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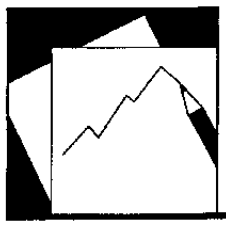

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Hierarchy and Authority in a Dynamic Perspective: A Model Applied to Donor Financing of NGO Proposals

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Hierarchy and Authority in a Dynamic Perspective: A Model Applied to Donor Financing of NGO Proposals

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Abstract

This paper presents a dynamic game of strategic delegation between a principal and an agent. The principal can choose between two organizational designs : a traditional hierarchy where she retains authority over the choice of projects to be implemented or a delegation where she allows her agent to select the project. The key objectives of this model are to identify the long-run determinants of the principal's choice and verify the impact of the authority allocation on the agent's effort levels and on the principal's payoffs. We apply the model to the relationships between institutional donors and nongovernmental organizations.

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I. INTRODUCTION

Official development assistance (ODA) has undergone deep changes since the end of the Second World War. Foreign aid, which used to be administered at the governmental level, is increasingly being channelled through "private" organizations. The significant rise of nongovernmental organizations (NGOs) in recent years reflects this evolution (see Appendix I).

The rapid development of the NGO community has been commented on extensively in the literature. Three major categories of factors have been perceived as favoring the rise of NGO actions. These are linked to (i) political and economical changes, (ii) donors' demand for NGO action, and (iii) a drive in NGO expansion to capture the available funds.

On the one hand, Bebbington and Farrington (1993) show that changes in the economic and political environments of recipient countries gave way to both increasing need for nonprofit organizations with the social consequences of early structural adjustment programs accompanied by diminishing public spending in social sectors leading to increased needs not being met by state programs and increasing opportunity for their actions. The relative democratization process in developing countries allowed more NGO activity, and the trend towards less state or decentralization contributed to their actions being developed.

On the other hand, Blair (1993) and Clark (1991,1993) clearly link the exponential growth of NGOs to the donors' demand for NGOs as implementers of development projects. Underlying motivations for this demand can come from various origins, such as the trade-off in favor of the nongovernmental sector as part of a more general distrust of the public sector, the relatively poor results of development aid leading to a general challenge of donors' methods and a promotion of participatory approaches with NGOs seen as particularly well-adapted actors for dealing with projects directly involving beneficiaries, and the general belief that NGOs are cost-effective subcontractors (Rose-Ackerman, (1996)) whose actions can be easily scaled up.

Finally, Edwards and Hulme (1997), Korten (1991), Robinson (1997), and Meyer (1995) address the "supply side." The growth of NGOs should be perceived not only as a political and moral response to underdevelopment but also as an economic answer to the availability of donors' funds. This availability of funding leads the NGOs to expand their operations and activities. Meyer (1995) suggests that entrepreneurship is a crucial feature of any nongovernmental organization. Korten (1991) and Robinson (1997) establish that NGOs are becoming more professional as they are increasingly dealing with major donors; they regard professionalization as an explanation for the drive for growth embedded in the organizational structure of the NGO.

This implies that the utility of an NGO will depend not only on satisfying the beneficiaries' needs but also on pursuing a growth-driven objective. Therefore, implementing a project also brings a "private" benefit to the NGO, such as, for example, increasing its expertise and hence contributing to its own organizational development. Concomitantly, it is a well-accepted notion in the development aid literature that donors have their own values and also satisfy private motives while financing beneficiaries. Donors assess the beneficiaries' needs through a grid of underlying motives and values and select projects that match their objectives. World Bank loans are granted to countries implementing the appropriate economic policies and undergoing structural adjustment

programs. The European Union supports regional integration. Moreover, the donors' objectives can vary and evolve. Poverty reduction and gender issues recently became concerns more or less shared by all members of the Organization for Economic Cooperation and Development (OECD), but among European countries fierce debate still rages with regard to the regional allocation of aid; at the 1995 Cannes European Council summit, France and Belgium insisted on maintaining a large part of the aid to African countries whereas Denmark and the Netherlands advocated a more diversified approach and Germany supported an increase in funds to Eastern European countries.

Numerous examples could be cited but the above-mentioned ones should be sufficient to illustrate a core feature of this paper: both donors and NGOs obtain private rewards or benefits from the implementation of a given project. The higher the appropriateness of the project that is, the better the project fits the donor's values or the NGO's objectives, the larger the reward.

Beyond the growing interaction between donors and NGOs, empirical studies such as Cox and Koning (1997) or the OECD report (Helmich and Smillie, 1999) examine the type of relationships that can be found between NGOs and donors. They highlight the existence of *two major organizational schemes* linking donors and NGOs. The donor can choose either to subcontract a project (subcontracting mode) or to finance a project proposed by the NGO (cofinancing mode). The first implies that the choice of project falls within the authority of the donor whereas the second implies that it is up to the NGO to decide which project to implement.

This paper aims to assess whether a principal (the donor) should delegate some authority over the choice of project to an agent (the NGO) and, if so, under what conditions. It considers two hierarchical structures (with and without delegation) in a dynamic perspective and assesses how, in the long run, authority allocation within an organization motivates the agent and ultimately affects the principal's payoff. This paper builds upon Aghion and Tirole's (1997) work on strategic delegation and organizational structures between a principal and an agent. A principal (she) and an agent (he) form a hierarchy. The goal of such a hierarchy is to implement projects carried out by the agent under the supervision of the principal. Before being implemented, a project has to be chosen among N possible projects. Implementing a project brings both the principal and the agent some private rewards, but choosing a project requires acquiring (costly) information. The paper distinguishes between two types of hierarchies: the traditional hierarchy and a delegation scheme. The organizational settings differ from one another in one respect: in the traditional hierarchy, the principal is in charge of selecting the project that will be implemented by the agent; in the delegation scheme, the agent is ex ante given the responsibility over the choice.

This paper considers a dynamic perspective since, with very few exceptions such as day laborer, and dockers, collaboration in a principal-agent relationship lasts more than one period. Moreover, I assume that both the principal and the agent have access to some training that will increase their expertise in decision making and project scanning. Players accumulate expertise while being trained and use up the competence when choosing a project; I assume that competence can be built only through continuing education and that organizations engaged exclusively in operational work without training would become outdated. This paper considers an infinite-time-horizon setting and introduces capacity-building functions that will enable players to acquire expertise. The principal and the agent maximize the discounted sum of their utilities playing Nash strategies. The players' long-term behaviors are then compared.

Results are as follows:

(i) The paper identifies a key threshold in the stake of the principal; the behaviors of the players change when the maximum potential reward of the principal moves above or below this threshold.

(ii) When the stake of the principal is low, the principal will adopt a "hands-off" approach even in a traditional hierarchy and actually let the agent make the decision about the project to be implemented — if she trusts him. When stakes are low, formal delegation increases the agent's effort in screening the projects. I also show that the principal is better off when formally delegating the choice of the project to her agent and this regardless of the trustworthiness of the agent.

(iii) When the stakes of the players are high, the results are entirely different. The principal will not let her agent choose the project. Delegation is not an option anymore; it actually reduces the principal's long-term utility.

This paper explains the incentive mechanism through which real authority is captured and the game is taken-over by the agent, and identifies when delegation is a profitable option for the principal. The paper identifies the conditions under which delegation increases the agent's effort and under which it augments the principal's profit.

This paper is organized as follows: Section II describes the model; Section III presents the incentive view of authority allocation in a traditional hierarchy; Section IV discusses delegation; and Section V concludes.

II. The Model

The proposed model deals with a principal-agent relationship analyzed through a strategic delegation framework. It has the following basic features. First, there is the strategic aspect; each player develops its strategy by taking into account the action of the other one. Second, there is a dynamic aspect; each player acquires organizational capacity through training. To capture both these aspects, the players are assumed to behave in a Cournot-Nash way in a dynamic framework. They will try to maximize the discounted sum of their utilities while taking the strategy of the other as given.

Moreover, the strategic delegation framework implies that one of the players, here the principal, comes upon an additional choice: facing two sub-games, she can choose which game will be played. She will do so by solving the two sub-games and choosing the one bringing her the highest utility. The key objectives of this model are to identify the determinants of the principal's choice and verify the impact of the authority allocation on the agent's effort levels.

A. Overall Structure

A hierarchy consists of a principal, P, and an agent, A. The goal of this hierarchy is to

develop and implement projects. The agent takes care of the implementation of the project under the principal's supervision. Screening potential projects and selecting the one to be implemented can be done either by the principal or by the agent. At each period t, the hierarchy chooses only one project among N potential projects. To the implementation of a given project is attached a reward for the principal and a private benefit to the agent. Among all possible projects, only one will bring to the principal a maximum marginal rate of return, B, and only one will bring to the agent a maximum private benefit b[2]. There is no a priori reason for the maximum reward of both players to be attached to the same project. Ex ante, all projects seem identical to the players and they have to invest in (costly) information in order to be able to distinguish between potential projects and choose the one with the highest reward. The agent is motivated by private benefits which may include job satisfaction, a sense of achievement, career concerns and so on. As I am interested in modelling the allocation of the choice of the project and leave aside subsequent implementation and monitoring issues, we consider that the agent receives a constant salary equal to his reservation wage, which is normalized to zero. This assumption fits if the agent is infinitely risk-averse with respect to income or if it is legally prevented from making a pecuniary profit (if the agent is an NGO, this is the case in most countries).

B. Hierarchies and Authority

I present two types of hierarchical structures and two authority concepts.

Let us first define formal authority as the *right to decide*: in the traditional hierarchy formal authority over the choice of project is assigned to the principal. However, it might occur that a decision-maker allows a subordinate to decide which project is going to be implemented.[3] In this case I consider that, although the principal is legally in charge, the agent exerts real authority, defined as *effective control over the given decisions*.

The second hierarchical structure is a delegation[4] scheme where the principal ex ante transfers her formal decision right to her subordinate. The agent chooses the project.

C. Information, Capacity, and Cost

Information. Let a_t and p_t denote the probabilities at time t, that the agent and the principal are perfectly informed, i.e. know the payoffs associated with each of the n projects. a_t and p_t reflect the efforts undertaken by the players in acquiring information about the reward attached to each project.

Capacity. Besides, each player has access to a training program that aims at increasing its professional expertise. Let us write $x_{t+1} = (1+\sigma)x_t - p_t$, the dynamics of the principal's capacity building, and $y_{t+1} = (1+\sigma)y_t - a_t$, the dynamics of the agent's expertise. The parameter σ measures the access to training provided to the player. When the player acquires information,

[2]The game rules out negative payoffs.

[3]For an analysis of different factors leading a principal to be overruled by her subordinate, see Aghion and Tirole (1997).

[4]Delegation is defined solely as the allocation of autority over the choice of the project to the agent.

he or she uses up the accumulated capacity; I assume that there is a depletion of competence when organizations engage in operational work and have less time for training activities.

Cost functions. Since information is not freely available, each player incurs costs while obtaining information about the payoffs of the N projects. These costs can be perceived as the administrative and organizational costs linked with handling and scanning project proposals. Let us write $C(p_t) = \frac{1}{2}p_t^2$ and $C(a_t) = \frac{1}{2}a_t^2$

D. Utility Functions

The traditional hierarchy or AP game. In the traditional hierarchy, formal authority belongs to the principal. If she decides to get informed (probability p_t), she will know the payoffs of the proposed projects and hence will choose the one yielding the maximum reward, B, for herself. Incidentally, this project also yields some benefit, βb, for the agent.

With probability $(1 - p_t)$ the principal will not get informed and, if the agent gets informed (probability a_t), he will choose the project yielding private benefit b and generating αB reward for the principal (I say that the agent exerts real authority). Both α and β belong to $[0, 1]$ and measure the externality incurred by one player when the other one chooses the project. The higher α, the lower the negative externality of the agent's choice on the reward of the principal. The higher β, the less the choice of the principal harms the agent. If none of the players gets informed, no project will be implemented.[5]

Hence, the one-period maximization functions of the principal (U_p) and of the agent (U_a) are as follows;

$$\begin{aligned} U_p &= B\left(p_t + (1 - p_t)\,\alpha a_t\right) - \frac{1}{2}p_t^2 \\ U_a &= b\left(\beta p_t + (1 - p_t)\,a_t\right) - \frac{1}{2}a_t^2 \end{aligned}$$

However, the principal can choose to enter into a different type of relationship: she can ex ante delegate formal authority to the agent

Delegation or AA game. If the agent is informed (he uses his formal authority *and* exercises real authority), he will select the project with payoffs$(b, \alpha B)$. If he is not informed and if the principal gets informed, she will propose a project yielding payoffs $(B, \beta b)$. Thus, the utility functions become:

$$\begin{aligned} U_p^d &= B\left(\alpha a_t + (1 - a_t)\,p_t\right) - \frac{1}{2}p_t^2 \\ U_a^d &= b(a_t + (1 - a_t)\beta p_t) - \frac{1}{2}a_t^2 \end{aligned}$$

Both games are perfectly symmetric. Delegation mirrors the traditional hierarchy; this organizational design empowers the agent (in terms of project choosing) but also considers that the agent has the option not to become informed, in which case the choice of the project would go to the principal. This configuration may not seem to be very plausible within a single organization,

[5]For the sake of simplicity, we describe the decisions of the players in a sequential manner, but, actually, they play simultaneously.

but I believe this is an appropriate setting for describing funding relationships. As an illustration, let us consider that a donor allocates a certain amount to a budget line, w_1, which objective is to finance projects proposed by NGOs (authority over the project choice to the NGO). If there are insufficient proposals and the funds are not used up, they will be returned to the more general "cooperation with NGO " budget line, w_2, and will be used to finance projects chosen by the donor and subcontracted to NGOs (real authority over the project is exercised by the principal).

III. The Incentive View of Authority Allocation Within a Traditional Hierarchy

The intertemporal utility of each player is the discounted sum of the one-period utilities described above. I solve for open-loop Cournot-Nash stationary strategies. In this setting, the information acquisition decisions by both parties are made in advance. I choose this type of strategic game as the choice between delegation and traditional hierarchy for the principal corresponds to a budget line allocation between subcontracting projects and cofinancing them. Empirical evidence indicates that the budget allocation process is not shifting regularly.

The principal maximizes

$$\sum_{t}^{\infty}(B\left(p_t+(1-p_t)\,\alpha a_t\right)-\frac{1}{2}p_t^2)\left(1+r\right)^{-t} \tag{1}$$

subject to

$$x_{t+1}=(1-\sigma)\,x_t-p_t \tag{2}$$

and

$$0\leq p_t\leq 1 \tag{3}$$

The agent maximizes:

$$\sum_{s=t}^{\infty}\left(b\left(\beta p_t+(1-p_t)\,a_t\right)-\frac{1}{2}a_t^2\right)\left(1+r\right)^{-t} \tag{4}$$

s.t.

$$y_{t+1}=(1-\sigma)\,y_t-a_t \tag{5}$$

and

$$0\leq a_t\leq 1 \tag{6}$$

where r stands for the constant rate of time preference and $r < \sigma$[6]

A. Maximization

The open loop equilibrium optimum necessary conditions for the principal are

$$B - a_t \alpha B - \lambda_t = p_t \tag{7}$$

$$\lambda_t = \frac{1+r}{1+\sigma}\lambda_{t-1} \tag{8}$$

$$x_{t+1} - x_t = \sigma x_t - p_t \tag{9}$$

where λ_t is a costate variable that can be interpreted as the shadow value of training, measured in utility terms.

The transversality conditions are :$\lim_{t\to\infty} \lambda_t x_t (1+r)^{-t} = 0$ and $\lim \lambda_t \, (1+r)^{-t} \geq 0$

The amount of information the principal will choose to acquire depends positively on her stake and negatively on the agent's initiative weighted by the congruence parameter. A high α and an active agent reduce the principal's motivation to retain control as her agent's choice will not harm her.

p is negatively related to λ; the higher the value of expertise and training, the higher the cost of becoming operational. If we assume an exogenous shock increasing the shadow price, the player will be more reluctant to get informed.

The first order conditions for the agent are:

$$b - p_t b - \pi_t = a_t \tag{10}$$

$$\pi_t = \frac{1+r}{1+\sigma}\pi_{t-1} \tag{11}$$

$$y_{t+1} - y_t = \sigma y_t - a_t \tag{12}$$

where π_t is the costate variable

The transversality conditions are :$\lim_{t\to\infty} \pi_t y_t (1+r)^{-t} = 0$ and $\lim \pi_t \, (1+r)^{-t} \geq 0$

An interior Cournot-Nash equilibrium of the AP game is a solution of the following system of difference equations:

[6]This technical assumption indicates that the players have unlimited access to training.

$$p_{t+1} = \frac{1+r}{(1+\sigma)} p_t + A_1 \tag{13}$$

$$x_{t+1} = (1+\sigma)\, x_t - p_t \tag{14}$$

$$a_{t+1} = \frac{1+r}{1+\sigma} a_t + A_2 \tag{15}$$

$$y_{t+1} = (1+\sigma)\, y_t - a_t \tag{16}$$

where for notational simplicity:

$$A_1 = \frac{(\sigma - r)(B - \alpha B b)}{(1+\sigma)(1 - \alpha B b)}$$

$$A_2 = \frac{(\sigma - r)(b - bB)}{(1+\sigma)(1 - \alpha b B)}$$

(See Appendix II for detailed computations)

Under the assumption $r < \sigma$ the dynamic system with eigenvalues $\left(\frac{1+r}{1+\sigma}, 1+\sigma\right)$ is saddle-point stable. The efforts of the players converge towards their steady state levels. Transversality conditions rule out dynamically unstable solutions.

Nonconstant solutions are given by:

$$p_t = \mu^t (p_0 - \bar{p}) + \bar{p}$$

$$a_t = \mu^t (a_0 - \bar{a}) + \bar{a}$$

$$x_t = (1+\sigma)^t \left(x_0 + \delta \left(\bar{p} \left(1 - \frac{1}{\sigma} \right) - p_0 \right) \right) + \mu^t \delta (p_0 - \bar{p}) + \frac{\bar{p}}{\sigma}$$

$$y_t = (1+\sigma)^t \left(y_0 + \delta \left(\bar{a} \left(1 - \frac{1}{\sigma} \right) - a_0 \right) \right) + \mu^t \delta (a_0 - \bar{a}) + \frac{\bar{a}}{\sigma}$$

where:

$$\bar{p} = \frac{B - \alpha B b}{1 - \alpha B b}$$

$$\bar{a} = \frac{b - B b}{1 - \alpha B b}$$

$$\mu = \frac{1+r}{1+\sigma}$$

$$\delta = \frac{1+\sigma}{\sigma^2 + 2\sigma - r}$$

Long-term values.

Let us denote $\{\overline{p}, \overline{a}, \}$ as the steady-state values of the players efforts in the AP game

obtained from the above dynamic system.

$$\begin{cases} \overline{p} = \dfrac{B - \alpha bB}{1 - \alpha Bb} \\ \overline{a} = \dfrac{b - Bb}{1 - \alpha Bb} \end{cases}$$

B. Real Authority and Efforts

Proposition 1. *When the stake of the principal is low ($B < 1$), her effort is negatively related to the congruence parameter α while the agent's effort is positively related to α.*

Proof. By differentiating $\bar{p}$ with respect to α

When her stake is low, the more the principal can trust the agent[7], the less effort she makes to learn about project payoffs. Concomitantly, the effort of the agent is increasing with α when $B < 1$; the more the principal allows the agent to show initiative, the more the agent makes an effort. A low stake for the principal and a high trustworthiness of the agent illustrate when the agent can take over and exert real authority over the project choice. However, when the principal's stakes are high, she is not decreasing her effort level and thus does not give way to the agent to get informed. The effort of the agent is decreasing with α when $B > 1$; as the principal keeps getting informed, it is useless for the agent to acquire information as his choice will be overruled by the principal.

IV. Delegation: The Choice of the Principal

Following the same method as for the traditional hierarchy, I obtain the following long term values for the principal's p^* and the agent's efforts a^* under delegation:

$$p^*(\beta) = \frac{B - Bb}{1 - \beta Bb}$$
$$a^*(\beta) = \frac{b - \beta Bb}{1 - \beta Bb}$$

Parametric restrictions. Having obtained the general form of steady-state values in both sub-games, it is necessary to define sets of parameters that constrain $\overline{p}$ and $\overline{a}$ as well as p^* and a^* to belong to $[0,1]$. In order to compare the efforts of both players in both games, appropriate parametric restrictions are selected. There are two sets of parameters when strategies are eligible.

Stationary strategies $\overline{p}$, $\overline{a}$ and p^* $a^*$are admissible:

either when (i) $b < 1$ and $B < 1$

or when (i) $1 \leq B$ and $1 \leq b$

[7]We define trust as the closeness of preferences

(ii) $1 - \frac{1}{B} - \frac{1}{Bb} < \alpha < 1$

(iii) $1 - \frac{1}{b} - \frac{1}{Bb} < \beta < 1$

Proposition 2. *When the stakes of the players are low,* $\overline{a} < a^*$. *When they are high,* $\overline{a} > a^*$.

Proof. See Appendix III

Proposition 2 identifies the conditions (low-key projects) under which delegation increases the agent's effort. When the stakes are low, delegation enhances the agent's effort to get informed; his effort level is higher when the principal cannot overrule his choice. When stakes are high, the agent's effort is actually higher in a traditional hierarchical setting. This result may seem counter-intuitive but we have to remember that when the stakes are high, β, measuring the convergence of the preferences between the principal and the agent, is above a certain threshold too (see Appendix 3). Hence, the choice of the principal is not harmful for the agent and the traditional hierarchy setting is more favorable.

Proposition 3. *When the stakes of the players are low, formal delegation increases the principal's long term utility. Otherwise, delegation is harmful.*

Proof. See Appendix IV.

When her stake is low, the result shows that the optimal organizational design for the principal lies in delegating the authority over the choice of the project to her agent. This results holds for all α. For low-key projects, the difference between the reward brought by her preferred project and the one attached by the project chosen by the agent does not justify the costs of her getting informed; the principal is better off delegating *even* if the agent's preferences are very different from her own. However, if the project is important to her, the principal's long-term utility is lower in the delegation scheme than in the traditional hierarchy even if the agent's preferences are close to her own. Therefore, a principal will not delegate when her stake is high.

Proposition 3 formalizes that (i) only the choice over low-key projects should be delegated to subordinates and (ii) the choice over *all* low-key projects should be delegated.

V. CONCLUSION

This paper analyzes two different ways for institutional donors to finance NGO action. Donors can either develop a project and subcontract it to an NGO (subcontracting mode) or finance an NGO proposal (cofinancing mode). This paper identifies the conditions under which it is sensible for a donor to choose the latter financing mode.

This paper uses a simple analytical framework with a dynamic principal-agent strategic game where players maximize quadratic utility functions and where the choice of one player induces negative externalities on the other player's reward. The results identify a key variable: the

stake of the principal. There exists a threshold in the reward of the principal that acts as a breaking point in the behaviors of both players.

This framework allows to formally describe how the agent can take over the choice of projects and exercise real authority even in a traditional hierarchy. When the stake of a donor is low, the donor might let a trustworthy NGO suggest a course of action even in a subcontracting mode.

Besides, this study demonstrate that choosing ex ante to play a delegation game and to formally allocate authority over the choice of project makes sense for a principal if and only if, her stake in the project is low. Low-key projects should always be cofinanced; the donor is betteroff delegating the choice of such projects to an NGO. Some donors seem to be moving along these lines by attributing a bigger share of their budget to cofinanced projects, compared with subcontracted ones. (OECD report 1999).

Delegation is harmful to the principal, however, when her stakes are high. This result is in line with the presence of upper bounds in the cofinancing schemes of most donors. The donors allocate the choice of projects to NGOs only when the projects are small scale. When the stakes are high (big projects, politically sensitive projects, or projects under high media scrutiny), the donors should retain responsibility for the choice of projects.

The increasing presence of NGOs in donor-financed projects raises important issues for future applied research. The impacts of NGO action on aid allocation, the welfare of the beneficiaries, or simply the donors 'perception of the beneficiaries 'welfare need to be explored further.

APPENDIXES

I. EVOLUTION OF NGO ACTIVITY

Since NGOs are private organizations and extremely diversified, it is rather difficult to gather precise and comprehensive data on all NGOs in the world. However, all sources seem to confirm an intensified NGO participation in ODA as well as an increase in their number (Meyer (1995)). For example, World Bank data shows that during the 1990's, the World Bank-NGO co-operation has been significantly enhanced. The number of "World Bank approved projects including an NGO-participation" which used to be below 20 per year from 1974 to1989 reaches 100 in 1995. The ratio "projects including an NGO participation" on "overall bank approved projects" confirms the same trend. If until 1991, less than 10 percent of all projects were involving NGOs, this ratio is well above 40 percent since 1995.

This trend is validated by OECD data. Net NGO transfers have been multiplied by more than 5 in 10 years; from USD 884 millions in 1985 to USD 5 636 millions in 1999.

Concomitantly, the share of bilateral ODA transferred through NGO is also increasing. OECD data indicates that ODA from its DAC members channelled through NGOs has risen from 0.11 percent in 1982-83 to roughly 3 percent in 1994, reaching more than a billion USD. This figure can even be much higher for some bilateral aid agencies; for example 30 percent of Swedish development aid is conveyed by NGOs (OECD 1999).

Emergency aid is a sector where NGOs gather a particularly significant share of public funding. According to the World Food Program, food aid distributed through NGOs increased from 9.76 percent to 20.96 percent of the overall food aid between 1988 and 1994. This evolution is particularly obvious during periods of crisis: between 1990 and 1994, between 45 and 67 percent of all funds from the European Community Humanitarian Office went to support NGO actions. In 1994, NGOs received USD 116 millions, i.e., around 44 percent of European Union humanitarian action for the Former Yugoslavia and US$ 13 millions, i.e. 44 percent of the emergency aid for Liberia. According to the Humanitarian Department of the United Nations, they have channelled, in 1993, US$ 100 millions to Somalia, which represented 47 percent of all aid to this country, and the same amount to Sudan, i.e., 49 percent of all the aid perceived.

More generally, the increasing participation of NGOs in development aid corresponds to an increase in the number and size of NGOs as well as to a rise of the budgets they are dealing with, as institutional donors "discovered" them as a new way of transferring aid. Hence, this rapid growth and the increasing political and economical importance of NGOs result in a significant part of development aid being channelled through NGOs.

II. DYNAMIC OPTIMIZATION

Let us solve the dynamic game by applying the maximum principle.

Let us first consider the traditional hierarchy setting. Let us write that the principal maximizes

$$\sum_{t}^{\infty}(B\left(p_t+(1-p_t)\,\alpha a_t\right)-\frac{1}{2}p_t^2)\left(1+r\right)^{-t} \tag{A-1}$$

subject to

$$x_{t+1}=(1+\sigma)\,x_t-p_t \tag{A-2}$$

and

$$0\leq p_t\leq 1 \tag{A-3}$$

The agent maximizes:

$$\sum_{s=t}^{\infty}\left(b\left(\beta p_t+(1-p_t)\,a_t\right)-\frac{1}{2}a_t^2\right)\left(1+r\right)^{-t} \tag{A-4}$$

s.t.

$$y_{t+1}=(1-\sigma)\,y_t+a_t \tag{A-5}$$

and

$$0\leq a_t\leq 1 \tag{A-6}$$

where r stands for the constant rate of time preference and we assume $r<\sigma$

Let us write H^p and H^a the current-value Hamiltonians of respectively the principal and the agent.

$$H^p=B\left(p_t+(1-p_t)\,\alpha a_t\right)-\frac{1}{2}p_t^2+\lambda_t\left(\sigma x_t-p_t\right)+g_1p_t+g_2(1-p_t) \tag{A-7}$$

$$H^a=b\left(\beta p_t+(1-p_t)\,a_t\right)-\frac{1}{2}a_t^2+\pi_t\left(\sigma y_t-a_t\right)+h_1a_t+h_2(1-a_t) \tag{A-8}$$

with $g_1\geq 0, p_t\geq 0\; g_1, p_t=0$ and $g_2\geq 0, 1-p_t\geq 0\,, g_2(1-p_t)=0$
with $h_1\geq 0, h_t\geq 0$ and $h_1a_t=0$ and $h_2\geq 0, 1-a_t\geq 0\,, h_2(1-a_t)=0$

We consider only interior solutions and the maximum principle yields:

$$\begin{aligned} B-a_t\alpha B-p_t-\lambda_t &= 0 && \text{(A-9)}\\ \lambda_t-\lambda_{t-1} &= -\sigma\lambda_t+r\lambda_{t-1} && \text{(A-10)}\\ x_{t+1}-x_t &= \sigma x_t-p_t && \text{(A-11)} \end{aligned}$$

$$\begin{aligned} b-p_tb-a_t-\pi_t &= 0 && \text{(A-12)}\\ \pi_t-\pi_{t-1} &= -\sigma\pi_t+r\pi_{t-1} && \text{(A-13)}\\ y_{t+1}-y_t &= \sigma y_t-a_t && \text{(A-14)} \end{aligned}$$

where λ_t and π_t are costate variables

with transversality conditions :$\lim_{t\to\infty} \pi_t y_t (1+r)^{-t} = 0$ and $\lim \pi_t \, (1+r)^{-t} \geq 0$

By solving (25) and (28) in terms of $a\,(t)$ and $p\,(t)$, then substituting $\pi\,(t)$ and $\lambda\,(t)$ by their expressions in (26) and (29) and further manipulating, we obtain

$$\begin{aligned} p_{t+1} &= \left(\frac{1+r}{(1+\sigma)}\right) p_t + A_1 \\ x_{t+1} &= (1+\sigma)\, x_t - p_t \\ a_{t+1} &= \left(\frac{1+r}{1+\sigma}\right) a_t + A_2 \\ y_{t+1} &= (1+\sigma)\, y_t - a_t \end{aligned}$$

where for notational simplicity:

$$A_1 = \frac{(\sigma - r)\,(B - \alpha B b)}{(1+\sigma)\,(1 - \alpha B b)}$$

$$A_2 = \frac{(\sigma - r)\,(b - bB)}{(1+\sigma)\,(1 - \alpha b B)}$$

Delegation Following the same method, I obtain

$$\begin{aligned} p_{t+1} &= \left(\frac{1+r}{(1+\sigma)}\right) p_t + C_1 \\ x_{t+1} &= (1+\sigma)\, x_t - p_t \\ a_{t+1} &= \left(\frac{1+r}{(1+\sigma)}\right) a_t + C_2 \\ y_{t+1} &= (1+\sigma)\, y_t - a_t \end{aligned}$$

where $C_1 = \dfrac{(\sigma - r)\,(B - Bb)}{(1+\sigma)\,(1 - \beta B b)}$

and $C_2 = \dfrac{(\sigma - r)\,(b - \beta B b)}{(1+\sigma)\,(1 - \beta B b)}$

III. COMPARISON OF THE AGENT'S EFFORT

Let us recall that $\overline{a} = \dfrac{b - Bb}{(1 - \alpha Bb)}$ and $a^* = \dfrac{b - \beta Bb}{(1 - \beta Bb)}$

Denote $E = \overline{a} - a^*$

$$E = -\frac{bB(b\beta + 1 - \beta Bb - \alpha b - \beta + \beta B\alpha b)}{(1 - \beta Bb)(1 - \alpha Bb)}$$

the sign of E depends on the sign of $d = -(bB(b\beta + 1 - \beta Bb - \alpha b - \beta + \beta B\alpha b))$

Solution of $d > 0$,

is: $\left\{ \begin{array}{c} \text{signum}\left(Bb^2\left(-1 + \beta B\right)\right) \\ \alpha < \text{signum}\left(Bb^2\left(-1 + \beta B\right)\right) \dfrac{-b\beta - 1 + \beta Bb + \beta}{b\left(-1 + \beta B\right)} \end{array} \right\}$

When $b < 1$ and $B < 1$,

we have $-1 + \beta B < 0$ and $\dfrac{-b\beta - 1 + \beta Bb + \beta}{b\left(-1 + \beta B\right)} > 1$. Hence, for all α, we have $E < 0$.

When $b \geq 1$ and $B \geq 1$, then $-1 + \beta B > 0$ and again $\dfrac{-b\beta - 1 + \beta Bb + \beta}{b\left(-1 + \beta B\right)} > 1$. Then for all α, we have $a^* < \overline{a}$.

IV. COMPARISON OF THE PAYOFFS OF THE PRINCIPAL

Let us write $\bar{u}_p$ the long term value of the principal utility in the traditional hierarchy:

$$\bar{u}_p = B\bar{p} + (1-\bar{p})\alpha B\bar{a} - \tfrac{1}{2}\bar{p}^2$$

which can be written as

$$\bar{u}_p = B\frac{B-\alpha Bb}{1-\alpha Bb} + (1-\frac{B-\alpha Bb}{1-\alpha Bb})\alpha B\bar{a} - \tfrac{1}{2}\left(\frac{B-\alpha Bb}{1-\alpha Bb}\right)^2$$

which simplifies into:

$$\bar{u}_p = \frac{(1-B)\,\alpha Bb}{1-\alpha Bb}$$

Let us write u_p^* the long term value of the principal utility under delegation:

$$u_p^* = \frac{(1-\beta B)\,\alpha Bb}{1-\beta Bb}$$

denote $F = \bar{u}_p - u_p^*$

$$F = \frac{-\alpha B^2 b(b\beta + 1 - \beta Bb - \alpha b - \beta + \beta Bb\alpha)}{(1-\alpha Bb)\,(1-\beta Bb)}$$

the sign of F depends from the sign of

$$f = -\alpha B^2 b(b\beta + 1 - \beta Bb - \alpha b - \beta + \beta Bb\alpha)$$

Solution of $f > 0$,

is : $\left\{\text{signum}\,(-b+\beta Bb)\,\alpha < \text{signum}\,(-b+\beta Bb)\,\dfrac{-b\beta - 1 + \beta Bb + \beta}{b\,(-1+\beta B)}\right\}$

When $b < 1$ and $B < 1$,

we have $-1+\beta B < 0$ and $\dfrac{-b\beta - 1 + \beta Bb + \beta}{b\,(-1+\beta B)} > 1$. Hence, for all α, we have $F < 0$ that is $\bar{u}_p < u_p^*$

When $b \geq 1$ and $B \geq 1$, then $-1+\beta B > 0$ and again $\dfrac{-b\beta - 1 + \beta Bb + \beta}{b\,(-1+\beta B)} > 1$. Then for all α, we have $\bar{u}_p > u_p^*$

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