Should Aid Reward Good Outcomes? Optimal Contracts in a Repeated Moral Hazard Model of Foreign Aid Allocation

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Abstract

We consider in this paper a repeated moral hazard model where a donor, characterized both by altruistic and non altruistic motives, finances a three periods poverty eradication project. In order to model the significant problems that donors face in the actual implementation of aid programs, we assume that the elites of the recipient country, who play an important role in carrying out the project, have an incentive to divert resources from the intended use. We show that optimal aid contracts should be conditional on the previous results of the project. We distinguish however between *strong conditionality* where contracts are specified on the basis of the performance of the project in all periods and *weak conditionality* where contracts have, instead, short memory. In this case a recipient that experienced a negative performance will receive less aid in the following period, but will bear no further consequences in the future. If a donor assigns a lot of weight to the welfare of the recipient country compared to the cost of giving aid and the incentive of the elite to divert resources, an optimal aid allocation policy always implies a positive level of aid even if the project had a negative outcome in the previous period. In the opposite case, optimal contracts imply no aid after a negative performance of the project.

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1 Introduction

Despite the large amount of resources employed to assist developing countries in the last fifty years, almost everybody today agrees that foreign aid does not work as it should. Given everything that they spend on the design and management of aid projects, are donors getting what they hoped for? Unfortunately, we do not know. Boone (1996) found that there is no impact of aid on growth; Svensson (2000) replied that aid has a positive impact on the growth of those countries with an efficient checking mechanism on the government on power. Burnside and Dollar (2000) showed that aid can have a positive impact on growth only in countries where sound macroeconomic policies are applied.

The failure of aid to promote the growth of developing countries sheds some doubts on whether the current practices in the actual implementation of aid and the aid allocation process are appropriate with respect to the main goals of development assistance and in light of the severe imperfections that characterize markets in less developed countries. It is often argued (Alesina and Dollar, 2000) that the outcome of foreign assistance programs is crucially determined by political and institutional factors, such as the non economic incentives of donors in giving bilateral aid (Berthelemy and Tichit, 2004), the incentive of donor organizations to give aid despite its lack of productivity (McGillivray, 2003), misappropriation of the aid flows by the recipient governments and/or the local elites that are involved in the actual implementation of the aid projects (Lahiri and Raimondos-Moeller, 2000).

This raises the issue on whether it is possible to design efficient mechanisms that can actually improve on the current practices that govern the allocation of foreign aid and to provide, at the same time, some idea on how *aid contracts* should look like in environments characterized by motivation-incentive problems. Although it cannot be denied that there is often a *moral hazard problem* between donors (the principal) and recipients (the agent) in the practical implementations of poverty alleviation projects, surprisingly, there has been little research on how aid agencies should design contracts to create good incentives for recipients.

To this purpose, we propose a model that analyzes the optimal aid allocation process in environments where i) donors have as a main goal that of helping the poor, but may also be conditioned by non-altruistic motives, ii) local elites have the possibility to capture a fraction of the benefits of foreign aid and iii) significant inefficiencies arise in the implementation of aid projects, due to asymmetric information and moral hazard.

Aid disbursement is not usually a one shot phenomenon but is rather a multiperiod relationship and, as a matter of fact, many developing countries depend heavily on foreign aid. For this reason, in order to model the aid allocation process, we build on the literature on repeated moral hazard developed, among others, by Lambert (1983), Holmstrom (1982), Fudenberg and Tirole (1990), Laffont and Martimort (2002) and we analyze a situation where the government of a donor country agrees to finance a multi-period project, such as a poverty eradication program. In this model the aid transfer enters directly in the production function of the recipient country, highlighting that foreign aid can represent in some cases the only source of capital for developing countries often excluded from the ordinary capital markets. The choice of modelling the relationship between the donor and the recipient country as a repeated moral hazard game, allows for the possibility that optimal contracts are made conditional on past outcomes. Indeed, one of the main results of the model is that the practice of making aid transfers conditional on the previous period's performance represents a powerful incentive mechanism that should be used in designing "foreign aid contracts".

The issue of conditionality in foreign aid is not new. Several authors have wondered whether conditionality is an efficient instrument to deal with the unsound domestic policies often pursued by developing countries. Traditionally, the use of conditionality has been criticized on the grounds that tying aid to the macroeconomic performance may be bad for the poor in recipient countries (see, e.g. Cassen et al. 1986). More recently Svensson (2000), (2003) has pointed out that conditionality may be a useful way to improve on the allocation of aid, but it may actually be ineffective if a donor country lacks a commitment technology. In the context of a two-period model where an altruistic donor faces the problem of allocating aid among two developing countries and aid is tied to a reform effort, Svensson shows that, once the political choices of the recipient are determined and the shock realized, the donor has the incentive to increase disbursement to the country in most need. The anticipation that this will happen will in turn affect the incentive to carry out politically costly reforms ex-ante. Azam and Laffont (2003) propose a model where the consumption of the poor is an international public good and aid contracts can be designed to ensure an optimal provision of it. Since the governments of developing countries may have different preferences towards the poor, aid contracts may be used to induce the various governments to reveal their type and incentive compatibility may require denying aid to the "worse governments". At the same time the authors analyze the role of multilateral institutions and local NGOs in mitigating the problems induced by informational asymmetries[1].

Our model differs from these contributions in several respects. First, we consider a multiperiod relationship between donor and recipient. Second, we model explicitly the problem that is often encountered in the practical implementation of aid programs, i.e. the fact that local elites, whose cooperation is necessary to achieve the intended results, can divert part of their resources to their private use[2]. At the same time, we allow for the possibility that donor countries are actually interested in the welfare of the elites for political or strategic reasons. The relative weight donors assign to the elites and the poor of developing countries defines, in our model, the degree of altruism. Third, the focus of our analysis is more microeconomic than macroeconomic. We analyze the funding of long term projects, such as poverty eradication programs, that occur in different stages and therefore the type of conditionality we consider here relates not to political reforms as in the Svensson model, but to the outcome of the project. Tying aid to

[1]These models focus on the problem of moral hazard in the allocation aid. There is also, however, a small literature that analyzes the problem of adverse selection. Cordella and Dell'Ariccia (2002), for example propose a model where recipient countries have different preferences on social commitment. Since the recipient governments characteristics are not observable and the donors cannot discriminate between recipient types, a donor will use conditionality to screen countries. Optimal contracts however might imply aid rationing.

[2]Also Lahiri and Raimondos-Mœller (2004) take into account the existence of two population groups into the recipient country (the rich and the poor). In this model, the rich are rent seekers and have the possibility of lobbying the government. Conditional aid may be used by the donor to achieve its social welfare objectives.

objective assessment of the performance of the project makes the definition of conditionality much more concrete, especially in a multiperiod context where the evaluation of intermediate steps becomes crucial. Fourth, we abstract from the time consistency problem which we recognize may be relevant in some cases, but that could also be overcome if contracts are designed carefully. Although the optimal long term contracts are derived under the assumption of full commitment, they are sequentially optimal and renegotiation-proof.

The analysis allows us to characterize the structure of optimal aid contracts and the factors that should determine their size. We show that conditionality is usually an efficient mechanism to deal with the moral hazard issues that arise in the aid allocation process. In our model, optimality always requires that aid transfer be conditional on the outcome of the project. Conditionality, however, in a multiperiod context may take different meanings. We distinguish between what we define as *strong conditionality* and *weak conditionality.* In the first case, contracts are specified on the basis of the performance of the project in all periods i.e. contracts have a long memory and donors, in deciding the structure of aid transfers, take into account the whole history of the project. The case that we call instead *weak conditionality* refers to contracts that have short memory. With these contracts, a donor will always impose a mechanism aimed at insuring incentive compatibility, but the allocation scheme will not involve strong consequences in the following periods for a recipient that experienced a negative performance in some previous period.

The interest of the donor in the welfare of the recipient country, that may have different meanings according to the preference assigned to the poor relative to the elite, is a major factor in determining the structure of these contracts. If a donor assigns a lot of weight to the welfare of the recipient country compared to the costs of giving aid and to the incentive the elite has to divert resources, then he should always grant a positive level of aid, even if the project had a negative outcome. If instead, for the donor, the desire to help the country is relatively less important than the desire to achieve the maximum level of efficiency and to avoid a possible misuse of funds by the elite, then optimal contracts imply no aid after a negative performance of the project. In general, as expected, the amount of aid destined to developing country should be higher, the higher is the concern of the donor country about the recipient.

The setup of the model is described in Section 2. Section 3 defines the intertemporal maximization model, while the optimal foreign aid contracts are obtained in Section 4.

2 The Model

In this model we consider a bilateral cooperation program[3] between two countries: a donor and a recipient country[4].

The two countries agree on a program that can be completed in three periods. The recipient does not have resources to employ in the project and foreign aid is given by the government of the donor country to the government of the recipient country in order to finance a program, such as a poverty eradication program which benefits the citizens of the recipient country. Therefore, in this model aid, is simply the input required each period to carry out production. We consider a situation in which a donor gives aid on a period by period basis to finance the different stages of the project, after having observed the past outcomes. In order to get the project off the ground, we assume that the recipient country provides an initial level of capital exogenously given, a_0.

The project can be realized only if the recipient country is involved. We assume that in the recipient country there are two types of agents: type I agents, that we call *the elite*, and type II agents, that we call *the poor*. Only type I agents own the technology necessary to influence the outcome of the project. Type II agents, instead, cannot influence the realization of the project.

The distribution of the final output between type I agents and type II agents is determined by the government of the country. For simplicity we assume that the fraction γ of the output given to the elite is exogenous and reflects the income distribution of the country. This

[3]The Bilateral ODA/OA flows still represent the 75% of the sources of aid.

[4]This paper abstracts from issues of inter-recipient competition for aid, by assuming that this feature may affect budget decision but the aid allocation process itself.

fraction expresses not only the contribution that type I agents give to the project due to the ownership of the technology, but also the political power they have inside the country. The poor have no technology but they are able to capture a fraction $(1-\gamma)$ of the output of the project. In this framework the allocation of aid between the two population groups is taken as exogenously given. The parameter γ makes us able to capture the institutional and political settings that characterize the less developed countries and in particular the income distribution. The focus of this analysis, in fact, is on the role that the donor's preferences play in the effectiveness of foreign aid taking the political equilibrium of the recipient country as given.

At each time, type I agents can undertake two types of actions that assume the values $i = 0$ or $i = 1$ and that influence the outcome of the project in each stage. When $i = 0$, type I agents exerts a low level of effort and divert resources from the project to a private use; if $i = 1$ type I agents exerts a high level of effort and devote all the available funds to the project. We assume that the donor cannot observe the level of effort of the elite.

The stochastic influence of agents' action on production is characterized by the probabilities $Pr(\tilde{\theta} = \overline{\theta} \mid i = 0) = \pi_0$ and $Pr(\tilde{\theta} = \overline{\theta} \mid i = 1) = \pi_1$ with $\pi_1 > \pi_0$[5], where $\tilde{\theta}$ is a random variable that can take only the values $[\overline{\theta}, \underline{\theta}]$ with $\overline{\theta} - \underline{\theta} = \Delta\theta > 0$.

Note that the effort improves production in the sense of first order stochastic dominance, i.e. $Pr(\tilde{\theta} \leq \theta^* \mid i)$ is decreasing in i for any given level of production θ^*. When a type I agent undertakes action $i = 0$, that we also denote as the "bad" action, he is able to extract a private benefit which is given by an extra fraction b of the output in addition to the fraction γ to which he is entitled. This benefit represents an alternative way in which the elite can employ the aid transfer and only the elite will benefit from this alternative. We assume that $(\gamma + b) < 1$. Undertaking the "good" action, i.e. $i = 1$ implies, for type I agents, a disutility ψ.

For the sake of simplicity we assume that, at each stage, the production function is linear in the level of aid, i.e.:

$$q_t(a_{t-1}, \tilde{\theta}_t) = \tilde{\theta}_t a_{t-1} \tag{1}$$

[5]We define $\Delta\pi = \pi_1 - \pi_0$.

The program has the following structure:

1. *at time 0* an amount a_0 is provided by the recipient country to start the project. This amount is fixed and exogenously given and represents the start up cost of the project;
2. *at time 1* an output $q_1(a_0, \tilde{\theta}_1)$ is realized. The realization can be either $\overline{q_1}$ or $\underline{q_1}$, depending on the values that the random variable assumes. Upon observing the realization of the project, the donor determines an amount of resources $a_1(q_1)$ to devote to the continuation of the project;
3. *at time 2* an output $q_2(a_1, \tilde{\theta}_2)$ is realized where, again, we can have only to possibilities: either $\overline{q_2}$ or $\underline{q_2}$ which depend on the realization at time 2 of the random variable $\tilde{\theta}$. After having observed q_2 the donor determines $a_2(q_2)$ and delivers it to the recipient;
4. *at time 3* an output $q_3(a_2, \tilde{\theta}_3)$ is realized, the project is completed and the game is over.

We assume that the elite's utility function u^e is linear in the level of output and that type I agents are also risk neutral expected value maximizers. In each period t, $(t = 1, 2, 3)$ a type I agent's expected utility is given by:

$$u^e_{0,t} = (\gamma + b)[\pi_0 \overline{\theta} a_t + (1 - \pi_0)\underline{\theta} a_t] \tag{2}$$

if he undertakes the bad action and

$$u^e_{1,t} = \gamma[\pi_1 \overline{\theta} a_t + (1 - \pi_1)\underline{\theta} a_t] - \psi \tag{3}$$

if he undertakes the good action.

In each period, the expected utility function of the poor u^p depends on the final output of the project undertaken by the elite. We assume that also the type II agents' utility function is linear in the level of output. The expected utility of the poor, therefore is given by:

$$u^p_{0,t} = (1-\gamma)[\pi_0\overline{\theta}a_t + (1-\pi_0)\underline{\theta}a_t] \quad (4)$$

if type I agents undertake the "bad action" and

$$u^p_{1,t} = (1-\gamma)[\pi_1\overline{\theta}a_t + (1-\pi_1)\underline{\theta}a_t] \quad (5)$$

if type I agents undertake the "good action".

The government of the recipient country has a Benthamite welfare utility function which is a weighted average of the expected utility of the two social groups:

$$U_r = \sum_{t=1}^{3} \epsilon_t[\beta u^e_t + (1-\beta)u^p_t] \quad (6)$$

where the parameter $\beta \leq 1$ is the fraction of type I agents in the total population.

The government of the donor country gives aid in order to enhance the development process in the recipient country. The main objective of the donor country is obviously to favor the poor of the recipient country and this is captured by the fact that the donor maximizes the utility of type II agents. However, the form of the donor's utility function takes into account the effects that its actions have on the utility of type I agents which, in this model, have an active role in the production process. This intends to capture the idea that donors' motives may not be entirely oriented on the needs of the poor of the recipient countries but also on the desire to influence the elites for political, economic and strategic reasons. As Alesina and Dollar (2000) emphasize "*Factors such as colonial past and voting patterns in the United Nations explain more of the distribution of aid than the political institutions or economic policy of recipients. Most striking here is that a non democratic former colony gets about twice as much aid as a non democratic non colony.*".

The fact that the donor receives utility from the utility of the poor measures the degree of altruism of the donor. We also assume that the donor receives utility simply from transferring resources to the developing country, independently of the level of aid. This could reflect many different possibilities. It could be the fact that the government receives a return from giving aid, such as higher reputation in the international arena, or the construction of political or economic ties with the recipient countries. We denote by $\tilde{V}_t$ this level of utility and we assume that it takes the following values:

$$\tilde{V}_t = 0 \quad \text{if} \quad a_t = 0; \qquad \tilde{V}_t = V_t \quad \text{if} \quad a_t > 0 \tag{7}$$

Hence, the utility function of the donor country will be a weighted average of the utility of the social groups in the recipient country minus the costs of giving aid, $C(a_t)$:

$$V_d = \sum_{t=1}^{3} \epsilon_t [\tilde{V}_t + \lambda u_t^e + (1-\lambda) u_t^p - C(a_t)] \tag{8}$$

$$where \quad C(a_t) = \delta a_t^2 \tag{9}$$

The parameter λ represents the weight that the donor assigns to the utility function of each population group in the recipient country. The cost function $C(a_t)$, which for simplicity we assume quadratic, represents the opportunity cost incurred by the donor in subtracting resources that could otherwise be directed towards domestic investment.

The solution of the model will give us, as a result, the *conditional aid equilibrium*, i.e., an array of optimal contracts conditional on the previous period's outcome. In order to simplify the notation, we denote the conditional contracts in the following way: $\bar{a_1} = a_1(\bar{q_1})$ and $\underline{a_1} = a_1(\underline{q_1})$ represent the first period transfers. Similarly, $\bar{a_2}(\bar{q_1}) = a_2(\bar{\theta} q_2(a_1(\bar{q_1})))$ and $\bar{a_2}(\underline{q_1}) = a_2(\bar{\theta} q_2(a_1(\underline{q_1})))$ and $\underline{a_2}(\bar{q_1}) = a_2(\underline{\theta} q_2(a_1(\bar{q_1})))$ and $\underline{a_2}(\underline{q_1}) = a_2(\underline{\theta} q_2(a_1(\underline{q_1})))$ represent the second period transfers after the realization of output q_2.

3 The Intertemporal Maximization Program

3.1 The Complete Program

In order to study the level of aid necessary to finance the project, we consider the optimal contracts between the donor/principal and the government of the recipient/agent country[6]. The contract can be seen as the outcome of an intertemporal maximization program, where the objective of the donor is to maximize his utility function subject to the relative constraints, such as the incentive compatibility, the individual rationality constraints and the non negativity constraints.

We allow for the donor to condition the transfer on the outcome of the project in the previous period, in order to provide the right incentives. In this model, we focus on the case where effort is extremely valuable for the donor, who always wants a high level of effort to be implemented in both periods. Therefore, we will consider a utility function which refers to the highest possible level of effort the recipient can exert, i.e. $i = 1$.

We consider therefore a donor that maximizes the following intertemporal utility function:

$$\begin{aligned}
\max_{\{\overline{a_1},\underline{a_1};\,\overline{a_2}(\overline{q_1}),\,\overline{a_2}(\underline{q_1}),\,\underline{a_2}(\overline{q_1})\underline{a_2}(\underline{q_1})\}} \quad & \pi_1\Big\{V_1 + F(\pi_1\bar{\theta}_2 + \\
& (1-\pi_1)\underline{\theta}_2)\bar{a_1} - \delta\bar{a_1}^2 + \\
& \epsilon[\pi_1(V_2 + F(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\overline{a_2}(\overline{q_1}) - \delta\overline{a_2}^2(\overline{q_1})) + \\
& (1-\pi_1)(V_2 + F(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\underline{a_2}(\overline{q_1}) - \delta\underline{a_2}^2(\overline{q_1}))]\Big\} + \\
& (1-\pi_1)\Big\{V_1 + F(\pi_1\bar{\theta}_2 + (1-\pi_1)\underline{\theta}_2)\underline{a_1} - \delta\underline{a_1}^2 + \\
& \epsilon[\pi_1(V_2 + F(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\overline{a_2}(\underline{q_1}) - \delta\overline{a_2}^2(\underline{q_1})) + \\
& (1-\pi_1)(V_2 + F(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\underline{a_2}(\underline{q_1}) - \delta\underline{a_2}^2(\underline{q_1})\Big)]\Big\} \quad (10)
\end{aligned}$$

which is given by the sum of the expected utility functions in $t = 1$ and in $t = 2$, discounted by the intertemporal factor ϵ.

[6] For a good introduction of agency theory see Laffont and Martimort (2002).

The recipient country accepts the long-term contract before q_1 and q_2 are realized. The recipient country anticipates its future stream of aid transfers to evaluate the current benefit of exerting a first-period effort or not. The intertemporal incentive compatibility constraint is given by:

$$\Big\{\beta D(\pi_1\bar{\theta}_2 + (1-\pi_1)\underline{\theta}_2)\bar{a_1} + \epsilon[\beta D(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\bar{a}_2(\bar{q_1}) - \\ \beta(D+b)(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\bar{a}_2(\underline{q_1})]\Big\} - \\ \Big\{\beta(D+b)(\pi_1\bar{\theta}_2 + (1-\pi_1)\underline{\theta}_2)\underline{a_1} + \epsilon[\beta D(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\underline{a}_2(\bar{q_1}) - \\ \beta(D+b)(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\underline{a}_2(\underline{q_1})]\Big\} \geq (1+\epsilon)\beta\psi \quad (11)$$

The intertemporal participation constraint can be written as:

$$\pi_1\Big\{\beta\gamma(\pi_1\bar{\theta}_2 + (1-\pi_1)\underline{\theta}_2)\bar{a_1} + \epsilon[\pi_1\beta\gamma(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\overline{a}_2(\bar{q_1}) \\ + (1-\pi_1)(\beta\gamma(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\underline{a}_2(\overline{q_1}))]\Big\} \\ + (1-\pi_1)\Big\{\beta\gamma(\pi_1\bar{\theta}_2 + (1-\pi_1)\underline{\theta}_2)\underline{a_1} + \\ \epsilon[\pi_1\beta\gamma(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\overline{a}_2(\underline{q_1}) + \\ (1-\pi_1)\beta\gamma(\pi_1\bar{\theta}_3 + (1-\pi_1)\underline{\theta}_3)\underline{a}_2(\underline{q_1})]\Big\} \geq (1+\epsilon)\beta\psi \quad (12)$$

The non negativity constraints are given by:

$$\bar{a_1} \geq 0; \quad \underline{a_1} \geq 0; \quad \bar{a}_2(\bar{q_1}) \geq 0; \quad (13)$$

$$\bar{a}_2(\underline{q_1}) \geq 0; \quad \underline{a}_2(\bar{q_1}) \geq 0; \quad \underline{a}_2(\underline{q_1}) \geq 0 \quad (14)$$

$$where \qquad F = [\lambda\gamma + (1-\gamma)(1-\lambda)]; \qquad D = [\pi_1\gamma - \pi_0(\gamma + b)]$$

In order to insure that the incentive compatibility constraint is satisfied, we assume:

$$D = [\pi_1\gamma - \pi_0(\gamma + b)] > 0 \quad (15)$$

The introduction of the non negativity constraints turns our model into a *limited liability model*, where (13) gives us the limited liability constraints, which limit the possible punishments of the donor. This derives from the fact that when the bad state of the world occurs, the donor country can at the utmost give no aid in the following period. For the sake of realism, we exclude the possibility that contracts provide for any negative transfers from the recipient country to the donor. In this model in fact, the only possible form of punishment is a no aid policy. The form of aid we consider is known as *aid grants*, i.e., transfers in money or in kind, for which no repayment is required[7].

3.2 The Maximization Program in t=2

In order to solve problem (10)-(13), we proceed backward. We consider here the problem of a donor that, before θ_2 is realized, chooses the optimal level of aid conditional on the second period outcome, given the results of first period's production, i.e. the realization of period 1 output, q_1[8]. Therefore, we first look at the problem in $t = 2$ and find the values of $\bar{a_2}(q_1)$ and $\underline{a_2}(q_1)$, i.e., the optimal level of aid that will be granted at the end of the period. These aid transfers will then be utilized by the recipient in the third and final periods using the same production technology defined in equation (1). In order to solve this program it is necessary to define the "*promised expected level of aid*". This level of aid, that we denote by $\tilde{a}_2(q_1)$, is the level of aid that the donor country promises to the recipient at the beginning of the project, as a function of the realization of the previous period's output, in order to elicit from the elite of the recipient country both the participation to the project and the optimal level of effort.

In this second period problem, we can abstract from the imposition of the non negativity constraints because the payoffs we obtain at this stage are not effective transfers, but simply functions of the *promised expected level of aid*, which will be determined in $t = 1$. We will,

[7]It includes grants for technical co-operation, grant-like flows, i.e., loans extended by governments or official agencies in currencies of the donor countries but repayable in recipients currencies and transfer of resources through sales of commodities for recipients currencies, less local currency balances used by the donor for other than development purposes.

[8]At this stage, we take as given the realization of period 1 output, q_1.

however, consider these constraints when we study the final solutions to the problem and determine the amount of aid that will be disbursed in all the periods.

Defining $\hat{\theta_3} = \pi_1\bar{\theta_3} + (1-\pi_1)\underline{\theta_3}$, the second period contracts will be obtained by solving the following maximization program between the donor/principal and the recipient/agent:

$$\max_{\{\overline{a_2}(q_1);\quad \underline{a_2}(q_1)\}} \quad \pi_1\Big(V_2 + F\hat{\theta_3}\overline{a_2}(q_1) - \delta\overline{a_2}^2(q_1)\Big) + (1-\pi_1)\Big(V_2 + F\hat{\theta_3}\underline{a_2}(q_1) - \delta\underline{a_2}^2(q_1)\Big) \tag{16}$$

$$\text{sub:} \quad \beta D\hat{\theta_3}\overline{a_2}(q_1) - \beta\psi \geq \beta(D+b)\hat{\theta_3}\underline{a_2}(q_1) \tag{17}$$

$$\text{and:} \quad \pi_1\Big(\beta\gamma\hat{\theta_3}\overline{a_2}(q_1) - \beta\psi\Big) + (1-\pi_1)\Big(\beta\gamma\hat{\theta_3}\underline{a_2}(q_1) - \beta\psi\Big) \geq \tilde{a}_2(q_1) \tag{18}$$

where equation (17) represents period 2 incentive compatibility constraint, which requires that type I agents find it optimal to undertake action $i = 1$ and equation (18) period 2 individual rationality constraint. This equation says that in order to participate, the elite of the recipient country must receive a utility greater or equal than the *promised expected level of aid*, that is $\tilde{a}_2(q_1)$.

In order to solve this problem we assume that, at this stage, equation (18) is always satisfied as an equality. We will then check the conditions for which this assumption is verified. Defining by $\bar{a_2}^*(q_1)$ the optimal level of aid the donor promises to type I agents after they obtained a good outcome at the end of the second period, and $\underline{a_2}^*(q_1)$ the optimal level of aid the donor promises to type I agents after they obtained a bad outcome at the end of the second period, we first prove:

Lemma 1. *Provided that equation* (18) *holds as an equality, the solution to problem* (16) – (18) *implies:*

$$\bar{a_2}^*(q_1) = \Big\{\frac{\tilde{a}_2(q_1)(D+b)}{\beta\gamma\Delta\pi\hat{\theta_3}(\gamma+b)} + \frac{\psi(1-\pi_0)}{\gamma\Delta\pi\hat{\theta_3}}\Big\} \tag{19}$$

$$\underline{a_2}^*(q_1) = \Big\{ \frac{\tilde{a}_2(q_1) D}{\beta\gamma\Delta\pi\hat{\theta}_3(\gamma + b)} - \frac{\psi\pi_0}{\gamma\Delta\pi\hat{\theta}_3} \Big\} \tag{20}$$

$$where \quad \Delta\pi = (\pi_1 - \pi_0)$$

Proof 1. *Assume that the incentive compatibility constraint* (17) *holds as a strict inequality. Since by assumption the individual rationality constraint* (18) *is binding, the first order conditions of problem* (16)-(18) *imply:*

$$\frac{F}{\beta\gamma} - \frac{2\delta\bar{a}_2(q_1)}{\beta\gamma\hat{\theta}_3} + \mu = 0 \tag{21}$$

$$\frac{F}{\beta\gamma} - \frac{2\delta\underline{a_2}(q_1)}{\beta\gamma\hat{\theta}_3} + \mu = 0 \tag{22}$$

where μ is the Lagrange multiplier associated to the individual rationality constraint, (18)*. Equating* (21) *and* (22) *we obtain:*

$$\bar{a}_2(q_1) = \underline{a_2}(q_1) \tag{23}$$

Substituting (23) *into* (18)*, that we assumed binding, we get:*

$$\pi_1\Big(\beta\gamma\hat{\theta}_3\underline{a}_2(q_1) - \beta\psi\Big) + (1 - \pi_1)\Big(\beta\gamma\hat{\theta}_3\underline{a}_2(q_1) - \beta\psi\Big) = \tilde{a}_2(q_1) \tag{24}$$

which gives us:

$$\bar{a}_2(q_1) = \underline{a}_2(q_1) = \frac{\beta\psi + \tilde{a}_2(q_1)}{\beta\gamma\hat{\theta}_3} \tag{25}$$

Substituting, now, this result into equation (17) *and rearranging the expression, we finally get:*

$$-\psi > b\Big(\frac{\beta\psi + \tilde{a}_2(q_1)}{\beta\gamma}\Big) \tag{26}$$

which implies a contradiction. It follows that the incentive compatibility constraint is always binding. The individual rationality constraint and the incentive compatibility constraint solved as strict equalities, determine jointly equations (19) *and* (20)*.* *Q.E.D.*

Equation (19), which represents the level of aid conditional on a good outcome, is positively affected by an increase in ψ and by the promised expected level of aid. At the opposite, equation (20), i.e. the aid transfer given conditional on a bad outcome is still increasing in the promised expected level of aid but is decreasing in ψ.

It is interesting to notice that the parameters that affect the aid transfers concern only the elite and its behaviour, while the preferences of the donor do not play a key role. These contracts in fact are determined mainly by the relevant constraints and in particular, by the incentive compatibility constraint. Lemma 1 gives us the optimal contracts that a donor stipulates with a recipient country, conditional on the realization of the project in period 2, when the individual rationality constraint turns out to be binding. In this case, optimality requires the existence of an incentive mechanism to deal with the problem of moral hazard. As a consequence, the incentive compatibility constraint is also binding and the optimal contracts will crucially depend on the performance of the project in the previous period.

3.3 The Maximization Program in t=1 and the Equilibrium Long Term Contracts

We can now move backward considering the problem of the donor in $t = 1$, given the second-period optimal payoffs $\bar{a_2}(q_1)$ and $\underline{a_2}(q_1)$. At this stage the donor, before observing the realization of the random variable θ_1, sets the optimal levels of aid $\bar{a_1}^*$ and $\underline{a_1}^*$ that he will grant at the beginning of the period, and the value of the continuation payoffs, i.e. $\tilde{a}_2^*(\bar{q_1})$ and $\tilde{a}_2^*(\underline{q_1})$, which represent the levels of aid that the donor guarantees to the elite if it continues undertaking the project in $t = 2$. The decision whether to accept the long-term contract depends on what occurs in the second period through the values of these two continuation payoffs.

Denoting by $\hat{\theta_2} = \pi_1\bar{\theta_2} + (1 - \pi_1)\underline{\theta_2}$ and given the *intertemporal discount factor* ϵ, which discounts the future optimal contracts in $t = 1$, the maximization problem of the donor is to choose the levels of $\bar{a_1}$, $\underline{a_1}$, $\tilde{a}_2(\bar{q_1})$ and $\tilde{a}_2(\underline{q_1})$, that maximize:

$$
\begin{aligned}
\max_{\{\bar{a_1},\underline{a_1};\tilde{a}_2(\bar{q_1}),\tilde{a}_2(\underline{q_1})\}} \quad & \pi_1\Big\{V_1 + F\hat{\theta_2}\bar{a_1} - \delta\bar{a_1}^2 + \\
& \epsilon\Big[\pi_1\Big(V_2 + F\hat{\theta_3}\tilde{a}_2(\bar{q_1}) - \delta\tilde{a}_2^2(\bar{q_1})\Big) \\
& + (1-\pi_1)\Big(V_2 + F\hat{\theta_3}\tilde{a}_2(\underline{q_1}) - \delta\tilde{a}_2^2(\underline{q_1})\Big)\Big]\Big\} \\
& + (1-\pi_1)\Big\{V_1 + F\hat{\theta_2}\underline{a_1} - \delta\underline{a_1}^2 + \\
& \epsilon\Big[\pi_1\Big(V_2 + F\hat{\theta_3}\tilde{a}_2(\bar{q_1}) - \delta\tilde{a}_2^2(\bar{q_1})\Big) + \\
& (1-\pi_1)\Big(V_2 + F\hat{\theta_3}\tilde{a}_2(\underline{q_1}) - \delta\tilde{a}_2^2(\underline{q_1})\Big)\Big]\Big\} \qquad (27)
\end{aligned}
$$

$$
\begin{aligned}
\text{sub:} \quad & \beta\Big(D\hat{\theta_2}\bar{a_1} - (D+b)\hat{\theta_2}\underline{a_1}\Big) + \\
& \epsilon\beta\Big(D\hat{\theta_3}\tilde{a}_2(\bar{q_1}) - (D+b)\hat{\theta_3}\tilde{a}_2(\underline{q_1})\Big) \geq \beta(\psi + \epsilon\psi) \qquad (28)
\end{aligned}
$$

$$
\begin{aligned}
\text{and:} \quad & \beta\gamma\Big(\pi_1\hat{\theta_2}\bar{a_1} + (1-\pi_1)\hat{\theta_2}\underline{a_1}\Big) + \\
& \epsilon\beta\gamma\Big(\pi_1\hat{\theta_3}\tilde{a}_2(\bar{q_1}) + (1-\pi_1)\hat{\theta_3}\tilde{a}_2(\underline{q_1})\Big) \geq \beta(\psi + \epsilon\psi) \qquad (29)
\end{aligned}
$$

$$
\text{and:} \quad \bar{a_1} \geq 0; \qquad \underline{a_1} \geq 0; \qquad \tilde{a}_2(\underline{q_1}) \geq 0; \qquad \tilde{a}_2(\bar{q_1}) \geq 0 \qquad (30)
$$

where equation (27) represents the intertemporal objective function given by the sum of the objective function in $t = 1$ and the discounted objective function in $t = 2$. Equation (28) and (29) represent the intertemporal incentive compatibility constraint and the elite's intertemporal participation constraint. Both constraints are rewritten as functions of the continuation payoffs $\tilde{a}_2(\underline{q_1})$ and $\tilde{a}_2(\bar{q_1})$ that the elite will get in period 2 following each possible first period output.

As we can see from equation (30), at this stage of the maximization we introduce non negativity constraints. Since the maximization gives us the effective transfers to the recipient country, we rule out the possibility of negative transfers, i.e., we assume that the donor cannot punish the agent: the worse case scenario for the recipient is to receive no aid. Denoting by:

$$M = \frac{\Delta\pi(\gamma + b)\hat{\theta}_2}{\pi_1(D + b)} \qquad H = \hat{\theta}_2[D^2(1 - \pi_1) - \pi_1(D + b)^2]$$

we can now prove:

Proposition 1. *Period* 1 *equilibrium contracts will always be made conditional on the realization of the problem in the previous period. In particular*

1. *if* $\frac{F}{2\delta} \geq \frac{\psi}{MD}$ *then the recipient will always receive a positive level of aid and optimal contracts are given by*

$$\bar{a_1}^* = \tilde{a_2}^*(\bar{q_1}) = \frac{FM}{2\delta}\Big(1 - \frac{D^2(1 - \pi_1)}{H}\Big) + \frac{\psi D(1 - \pi_1)}{H} \qquad (31)$$

$$\underline{a_1}^* = \tilde{a_2}^*(\underline{q_1}) = \frac{FMD}{2\delta}\frac{\pi_1(D + b)}{H} - \frac{\psi\pi_1(D + b)}{H} \qquad (32)$$

2. *if* $\frac{F}{2\delta} < \frac{\psi}{MD}$ *then the recipient will receive no aid after a negative outcome of the project and optimal contracts are given by*

$$\bar{a_1}^* = \tilde{a_2}^*(\bar{q_1}) = \frac{\psi}{D\hat{\theta}_2} \qquad (33)$$

$$\underline{a_1}^* = \tilde{a_2}^*(\underline{q_1}) = 0 \qquad (34)$$

Proof 1. *Before proceeding with the solution of problem* (27)-(30)*, notice that the individual rationality constraint is implied by the incentive compatibility constraint. In fact, denoting by IC the left hand side of equation* (28) *and by IR the left hand side of equation* (29)*, we see that equation* (28) *can be rewritten as:*

$$IC = IR - \beta(\gamma + b) + \epsilon[\pi_0\beta(\gamma + b)\hat{\theta}_3\tilde{a_2}(\bar{q_1}) + (1 - \pi_0)\beta(\gamma + b)\hat{\theta}_3\tilde{a_2}(\underline{q_1})] \geq 0 \qquad (35)$$

Now, since:

$$\beta(\gamma+b)+\epsilon[\pi_0\beta(\gamma+b)\hat{\theta}_3\tilde{a}(\bar{q_1})+(1-\pi_0)\beta(\gamma+b)\hat{\theta}_3\tilde{a}(\underline{q_1})]>0$$

then if $IC \geq 0$, $IR > 0$, *i.e., the individual rationality constraint is always satisfied if the incentive compatibility constraint is satisfied. Therefore, we can neglect the participation constraint in the optimization problem.*

In order to prove the Proposition, the strategy is to ignore for the moment the non negativity constraints and check at the end whether they are satisfied in equilibrium. Since the individual rationality constraint in $t = 1$ *is always satisfied as a strict inequality, the maximization problem reduces to maximizing* (27) *subject to* (28)*. Let us assume that the incentive compatibility constraint is satisfied as a strict inequality. In this case, from the FOC we derive:*

$$\bar{a_1}=\frac{F\hat{\theta}_2}{2\delta} \tag{36}$$

$$\tilde{a_2}(\bar{q_1})=\frac{F\hat{\theta}_3}{2\delta} \tag{37}$$

$$\underline{a_1}=\frac{F\hat{\theta}_2}{2\delta} \tag{38}$$

$$\tilde{a_2}(\underline{q_1})=\frac{F\hat{\theta}_3}{2\delta} \tag{39}$$

Notice that all the aid transfers are strictly positive, thus all the non negativity constraints are satisfied.

Since the events are independently distributed over time, then $\hat{\theta}_2 = \hat{\theta}_3 = \hat{\theta}$ *and therefore,*

$$\bar{a_1}=\underline{a_1}=\tilde{a_2}(\bar{q_1})=\tilde{a_2}(\underline{q_1})=\frac{F\hat{\theta}}{2\delta} \tag{40}$$

Substituting now this result into (28)*, we obtain:*

$$-b\hat{\theta}^2\frac{F}{2\delta}\geq\psi \tag{41}$$

which implies a contradiction and therefore, the incentive compatibility constraint must always be binding.

Denoting by μ_1 *the Lagrange multiplier associated with the incentive compatibility constraint, if* (28) *holds as a strict equality, the first order conditions are given by:*

$$\pi_1 F\hat{\theta_2} - \pi_1 2\delta\bar{a_1} + \mu_1\beta D\hat{\theta_2} = 0 \tag{42}$$

$$(1-\pi_1)F\hat{\theta_2} - (1-\pi_1)2\delta\underline{a_1} - \mu_1\beta(D+b)\hat{\theta_2} = 0 \tag{43}$$

$$\pi_1 F\hat{\theta_3} - \pi_1 2\delta\tilde{a}(\bar{q_1}) + \mu_1\beta D\hat{\theta_3} = 0 \tag{44}$$

$$(1-\pi_1)F\hat{\theta_3} - (1-\pi_1)2\delta\tilde{a}(\underline{q_1}) - \mu_1\beta(D+b)\hat{\theta_3} = 0 \tag{45}$$

Dividing (42) *and* (43) *and* (44) *and* (45) *we obtain:*

$$\frac{\pi_1 F\hat{\theta_2} - \pi_1 2\delta\bar{a_1}}{(1-\pi_1)F\hat{\theta_2} - (1-\pi_1)2\delta\underline{a_1}} = -\frac{D}{(D+b)} \tag{46}$$

$$\frac{\pi_1 F\hat{\theta_3} - \pi_1 2\delta\tilde{a}(\bar{q_1})}{(1-\pi_1)F\hat{\theta_3} - (1-\pi_1)2\delta\tilde{a}(\underline{q_1})} = -\frac{D}{(D+b)} \tag{47}$$

Notice that (46) *and* (47) *imply:*

$$\bar{a_1} = \tilde{a}(\bar{q_1}) and \quad \underline{a_1} = \tilde{a}(\underline{q_1}) \tag{48}$$

Substituting (46) *into the incentive compatibility constraint, we obtain:*

$$(1+\epsilon)\Big\{D\hat{\theta_2}[\frac{F(\pi_1 b + D)\hat{\theta_2}}{2\delta(D+b)\pi_1} - \frac{D(1-\pi_1)}{(D+b)\pi_1}\underline{a_1}] - (D+b)\hat{\theta_2}\underline{a_1}\Big\} = (1+\epsilon)\psi \tag{49}$$

which gives us equation (32). *Substituting then into* (48) *we obtain equation* (31).

Notice that $\bar{a_1}$ *is always positive and therefore the nonnegativity constraint is always satisfied as a strict inequality. Consider instead* $\underline{a_1}$*. If* $\frac{F}{2\delta} \geq \frac{\psi}{MD}$ *then the non negativity constraint is not binding and equation* (32) *is an optimal contract. If instead* $\frac{F}{2\delta} < \frac{\psi}{MD}$ *then the non negativity constraint is violated and therefore* $\underline{a_1} = 0$*. Substituting this result into* (28) *we obtain that the optimal contract conditional on* $q = \bar{q_1}$ *is given by* (33). *Q.E.D.*

Proposition 1 gives us the level of aid that donors will grant in period 1 conditional on the outcome of the project in period 0. These aid contracts also represent the minimum level of aid the donor will insure in period 2, conditional on the positive or negative state of the world.

Notice that, depending on the value of the parameters, we have two possible pairs of period 1 contracts. The first case occurs when parameter F, i.e. the weight that the utility of the recipient has on the utility of the donor, is large relatively to the parameter ψ, i.e. to the effort the elite of the recipient country must exert, and the parameter δ which determines the costs for the donor of giving aid. In this case, a high degree of interest of the donor on the welfare of the recipient country leads the donor to provide a positive level of aid even when the project had a negative outcome in the previous period.

In the other event, where the donor is not interested on the welfare of the recipient country, the cost of aid is quite high, and the elite is strongly inclined to provide little effort toward the success of the project. In this case, optimality would require a punishment, i.e., a negative transfer from the donor after a negative realization of the state of the world. However, since foreign aid transfers cannot be negative by nature, the maximum punishment that the donor can impose in order to satisfy the incentive compatibility constraint implies no aid to the recipient if in the previous period the project failed. The size of aid conditional on a positive performance of the project instead depends only on the costs the elite faces in providing the appropriate level of effort.

Comparing the two sets of contracts results obtained in Proposition 1 we notice that the aid transfers obtained respectively in equations (31) (32) imply always a higher level of aid than those implied by equations (33) and (34). This is due to the role that the parameter F plays in determining this equilibria. A high degree of interest of the donor on the welfare of the recipient guarantees not only a higher level of aid but also that the recipient receives always a positive level of aid in both states of the world, but also that he obtains a higher level of aid.

4 Optimal Aid Contracts

Proposition 1 not only determines the optimal period 1 contracts but also the optimal continuation payoffs. We can now combine them with the second period payoffs, in order to obtain the optimal long term contracts which are signed at the beginning of the period. Under the condition that the individual rationality constraint is always satisfied as a strict equality we obtain the following equilibrium payoffs:

1. If $\frac{F}{2\delta} \geq \frac{\psi}{MD}$ then:

$$\bar{a_2}(\bar{q_1}) = \Big[\frac{FM}{2\delta}(1 - \frac{D^2(1-\pi_1)}{H}) + \frac{\psi D(1-\pi_1)}{H}\Big] \frac{1}{\beta\gamma M\pi_1} + \frac{\psi(1-\pi_0)}{\gamma\Delta\pi\hat{\theta_3}} \tag{50}$$

$$\bar{a_2}(\underline{q_1}) = \Big[\frac{(D+b)}{H}(\frac{F}{2\delta} - \frac{\psi}{MD})\Big]\frac{1}{\beta\gamma} + \frac{\psi(1-\pi_0)}{\gamma\Delta\pi\hat{\theta_3}} \tag{51}$$

$$\underline{a_2}(\bar{q_1}) = \Big[\frac{FM}{2\delta}(1 - \frac{D^2(1-\pi_1)}{H}) + \frac{\psi D(1-\pi_1)}{H}\Big] \frac{D}{\beta\gamma M(D+b)\pi_1} - \frac{\psi\pi_0}{\gamma\Delta\pi\hat{\theta_3}} \tag{52}$$

$$\underline{a_2}(\underline{q_1}) = \Big[\frac{D}{H}(\frac{F}{2\delta} - \frac{\psi}{MD})\Big]\frac{D}{\beta\gamma} - \frac{\psi\pi_0}{\gamma\Delta\pi\hat{\theta_3}} \tag{53}$$

2. If $\frac{F}{2\delta} < \frac{\psi}{MD}$ substituting we finally obtain:

$$\bar{a_2}(\bar{q_1}) = \frac{1}{\gamma\Delta\pi\hat{\theta_3}}\Big\{\frac{(D+b)}{(\gamma+b)}\frac{\psi}{D\hat{\theta_2}} + \psi(1-\pi_0)\Big\} \tag{54}$$

$$\bar{a_2}(\underline{q_1}) = \frac{\psi(1-\pi_0)}{\gamma\Delta\pi\hat{\theta_3}} \tag{55}$$

$$\underline{a_2}(\bar{q_1}) = \frac{1}{\gamma\Delta\pi\hat{\theta_3}}\Big\{\frac{(D+b)}{(\gamma+b)}\frac{\psi}{D\hat{\theta_2}} - \psi\pi_0\Big\} \tag{56}$$

$$\underline{a_2}(\underline{q_1}) = 0 \tag{57}$$

All the contracts we have derived so far exhibit memory, i.e., the level of aid granted in the following period is conditional on the outcome of the project in the previous periods. These contracts, however, are not yet the equilibrium contracts, since they are derived under the assumption that the individual rationality constraint in period 2 is always binding.

In order to determine the *final contracts*, therefore, we must verify whether this constraint is satisfied as an equality and derive the conditions under which this occurs; this is particularly interesting because as we will see, when the individual rationality constraint is not binding contracts exhibit no memory.

Let us define:

$$\Gamma = -\frac{F}{\beta\gamma} + \frac{\bar{a_2}(\bar{q_1})2\delta}{M} + \frac{\underline{a_2}(\bar{q_1})2\delta(1-\pi_1)D}{\beta\gamma\pi_1 M(D+b)} \lesseqgtr 0 \tag{58}$$

where $\bar{a_2}(\bar{q_1})$ is given by equation (50) and $\underline{a_2}(\bar{q_1})$ is given by equation (52) and

$$\Upsilon = -\frac{F}{\beta\gamma} + \frac{\bar{a_2}(\underline{q_1})2\delta}{M} + \frac{\underline{a_2}(\underline{q_1})2\delta(1-\pi_1)D}{\beta\gamma\pi_1 M(D+b)} \lesseqgtr 0 \tag{59}$$

where $\bar{a_2}(\underline{q_1})$ is given by equation (51) and $\underline{a_2}(\underline{q_1})$ is given by equation (53). We can, therefore, prove the following:

Proposition 2. *Long term equilibrium contracts may exhibit strong or weak conditionality. Under strong conditionality the optimal level of aid is tied to the outcome of the project in any previous period. Under weak conditionality the optimal level of aid depends only on the outcome of the project in the previous period. Depending on the values of the relevant parameters of the model F, λ, γ, ψ, we can distinguish among the four possible cases:*

1. *If $\frac{F}{2\delta} \geq \frac{\psi}{MD}$ and $\Gamma > 0$, then the optimal long term contracts conditional on $q_1 = \bar{q}$ are given by equations (50)-(52). If instead $\Gamma \leq 0$ then the optimal long term contracts are given by $\bar{a_2}(q_1) = \bar{a_1}$, where $\bar{a_1}$ is defined by equation (31) and $\underline{a_2}(q_1) = \underline{a_1}$, where $\underline{a_1}$ is defined by equation (32).*

2. *If $\frac{F}{2\delta} \geq \frac{\psi}{MD}$ and $\Upsilon > 0$, then the optimal long term contracts conditional on $q_1 = \underline{q}$ are given by equations (54) and (56). If instead $\Upsilon \leq 0$ then the optimal long term contracts are given by $\bar{a_2}(\underline{q}_1) = \bar{a_1}$ and $\underline{a_2}(\underline{q}_1) = \underline{a}_1$ where again $\bar{a_1}$ and $\underline{a_1}$ are respectively defined by equations (31) and (32).*

3. *If $\frac{F}{2\delta} < \frac{\psi}{MD}$ a nd $\Gamma > 0$ then the optimal long term contracts conditional on $q_1 = \bar{q}$ are given by (51) and (53). If instead $\Gamma \leq 0$ then the optimal long term contracts are given by $\bar{a_2}(\bar{q_1}) = \bar{a_1}$, where $\bar{a_1}$ is defined by equation (33) and $\underline{a_2}(\bar{q_1}) = \underline{a_1}$, where $\underline{a_1}$ is defined by equation (34).*

4. *If $\frac{F}{2\delta} < \frac{\psi}{MD}$ and $\Upsilon > 0$ then the optimal long term contracts conditional on $q_1 = \underline{q}$ are given by (55) and (57). If instead $\Upsilon \leq 0$ then the optimal long term contracts are given by $\bar{a_2}(\underline{q_1}) = \bar{a_1}$ and $\underline{a_2}(\underline{q_1}) = \underline{a_1}$ where again $\bar{a_1}$ and $\underline{a_1}$ are respectively defined by equations (33) and (34).*

Proof 2. *We now go back to period $t = 2$ maximization problem, $(16)-(18)$, considering both the individual rationality and the incentive compatibility constraints. The first order conditions are given by:*

$$\frac{F}{\beta\gamma} - \frac{2\delta\bar{a_2}(q_1)}{\beta\gamma A\hat{\theta}_3} + \mu_1[1 - \frac{\pi_0(\gamma + b)}{\pi_1\gamma}] + \mu_2 = 0 \tag{60}$$

$$\frac{F}{\beta\gamma} - \frac{2\delta \underline{a_2}(q_1)}{\beta\gamma A\hat{\theta}_3} + \mu_1[1 - \frac{(1-\pi_0)(\gamma+b)}{(1-\pi_1)\gamma}] + \mu_2 = 0 \quad (61)$$

where again μ_1 *is the Lagrange multiplier associated with the incentive compatibility constraint and* μ_2 *is the Lagrange multiplier associated with the individual rationality constraint. Subtracting now* (60) *and* (61) *and rearranging we get:*

$$\mu_1 = \frac{2\delta\pi_1(1-\pi_1)}{\beta(\pi_1-\pi_0)(\gamma+b)\hat{\theta}_3}\left[\bar{a_2}(q_1) - \underline{a_2}(q_1)\right] \quad (62)$$

Substituting now (62) *into* (60), *we finally get:*

$$\mu_2 = -\frac{F}{\beta\gamma} - \frac{\bar{a_2}(q_1)}{\hat{\theta}_3}\{\frac{2\delta\pi_1}{\beta\gamma\Delta\pi(\gamma+b)}(D+b)\} + \frac{\underline{a_2}(q_1)}{\hat{\theta}_3}\{\frac{2\delta(1-\pi_1)}{\beta\gamma\Delta\pi(\gamma+b)}D\} \quad (63)$$

Substitute, now, the contracts (50) *and* (52), *obtained under the assumption* $\frac{F}{2\delta} \geq \frac{\psi}{MD}$, *into equation* (63). *Notice that if* $\Gamma > 0$, *then* $\mu_2 > 0$ *and the individual rationality constraint is binding. In this case the optimal long term contracts are given by equations* (50) *and* (52). *If instead* $\Gamma \leq 0$, *then* $\mu_2 \leq 0$ *and the individual rationality constraint is not binding. The equilibrium contracts are obtained by* (60) *and* (61), *setting* $\mu_2 = 0$. *In this case, we can easily see that* $\bar{a_2}(q_1) = \bar{a_1}$ *and* $\underline{a_2}(q_1) = \underline{a_1}$ *where* $\bar{a_1}$ *and* $\underline{a_1}$ *are respectively defined by equations* (31) *and* (32).

Substitute, now, the contracts (51) *and* (53), *obtained under the assumption* $\frac{F}{2\delta} \geq \frac{\psi}{MD}$ *into equation* (63). *Notice that if* $\Upsilon > 0$ *then* $\mu_2 > 0$ *and the individual rationality constraint is binding. In this case the optimal long term contracts are given by equation* (51) *and* (53). *If, instead,* $\Upsilon \leq 0$ *then* $\mu_2 \leq 0$ *and the individual rationality constraint is not binding. The equilibrium contracts are obtained again by* (60) *and* (61), *setting* $\mu_2 = 0$. *We can easily see that* $\bar{a_2}(q_1) = \bar{a_1}$ *and* $\underline{a_2}(q_1) = \underline{a_1}$ *where* $\bar{a_1}$ *and* $\underline{a_1}$ *are respectively defined by equations* (31) *and* (32).

Substitute, now, the contracts (54) *and* (56), *obtained under the assumption* $\frac{F}{2\delta} < \frac{\psi}{MD}$, *into equation* (63). *Notice that if* $\Gamma > 0$, *then*

$\mu_2 > 0$ *and the individual rationality constraint is binding. In this case the optimal long term contracts are given by equations* (54) *and* (56). *If instead* $\Gamma \leq 0$, *then* $\mu_2 \leq 0$ *and the individual rationality constraint is not binding. The equilibrium contracts are obtained by* (60) *and* (61), *setting* $\mu_2 = 0$. *In this case, we can easily see that* $\bar{a_2}(q_1) = \bar{a_1}$ *and* $\underline{a_2}(q_1) = \underline{a_1}$ *where* $\bar{a_1}$ *and* $\underline{a_1}$ *are respectively defined by equations* (33) *and* (34).

Substitute, now, the contracts (55) *and* (57), *obtained under the assumption* $\frac{F}{2\delta} < \frac{\psi}{MD}$ *into equation* (63). *Notice that if* $\Upsilon > 0$ *then* $\mu_2 > 0$ *and the individual rationality constraint is binding. In this case the optimal long term contracts are given by equation* (55) *and* (57). *If, instead,* $\Upsilon \leq 0$ *then* $\mu_2 \leq 0$ *and the individual rationality constraint is not binding. The equilibrium contracts are obtained again by* (60) *and* (61), *setting* $\mu_2 = 0$. *In this case, we can easily see that* $\bar{a_2}(q_1) = \bar{a_1}$ *and* $\underline{a_2}(q_1) = \underline{a_1}$ *where* $\bar{a_1}$ *and* $\underline{a_1}$ *are respectively defined by equations* (33) *and* (34). *Q.E.D.*

Proposition 2 gives us the main results of the model, defining the full range of contracts that an optimizing donor, who is interested in the welfare of the recipient country should offer in an environment characterized by asymmetric information and moral hazard.

The first important result is that aid should be conditional, i.e. should reward good outcome. The presence of a private benefit and the possibility, for the elite of the recipient country, to provide a low level of effort requires that the donor provides some incentive mechanism. In the multi-period framework we are here analyzing, incentive compatibility can be always guaranteed by tying the level of aid to the performance of the project in the previous period.

An interesting aspect that arises in our model, however, is that conditionality may take different forms. Aid, in fact, could be made conditional on the performance of the recipient country in all previous periods (strong conditionality), or only on the results obtained in the previous period (weak conditionality). In other words, an optimizing donor must determine not only whether past performance is relevant in granting aid, but also whether the whole history must be taken into account, i.e. whether contracts should exhibit memory. The time structure of the contracts depends on the value of the parameters.

If $\Gamma > 0$ or $\Upsilon > 0$ a donor will offer in period 0 six contracts: two contracts at time 1 conditional on the realization of the output in period 0 and four contracts at time 2, that depend on the outcome of the project at time 0 and the outcome of the project at time 1.

If $\Gamma \leq 0$ or $\Upsilon \leq 0$, then period 2 contracts will be made conditional on the realization of the output in period 1, but will not depend on what happened in period 0. Technically, this is the result of the fact that, for $\Gamma \leq 0$ or $\Upsilon \leq 0$ the period 2 individual rationality constraint is never binding. This means that the elite of the recipient country will always find optimal to participate to the contract, independently of the level of aid promised by the donor in the previous period. In this case the need to establish a relationship between the level of aid granted in period 2 and the level of aid promised in period 1 to induce participation is severed, and aid is determined purely by the donor's preferences and by the need to insure the right incentives to the recipient. For this purpose it is sufficient that aid is made conditional on the outcome achieved just in the previous period.

Entering more in detail about the characteristics of the equilibrium contracts, let us first consider the ones that exhibit memory. Proposition 2 tells us that the six contracts offered by the donors do not depend only on Γ or Υ but also the whether $\frac{F}{2\delta} \gtreqless \frac{\psi}{MD}$, a condition we mentioned before that establishes a relationship between F, the weight the donor assigns to the recipient's utility, δ the opportunity cost of giving aid and ψ, the disutility of the elite of the recipient country in exerting a high level of effort.

When $\Gamma > 0$ or $\Upsilon > 0$ and $\frac{F}{2\delta} > \frac{\psi}{MD}$, equilibrium contracts are given by equations (50) (52)(54)(56). In this case the donor values very highly the utility of the recipient country relative to the cost of giving aid and to the costs that the elite faces in pursuing the best project. As a consequence, he will offer a positive level of aid even if the results of the project were negative in both the previous periods. Notice that the transfers are characterized by our three key parameters F, and δ and ψ. In particular, the higher is F, the higher is the level of aid in all the states of the world and the lower are δ and ψ, the lower is the size of the aid transfers. This is quite intuitive, since a higher interest on the recipient country leads the donor to provide more aid, while higher costs and, especially, the awareness that the elite might divert resources from the intended use will lead the donor to decrease the level of aid.

When $\Gamma > 0$ or $\Upsilon > 0$ and $\frac{F}{2\delta} \leq \frac{\psi}{MD}$, equilibrium contracts are given by equations (51)(53)(55)(57). In this case the interest of the donor towards the recipient is low compared to the cost of giving aid and to the disutility of effort for the recipient. This leads the donor to concentrate mainly on the incentive mechanism necessary to induce the elite of the recipient country to choose the highest level of effort. The size of the contracts does not depend on the parameter F, but is determined mainly by the parameter, ψ, that expresses the incentive of the elite to divert resources from the intended use. In this case, when the elite obtains a low level of output in both periods, the nonnegativity constraint becomes binding and the donor chooses to give no aid, which represents the maximum possible punishment he can impose.

If we now compare the contracts obtained in this last case with those obtained when $\frac{F}{2\delta} > \frac{\psi}{MD}$, we can easily see that they imply smaller transfers. When the interest of the donor country is not very high, he will grant just the level of aid that guarantees the participation of the recipient country and gives it the right incentives.

The cases in which $\Gamma < 0$ or $\Upsilon < 0$ are the ones where the contracts do not exhibit memory. The donor offers in period 2 the same contracts offered in period 1. It turns out, in fact, that since the time 2 participation constraint is never binding and there is no inter-temporal link between the aid policies in the two periods, the problems faced by the donor in period 1 and in period 2 are identical.

The characteristics of these contracts have been discussed in the previous section. When $\frac{F}{2\delta} > \frac{\psi}{MD}$ the donor is highly interested in providing aid to the recipient country and the aid transfers are both positive. The size of these transfers is increasing in the parameter F and decreasing in the parameters δ and ψ. On the other side, when $\frac{F}{2\delta} \leq \frac{\psi}{MD}$ the optimal aid contracts depend only on the parameter ψ. In this case, the donor offers a contract that provides a positive level of aid only if the outcome of the project in the previous period has been the positive one.

The results obtained in Proposition 2 highlight not only the role of conditionality, that in our multi-period framework can take the form of *weak conditionality*, or *strong conditionality* but they also assign a leading role to the preferences of the donor in the optimal allocation process. A donor who is very interested in the welfare of the recipient country will offer different contracts depending on the state of world, but will always insure to the recipient a positive level of aid. A donor that is less interested in the welfare of the country and is highly concerned about the moral hazard problems that may plague the implementation of foreign aid contracts, may decide to deny aid after having observed a negative performance in the previous period.

It is important, here, to be more specific on what we have called, so far, the degree of interest of the donor country on the welfare of the recipient country, which is expressed by the parameter F. Recall that F= $[\lambda\gamma + (1-\gamma)(1-\lambda)]$ expresses the marginal utility to the donor of a unit of output produced with aid. This parameter λ is the weight that the donor assigns, in its utility function, to the utility of the elite, while the parameter γ represents the share of the output of the project that goes to the elite, which depends not only on the contribution the elite gives to the implementation of the project, but also on the political power it has inside the country. In our model F cannot be interpreted exactly as the degree of altruism, because we explicitly consider the possibility that aid is given to support the elites of the recipient country, i.e. for strategic or economic reasons. When λ increases we have two effects: i) the marginal utility the donor derives from giving aid to the elite increases; ii) the marginal utility that the donor obtains from giving aid to the poor decreases. If $\gamma > 1/2$ the fraction of output that goes to the elite is high, so an increase in λ determines a global increase in the marginal utility of aid. If $\gamma < 1/2$, then an increase in λ will lead to a decrease in the global marginal utility of aid. In practice, an increase in F can be associated with an increase in the degree of altruism, intended as an increase in the interest for the poor of the recipient country, only if the fraction of output going to the poor is greater than 1/2. Only in this case, in fact, an increase in F is determined by a decrease in λ.

One last interesting issue is: what determines the probability that contracts have long memory? A way to look at this issue is to look at the conditions $\Gamma > 0$ and $\Upsilon > 0$. Taking derivatives of Γ and Υ with respect to the relevant parameters of the model in all possible cases we can determine whether an increase in F, δ or ψ has a positive effect on the likelihood that the condition $\Gamma > 0$ and $\Upsilon > 0$ is satisfied. Unfortunately, however, we cannot say very much on this issue because, generally, the sign of these derivatives is ambiguous. We can say something, in this respect, only in cases 3. and 4. of Proposition 2, i.e. only when $\frac{F}{2\delta} \leq \frac{\psi}{MD}$. In these cases, as we can easily verify,

$$\frac{\partial \Gamma}{\partial F} < 0, \frac{\partial \Upsilon}{\partial F} < 0, \frac{\partial \Gamma}{\partial \psi} > 0, \frac{\partial \Upsilon}{\partial \psi} > 0, \frac{\partial \Gamma}{\partial \delta} > 0, \frac{\partial \Upsilon}{\partial \delta} > 0 \tag{64}$$

which implies that an increase in the interest of the recipient for the donor country will decrease the probability that contracts are conditional on the whole history of the project, while an increase in the cost of effort for the elite will have the opposite effect.

5 Conclusions

We have developed, in this paper, a *repeated moral-hazard model* to analyze the optimal aid allocation policy that a donor country should undertake in financing a three periods poverty eradication program. In this model the elite of the recipient country which have an important part in the implementation of development projects, receives a private benefit from diverting resources from the intended purpose.

The main result of the model is that foreign aid should always reward good outcomes. In a long term relationship, the donor should allocate aid on the basis of the past performance of the recipient country. This result is consistent with the well-known result obtained by Dollar and Burnside (2000), who conclude that aid works only in countries characterized by institutions able to apply sound economic policies.

The type of conditionality we study in this model is strongly affected by the concern of the donor about the welfare of the recipient country and the weight that the history of past performance should have in the aid allocation process. Depending on parameter values, in this model, optimality implies two types of contracts. We can have *weakly conditional contracts* where aid is conditioned only on the previous period's performance; in this case contracts have short memory. On the other hand we can have *strongly conditional contracts* where aid depends on the whole history of the project; in this case contracts have long memory.

Regarding also the preferences of the donor, that in this model are extremely important, we have again two relevant cases. When the donor is highly interested in the welfare of the recipient country, then he will offer contracts that always insure to the recipient a positive level of aid even after a history of bad performance. In the opposite case, when the desire to achieve a maximum level of efficiency and to avoid a possible misuse of funds is high relative to the desire to help the country, optimality requires that no aid is granted after having observed a negative realization of the state of the world.

According to this model, therefore, an efficient aid policy should require some kind of incentive mechanism that induce the elite of the country to actively cooperate toward the success of development projects. The lower the cost of the effort that these types of agents should exercise toward the realization of the project, the higher should be the size of the project. In other words, if a country has sound institutions able to minimize the possibility of diverting resources and increase the effectiveness of foreign aid, donors should be more generous in providing aid.

On the other side, however, these considerations must be balanced with the desire of the donor to help the recipient. In our model the interest of the donor in the welfare of the recipient country has an ambiguous meaning, because it may be the consequence both of pure altruistic motives and strategic/economic considerations. Nevertheless, a high interest of the donor may help overcome pure efficiency issues. Some kind of conditionality is always needed in order to guarantee that the recipient works effectively toward the success of the project, but if a donor has a strong desire to help the developing country it will never deny aid to it. Also, in some important cases, the incentive mechanism might have less memory and a recipient country might not have to bear the consequences of bad performance in the more distant past.

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