[2\theta^d + 2k + \theta^l - \frac{L}{\lambda}\right]$$

ii. When $\theta^l - \theta^d \leq \frac{L}{\lambda} - 2k$: $3k + \left(\theta^l - \theta^t\right) - \frac{L}{\lambda} < k < \frac{1}{3}\left[k - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right]$:

$$\left(\frac{1}{2x}\right)^* = k$$

and

$$\theta^x = \theta^d$$

To sum up:

$$\frac{1}{2x}^* = \begin{cases} k & \text{if} \quad \theta^l - \theta^d \leq \frac{L}{\lambda} - 2k \\ \frac{1}{3}\left[k - \left(\theta^l - \theta^d\right) + \frac{L}{\lambda}\right] & \text{if} \quad \theta^l - \theta^d > \frac{L}{\lambda} - 2k \end{cases}$$

Therefore the elite's optimal proposal becomes equal to:

$$\theta^x = \theta^d + k - \frac{1}{2x}^* = \begin{cases} \theta^d & \text{if } \theta^l - \theta^d \leq \frac{L}{\lambda} - 2k \\ \frac{1}{3}\left[2\theta^d + 2k + \theta^l - \frac{L}{\lambda}\right] & \text{if } \theta^l - \theta^d > \frac{L}{\lambda} - 2k \end{cases}$$

3. Given his signal $\theta^d$, the donor chooses the strategy $i = \{r, s, x\}$ that minimizes the expected bias in the elite's proposal. For convenience we use the symbol $d^i = E\left[\left|\theta^i - \theta^t\right|\right]$.

   (a) First, we compare $r$ and $s$. Given $\theta^r$ and $\theta^s$ above:

   $$d^r = E\left[\left|\theta^d + k - \theta^t\right|\right] = \left|\theta^d + k - E\left[\theta^t\right]\right| = \left|\theta^d + k - \theta^d\right| = k$$

   and

   $$d^s = \begin{cases} \frac{1}{2\varphi} - k & \text{if } \left(\theta^l - \theta^d\right) \leq \frac{L}{\lambda} - 3k + \frac{1}{2\varphi} \\ \frac{1}{2}\left(\theta^l - \theta^d + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) & \text{if } \left(\theta^l - \theta^d\right) > \frac{L}{\lambda} - 3k + \frac{1}{2\varphi} \end{cases}$$

   Therefore:

   i. If $k \leq \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right]$: $r$ is preferred to $s$ if $d^s > d^r \iff \frac{1}{2\varphi} - k > k \iff \frac{1}{2\varphi} > 2k$ which is always true (by assumption).

   ii. If $k > \frac{1}{3}\left[\frac{1}{2\varphi} - \left(\theta^l - \theta^t\right) + \frac{L}{\lambda}\right]$: $r$ is preferred to $s$ if $d^s > d^r$

   $\iff \frac{1}{2}\left(\theta^l - \theta^d + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) > k \iff \theta^l - \theta^d > \frac{L}{\lambda} + k - \frac{1}{2\varphi}$, otherwise $s$ is preferred to $r$.

   i. Conclusion: $r$ is preferred to $s$ if $\theta^l - \theta^d > \frac{L}{\lambda} + k - \frac{1}{2\varphi}$, otherwise $s$ is preferred to $r$.

   (b) Second, we compare $r$ and $x$:

   $$d^r = E\left[\left|\theta^d + k - \theta^t\right|\right] = \left|\theta^d + k - E\left[\theta^t\right]\right| = \left|\theta^d + k - \theta^d\right| = k$$

   and

   $$d^x = \begin{cases} 0 & \text{if } \theta^l - \theta^d \leq \frac{L}{\lambda} - 2k \\ \frac{1}{3}\left[\theta^l - \theta^d + 2k - \frac{L}{\lambda}\right] & \text{if } \theta^l - \theta^d > \frac{L}{\lambda} - 2k \end{cases}$$

   Therefore:

   i. If $\left(\theta^l - \theta^d\right) \leq \frac{L}{\lambda} - 2k$: $x$ is preferred to $r$.

   ii. If $\left(\theta^l - \theta^d\right) > \frac{L}{\lambda} - 2k$: $x$ is preferred to $r$ if $\frac{1}{3}\left[\theta^l - \theta^d + 2k - \frac{L}{\lambda}\right] < k \iff \theta^l - \theta^d < \frac{L}{\lambda} + k$, otherwise $r$ is preferred to $x$.

iii. Conclusion: $x$ is preferred to $r$ if $\theta^l - \theta^d < \frac{L}{\lambda} + k$, otherwise $r$ is preferred to $x$.

(c) Finally, we compare $x$ and $s$:

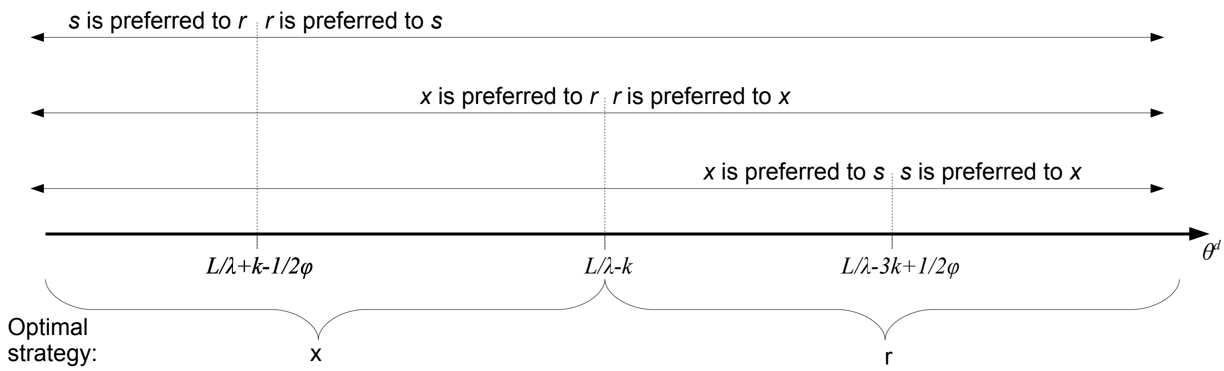
i. If $\left(\theta^l - \theta^d\right) \leq \frac{L}{\lambda} - 2k$: $x$ is preferred to $s$.

ii. If $\left(\theta^l - \theta^d\right) > \frac{L}{\lambda} - 2k$ and $\left(\theta^l - \theta^d\right) > \frac{L}{\lambda} - 3k + \frac{1}{2\varphi}$: $x$ is preferred to $s$ if $\frac{1}{3}\left[\theta^l - \theta^d + 2k - \frac{L}{\lambda}\right] < \frac{1}{2}\left(\theta^l - \theta^d + \frac{1}{2\varphi} + k - \frac{L}{\lambda}\right) \Longleftrightarrow \theta^l - \theta^d > k - 3\frac{1}{2\varphi} - \frac{L}{\lambda}$ which is impossible because $k - 3\frac{1}{2\varphi} - \frac{L}{\lambda} < 0$ ($\frac{1}{2\varphi} > k$ and $\frac{L}{\lambda} > 0$).

iii. If $\left(\theta^l - \theta^d\right) > \frac{L}{\lambda} - 2k$ and $\left(\theta^l - \theta^d\right) \leq \frac{L}{\lambda} - 3k + \frac{1}{2\varphi}$: $x$ is preferred to $s$ if $\frac{1}{3}\left[\theta^l - \theta^d + 2k - \frac{L}{\lambda}\right] < \frac{1}{2\varphi} - k \Longleftrightarrow \theta^l - \theta^d < \frac{L}{\lambda} + 3\frac{1}{2\varphi} - 5k$ which is always true when $\left(\theta^l - \theta^d\right) \leq \frac{L}{\lambda} - 3k + \frac{1}{2\varphi}$.

iv. Conclusion: $x$ is preferred to $s$ if $\theta^l - \theta^d < \frac{L}{\lambda} - 3k + \frac{1}{2\varphi}$, otherwise $s$ is preferred to $x$

The donor's best strategies given the parameter's value are summarized in the following figure:




(in this figure, we considered that $\frac{1}{2\varphi} > 4k$ which implies $\frac{L}{\lambda} - k < \frac{L}{\lambda} - 3k + \frac{1}{2\varphi}$)

To conclude, the donor's optimal strategy, $i^*$, is:

$$i^* = \begin{cases} x & \text{if} \quad \theta^l - \theta^d \leq \frac{L}{\lambda} - k \\ r & \text{if} \quad \theta^l - \theta^d > \frac{L}{\lambda} - k \end{cases}$$

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