Moral hazard and the Composition of Transfers: Theory and Evidence from Cross-Border Transfers*

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ABSTRACT

We study how a donor can use restricted transfers to control the moral hazard behavior of a recipient and how the composition of unrestricted and restricted transfers is adjusted in response to changes in the moral hazard behavior of the recipient. Under certain conditions, our game-theoretic model predicts that the donor reduces the proportion of restricted transfers in total transfers as the moral hazard behavior of the recipient declines. Using foreign aid transfers (i.e., project aid and program aid) and panel data covering the period 1990-2004, we find econometric support for the prediction of the model.

Key words: public goods, moral hazard, political agency, project aid, program aid, signaling.
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1. Introduction

The need to ensure that transfers reach their intended recipients is one of the cornerstones of the information-based approach to public economics pioneered by Mirrlees (1971). In this regard an extensive amount of the literature has focused on assessing the appropriateness of using in-kind or restricted versus unrestricted transfers to achieve this goal; see the recent survey by Currie and Gahvari (2008). By and large the general conclusion has been that while in-kind or restricted cash transfers may dominate unrestricted transfers by leading to better targeting, reduce moral hazard behaviour, and relax self selection constraints (adverse selection)[1], they may also be associated with deadweight losses since the donor may have incomplete information about the preferences of the recipient or may narrow the recipient's consumption set relative to if the transfers were in cash.[2] However, there are two aspects within the context of the information-based approach to the issue of restricted versus unrestricted transfers that remain largely unexplored in the existing academic studies but in actual policy implementation are arguably quite important. Firstly, the issue of the optimal mix of transfers has been limited to examining within-country transfers but not transfers across countries." Secondly, a donor is in many cases is unlikely to be limited between choosing between in-kind or restricted and unrestricted transfers, but in reality may be able to implement a mix of the two to attempt to achieve efficient targeting.

In the present paper we make a first attempt at addressing these shortcomings by analysing a donor's choice of the *composition* of restricted and unrestricted transfers in the context of donor transfers across borders from both a theoretical and empirical perspective. Our analysis is

[1] See, for example, Nichols and Zeckhauser, 1982; Besley and Coate, 1991, 1992; Bruce and Waldman, 1991; Coate, 1989, 1995; Blackkorby and Donaldson, 1988; Boadway, 1997, 1998; and Gahvari and Enlinson, 2007).In Besley and Coate (1991) only in-kind transfers are used. Gahvari and de Mattos (2007) show that combining conditional cash transfers with in-kind transfers in the Besley and Coate (1991) model reduces or eliminates the deadweight losses of in-kind transfers. Nichols and Zeckhauser (1982) and Blackorby and Donaldson (1988) also combine cash and in-kind transfers.

[2] This need not be the case, though (e.g., Moffitt, 1989). In Nichols and Zeckhauser (1982) there are deadweight losses, even if the transfers are in cash. This is because to satisfy self-selection constraints and thus qualify for a cash transfer, it is necessary to introduce distortions into the recipient's labor supply, such that by earning income below a certain threshold his type is revealed. In Moffitt (1983), cash transfers lead to deadweight losses because the recipients suffer from a stigma of being on public assistance (i.e., welfare stigma).

undertaken within the context of foreign aid and rests on distinguishing between project aid and program aid where the former can be viewed as the substantially more restrictive type. More specifically, project aid is typically used to finance *specific* projects, which often involve direct participation by the donor in their design and implementation. In contrast, according to a recent OECD/DAC publication, program aid is restricted to 'financial contributions not linked to specific activities' (OECD, 2005, p. 34). Budget support, which is a component of program aid, provides funds to boost aggregate revenue and overall spending. In this regard, a study commissioned by the Overseas Development Council, van de Walle and Johnston (1996, p. 8) noted that "... [Program aid] is not likely to promote development in the absence of sound economic policies. In such situations, donors should ... limit aid flows and direct them to project assistance ... When sound economic policies have been put in place, donors should expand program aid ..." Similarly, the World Bank (1998, p. 80) recognizes this point when it recommends that "[i]n a country with sound public expenditure management, a larger portion of aid can be in the form of general budget support."[3]

Our theoretical contribution in terms of examining the choice of composition of project and program aid by international donors is based on a canonical political agency model of a simple signaling game between a possibly corrupt politician in the recipient country and an altruistic donor to illustrate the donor's optimal choice of project aid and program aid. In this regard, the model is designed to strike a balance between the deadweight loss of project aid and its superior ability, relative to program aid, in controlling a recipient's moral hazard behavior in terms of expenditure on public goods. We show that, under certain conditions, the donor reduces the proportion of project aid the more the recipient country uses the transferred funds as intended. Also, we find that the proportion of project aid in total aid is increasing in the per capita income of the recipient country.

[3] As noted above, budget support is a component of program aid.

A noted above, there are a number of therotical works, such as Bruce and Waldman (1991), Coate (1998) and Andolfatto (2005) that show that in-kind or restricted transfers may be welfare-improving and effective in controlling moral hazard behavior.[4] They do not however examine how the composition of transfer changes in response to changes in the moral hazard behavior of recipients Moreover, their models are *complete-information* models, however, so that the moral hazard actions of recipients are perfectly observable to the benefactors. However, the inefficiency of unrestricted transfers stems from the benefactor's inability to credibly refuse to bail out recipients from the adverse effects of their moral hazard behavior (i.e., the Samaritan's dilemma). In contrast, the benefactor can commit to punishing moral hazard behavior in our model, but due to *incomplete information* cannot necessarily observe such behavior.

In terms of searching for empirical support for our theoretical analysis, we construct a cross-country panel data of foreign aid composition, expenditure on a number of public goods, income and other determinants, and conduct an econometric analysis of the determinants of foreign aid composition. Reassuringly, our estimates generally support the predictions of the theory. More specifically, we find that there is typically an inverse relationship between the proportion of project aid and the level of a recipient country's expenditure on more welfare enhancing public goods. We also find that the proportion of project aid is, in line with our model, increasing in per capita of the recipient country.

There is of course already a relatively wide literature on the determinants of foreign aid, including its project and program aid components. These tend to show that factors such as past colonial ties, political alliances, good governance, income, being a member of the UN security council, and population size, amongst many others, play important roles.[5] Similarly, there are empirical studies that study how the size of transfers like welfare payments including in-kind transfers like food stamps affect incentives to save, look for work, labor supply decisions, etc

[4] The other papers above focus on the use of restricted transfers in dealing with adverse selection.
[5] See, for instance, Alesina and Dollar (2000), Neumayer (2003), Kuziemko and Weker (2006).

and/or how the size of such payments is adjusted in response to the behavior of recipients (e.g., Fraker and Moffitt, 1988; and the surveys by Danzinger et al., 1981; Moffitt, 1992; Dobkin and Puller, 2007). However, these studies almost all focus on changes in the *size* of transfers as opposed to changes in the *composition* of transfers in response to changes in moral hazard behavior.[6] In fact the few studies that have looked at the composition of transfers are based on complete information, so that there are no moral hazard or self-selection issues as in our framework; see, for example, Moffit (1990) and Marton and Wildasin (2007).[7]

The remainder of the paper is organized as follows. The next section develops a simple theoretical model of a donor's optimal choice of project and program aid. Sections 3 and 4 describe the data and empirical analysis. We conclude the paper in Section 5.

2. A donor's composition of aid in the presence of moral hazard

In this section, we construct a simple model to theoretically determine a donor's optimal choice of program aid and project aid. We demonstrate and clarify the channel through which an improvement in governance might lead to a reduction in the proportion of project aid (i.e., relatively restricted aid).

We use a canonical model of political agency due to Barro (1973) and extended by Ferejohn (1986) with the donor playing the role that voters (i.e., the principals) play in this class of models.[8] In these models, politicians are disciplined via the risk of being voted out of office and thereby losing the rents of being in office. In our model, the leader (politician) in the recipient country is not voted out of office but is disciplined by the donor conditioning the size and

[6] They also tend to focus on the effect of transfers on moral hazard behavior as opposed to the effect of moral hazard behavior on transfers.

[7] Moffitt (1990) finds that US state legislatures allowed federally-financed in-kind transfers like Food Stamp benefits and federally-subsidized Medicaid benefits to substitute for cash transfer programs like AFDC. In a recent paper, Marton and Wildasin (2007) develop a model to examine how US states choose the mix of cash transfers (i.e., AFDC/TANF) and in-kind transfers (i.e., Medicaid) for poor households, and how this mix is affected by changes in the level of Federal government support for each program.

[8] See, for example, Besley and Case (1995), Persson et al. (1997), Coate and Morris (1995), Besley and Smart (2007) and Besley and Prat (2006). See also the books by Persson and Tabellini (2000) and Besley (2006) for more references and exposition.

composition of aid on the quality of governance. However, as we indicate in appendix A, the donor in our model plays an additional role (i.e., makes expenditure decisions) that voters in this class of political agency models do not play.

As in Coate and Morris (1995), Besley and Smart (2007), and Besley and Prat (2006), we assume that a leader rules for only two periods, where a period is indexed by $t = 1, 2$.[9] Let $0 < \delta < 1$ be a leader's discount factor. Suppose that leaders of the recipient country come in one of two types: good (honest) or bad (corrupt). In period 1, these types are independent random draws from an identical distribution, where honest types are drawn with probability, π and dishonest types are drawn with probability $1 - \pi$, where $0 < \pi < 1$. A leader's type is his private information in period 1 but may become public information in period 2. His type in period 1 is the same as in period 2.

Foreign aid is given to the leader of the recipient country for the provision of public goods which are assumed to fully depreciate in each period. The leader can embezzle all the aid or part of it. It is important to note that while we assume that aid that is embezzled is synonymous with corruption, we could alternatively assume that embezzled aid means that such aid is spent on items such as military equipment that the donor does not care about because they do not enhance the welfare of the citizens.

When the donor gives the recipient country G_t dollars of program aid in period t, it can be used to produce G_t/θ units of a public good in period t, where $\theta > 0$ is the cost of a unit of the public good financed with program aid in period t, $t = 1,2$. We assume that θ is a binary random variable which can be high or low in each period. That is, $\theta \in \{\theta_L, \theta_H\}$, where $\theta_H > \theta_L > 0$. This unit cost is independently and identically distributed in each period where, in each period, the probability that the unit cost is high is $Pr(\theta_H) = q$. So $Pr(\theta_L) = 1 - q$, where $0 < q < 1$. We assume that the realization of θ is private information to the leader of the recipient country. Also, the

[9]In our model, leaders rule for two periods with certainty. In Besley and Smart (2007) and Besley and Prat (2006), they rule for two periods if and only if they are re-elected. In both papers, the authors focus on the incentive effects of elections, with voters observing direct signals from politicians in the former case and indirectly doing so through the media in the latter case.

provision of the public good financed from program aid cannot exceed G_t/θ_L because the donor's aid is the only source of revenue, $t = 1, 2$.[10] The donor knows the distribution of costs and leaders' types but does not directly observe any of these variables. We also assume that the donor has to make his aid allocation decision before the realization of θ is revealed to the leader.[11]

In period t, the donor can also give project aid of size B_t dollars which results in the provision of a service or good of size $x_t = G_t/\theta_k + B_t/\alpha$ in the recipient country and a corresponding welfare level of $U(x_t)$ which is an increasing and strictly concave function, $k = H, L$ and $t = 1,2$. Note that x_t is the consumption of a composite good or service by the citizens of the recipient country. This good or service is provided by the leader by using the aid allocated to the country. It could be a publicly-provided *composite* private good like education *and* health care and/or a *composite* public good like a road and police protection. In short, it a good that increases welfare or reduces poverty.[12] For the sake of exposition, we refer to the good as a public good.

We assume that $\alpha > \theta_H > \theta_L$. Therefore, given $x_t = G_t/\theta_k + B_t/\alpha$, a dollar of program aid contributes $1/\theta_k$ units to welfare in the recipient country while a dollar of project aid contributes $1/\alpha$, where $1/\alpha < 1/\theta_k$, $k = L, H$. This captures the deadweight loss of project aid. However, because it is easier to embezzle program aid than project aid, it is more likely that a smaller proportion of a dollar of program aid will be spent on the welfare on the people in the recipient country. Herein lies the trade-off between using program aid and project aid.

We assume that, under project aid, the leader does not possess any private information. This may reflect the fact that, under project aid, the donor invests relatively more resources into monitoring and auditing the use of such aid. As noted in section 1, the design and implementation of project aid involves the direct participation of the donor. It may also stem from the fact that the

[10] This is a common assumption in formal models of foreign aid (e.g., see Svensson, 2003).
[11] This is because in our model, only honest types will truthfully reveal θ_L. So without this assumption, the donor might wait for a leader to report the realization of θ before making his aid allocation decision, hoping that if $\theta = \theta_L$ and the leader is an honest type, then he will truthfully reveal it. This assumption is not necessary in the standard political agency versions of this model (e.g., Besley and Smart (2007) and Besley and Prat (2006)) because it is the politician who makes expenditure decisions and also observes the unit cost of production.
[12] See also Svensson (2003) who uses a broad definition of poverty reduction as the goal for a donor.

donor may direct the aid into an activity (e.g., road construction) where it has a better expertise at monitoring while program aid directed at a more general activity like educational reform is *relatively* more difficult to monitor.

In each period, the donor has the *same* budget of size $\overline{A} > 0$ to allocate between program aid and project aid. Therefore, $G_t + B_t \leq \overline{A}$, t = 1,2. As in theoretical papers on foreign aid, we assume that this budget is exogenous (e.g., Pedersen, 2001; Svensson, 2003). Let $U = U(x_t)$ be the donor's objective function in period t, t = 1,2. Note that implicit in the donor's objective function is the assumption that he is altruistic since he cares about the level of welfare from the consumption of the composite public good in the recipient country. For simplicity, we assume that $U(x_t) = \log(x_t)$.

The donor's choice of the size and composition of aid in period t depends on the level of governance in the recipient country in period t-1. To the donor, the quality of governance in the recipient country in a given period is an increasing function of the level of public good provision. Since we assume that project aid cannot be embezzled, the donor's belief of the leader's type depends on how many units of the public good are financed from program aid. Therefore, the donor's aid allocation is based on the component of governance given by $g_t = x_t - B_t/\alpha = G_t/\theta_k$, t = 1,2. This function is common knowledge.

The timing of actions is as follows:

In period 1,

(a) the donor chooses the composition of foreign aid (i.e., the sizes of project aid and program aid),

(b) the leader chooses the quantity of public good to provide, given the transfer in (a).

Then in period 2,

(c) the donor, having observed the quantity of public good provided in (b), chooses the composition of foreign aid (i.e., the sizes of project aid and program aid).

2.1 Equilibrium analysis

This is a dynamic game of incomplete information between the donor and the leader (i.e., agent) of the recipient country. We look for perfect Bayesian equilibria of this game.

It is important to reiterate that since project aid cannot be embezzled the donor determines the quality of governance by inferring how much of program aid was spent in the provision of the composite public good. Therefore, in the signaling game analyzed below, the signal is the units of public good that is financed from program aid.

An honest leader does not embezzle aid. In a given period, the objective of a corrupt leader is to maximize the size of aid he can embezzle while striking a balance against the cost of such embezzlement which takes the form of a lower aid flow in the next period the higher is the donor's belief that the leader is corrupt.

Let $\rho_t \equiv \rho_t(h|g_{t-1})$ be the donor's posterior belief in period t that the leader is honest given that he observed a level of governance g_{t-1} in the previous period. Necessarily $\rho_1 = \pi$. Define $g_1^H \equiv G_1/\theta_H$ and $g_1^L \equiv G_1/\theta_L$. Since the game ends in period 2, the quality of governance in period 2 has no effect on the donor's behaviour, so we only focus on governance in period 1.

Lemma 1: If $\delta G_2^*(\rho_2^H) \geq \theta_L G_1^*(\rho_1)/\theta_H$, π, and q are sufficiently high and an additional condition holds,[13] then the following is a unique perfect Bayesian Nash equilibrium which satisfies the intuitive criterion: if the donor uses program aid in a given period, the optimal size is a function of his beliefs in that period and is given by $G_t^*(\rho_t)$ with project aid equal to $B_t^*(\rho_t) = \overline{A} - G_t^*(\rho_t)$, t = 1,2. In period t, an honest leader finances $G_t^*(\rho_t)/\theta_L$ units of the public good from program aid if $\theta = \theta_L$ and $G_t^*(\rho_t)/\theta_H$ units if $\theta = \theta_H$, t =1, 2. If $\theta = \theta_L$, then in period 1, a corrupt leader finances

[13] See Appendix A for this condition.

$G_1^*(\rho_1)/\theta_H$ units of the public good by spending X_1 dollars of program aid and embezzles ($G_1^*(\rho_1) - X_1$) dollars of program aid, where $X_1/\theta_L = G_1^*(\rho_1)/\theta_H$. If $\theta = \theta_H$, a corrupt leader embezzles all program aid in period 1. A corrupt leader embezzles all program aid in period 2, regardless of θ. The donor's equilibrium belief in period 1 is $\rho_1 = \pi$. His beliefs in period 2, using Bayes' rule, are as follows: $\rho_2(h|g_1 = 0) = 0$, $\rho_2(h|g_1^H) = q\pi/(q\pi + (1-\pi)(1-q))$, and $\rho_2(h|g_1^L) = 1$. The out-of-equilibrium belief for the donor is $\rho_2(h|g_1) = 0$ if $g_1 \notin \{g_1^H, g_1^L\}$. If a corrupt leader embezzles all program aid in period 1, the donor uses only project aid in period 2.

Proof:

The equilibrium in lemma 1 says that a corrupt leader mimics (i.e., pools with) an honest leader when $\theta = \theta_L$ but separates when $\theta = \theta_H$. We show in appendix A that the donor is better off by maximizing his period-1 payoff, learn about the leader's type in period 1, and then use this information to maximize his period-2 payoff. Accordingly, given the strategies of corrupt and honest types in lemma 1, the donor chooses program aid G_1 in period 1, given his prior belief $\rho_1 = \pi$, to maximize[14]

$$W(\rho_1) = \rho_1\left((1-q)\log\left(\frac{G_1}{\theta_L} + \frac{B_1}{\alpha}\right) + q\log\left(\frac{G_1}{\theta_H} + \frac{B_1}{\alpha}\right)\right) + (1-\rho_1)\left((1-q)\log\left(\frac{G_1}{\theta_H} + \frac{B_1}{\alpha}\right) + q\log\left(\frac{B_1}{\alpha}\right)\right), \quad (1)$$

subject to the budget constraint, $G_1 + B_1 = \overline{A}$.[15]

Noting that a corrupt leader embezzles all program aid in period 2, it follows that if the donor observed G_1/θ_L or G_1/θ_H in period 1, he chooses program aid G_2 in period 2 to maximize

[14]Notice that in Besley and Smart (2007) and Besley and Prat (2006), the politician chooses the size of resources for public expenditure and how much of this to embezzle. In our model, the size of program aid is determined by the donor (i.e., the principal) not the politician (i.e., the agent). The politician only chooses how much to embezzle of program aid to embezzle but not its size. Therefore, the principal in our model plays an additional role that voters do not typically play in this political agency model.

[15] The budget constraint binds because the aid budget is exogenous and $U(x_t) = \log(x_t)$ is a strictly increasing function.

$$W(\rho_2) = \rho_2\left((1-q)\log\left(\frac{G_2}{\theta_L}+\frac{B_2}{\alpha}\right)+q\log\left(\frac{G_2}{\theta_H}+\frac{B_2}{\alpha}\right)\right)+(1-\rho_2)\log\left(\frac{B_2}{\alpha}\right) \tag{2}$$

subject to the budget constraint, $G_2 + B_2 = \overline{A}$, where in period 1 depending on what the donor observed in equilibrium, he uses one of the following for ρ_2:

$\rho_2^H \equiv \rho_2\left(h\middle|g_1^H\right) = q\pi/(q\pi + (1-\pi)(1-q))$, $\rho_2^L \equiv \rho_2\left(h\middle|g_1^L\right) = 1$, and $\rho_2\left(h\middle|g_1 = 0\right) = 0$.

Putting $B_t = \overline{A} - G_t$ into equations (1) and (2) and maximizing with respect to G_t gives

$\frac{\partial W(\rho_t)}{\partial G_t} < 0$ if $\rho_t < \hat{\rho}_t \in (0,1)$, $\frac{\partial W(\rho_t)}{\partial G_t} = 0$ for some $G_t \in (0,\overline{A})$ if $\rho_t \in [\hat{\rho}_t,1)$, and

$$\frac{\partial W(\rho_t)}{\partial G_t} > 0 \text{ if } \rho_t = 1, \tag{3}$$

$t = 1,2$.

To see this note, for example, that

$$\frac{\partial W(\rho_2)}{\partial G_2} = \rho_2\left((1-q)\left(\frac{1}{\theta_L}-\frac{1}{\alpha}\right)\frac{\alpha\theta_L}{\theta_L\overline{A}+(\alpha-\theta_L)G_2}+q\left(\frac{1}{\theta_H}-\frac{1}{\alpha}\right)\frac{\alpha\theta_H}{\theta_H\overline{A}+(\alpha-\theta_H)G_2}\right)-\frac{(1-\rho_2)}{\overline{A}-G_2}, \tag{4}$$

and $\frac{\partial^2 W(\rho_2)}{\partial (G_2)^2} < 0$. Then as $\rho_2 \to 0$, the derivative in (4) is negative and for $\rho_2 = 1$, the derivative is positive. Therefore, on the equilibrium path, $G_2^* = 0$ if $\rho_2 = 0$ and $G_2^* = \overline{A}$ if $\rho_2 = 1$. These are corner solutions. If we choose π and q sufficiently high enough so that $\rho_2^H \equiv \rho_2\left(h\middle|g_1^H\right)$ and ρ_1 are sufficiently high and also satisfy the restriction $\alpha > \theta_H > \theta_L$, then an interior solution exists. In this case, the expressions for G_1 and G_2 take the form $G_1^*(\rho_1) = \phi\overline{A}$ and $G_2^*(\rho_2^H) = \gamma\overline{A}$, where γ and ϕ

are positive constants (less than 1) which are independent of $\overline{A}$.[16] For the sake of exposition, the rest of the proof is relegated to appendix A where we demonstrate the additional conditions for our equilibrium in lemma 1 to hold. **QED**.

We focus on the proportion of project aid in period 2 because this is what is influenced by the quality of governance observed by the donor in period 1. This proportion is given by

$$\sigma_2^*(\rho_2) = \frac{B_2^*(\rho_2)}{\overline{A}} = 1 - \frac{G_2^*(\rho_2)}{\overline{A}} \tag{5}$$

On the equilibrium path, the donor observes one of the following three levels of public good provision that is financed from program aid in period 1: $\{0, G_1^*/\theta_H, G_1^*/\theta_L\}$. Our numerical simulations show that, at an interior solution, $G_2^*(\rho_2)$ is a strictly increasing function. Therefore, given that $0 = G_2^*(0) < G_2^*(\rho_2^H) < G_2^*(\rho_2^L)$, equation (5) implies that $\sigma_2^*(0) > \sigma_2^*(\rho_2^H) > \sigma_2^*(\rho_2^L)$. Note that $G_2^*(0) = 0$ and $G_2^*(\rho_2^L) = \overline{A}$. That is, the donor gives only project aid in period 2 if he believes with certainty that the leader is corrupt and gives only program aid in period 2 if he believes with certainty that the leader is honest.

We can state the following proposition:

Proposition 1: *Suppose (a) lemma 1 holds. Then the higher is the provision of public goods or the provision of publicly-provided private goods (i.e., an improvement in governance) in period 1, the smaller is the proportion of project aid in total aid in period 2.*

The intuition for this comparative static result stems from the fact an improvement in governance (as measured in more provision of public goods) increases the donor's posterior that the leader is honest and increases the probability that the cost savings due to a possible draw of the lower unit cost (i.e., θ_L) will be realized. This increases the donor's expected payoff from using

[16] Tedious but straightforward algebra shows that setting (4) to zero gives a quadratic equation in G_2 which gives two roots (one positive and the other negative). The same is true for G_1. The positive roots are of the form claimed above. We also performed numerical simulations with the math software Maple 12 to conform this. Also, by putting $B_t = \overline{A} - G_t$ into equations (1) and (2) and using the math software Maple 12 to plot these equations with respect to G_1 and G_2 respectively on the domain $[0, \overline{A}]$, we confirmed that the donor's payoff functions are strictly concave, t = 1,2.

more program aid. Hence, an improvement in governance leads to an increase in the *expected* deadweight loss of project aid and a reduction in *expected* moral hazard behaviour.

Given our assumption that project aid cannot be embezzled, it is not possible for the donor to know whether governance has improved or worsened if no program aid is given. This makes it difficult to test the effect of governance on the proportion of project aid. However, in our data, it turned out that donors gave some program aid to each recipient in almost every period and so this makes proposition 1 testable.

Notice that we do not focus on comparing $G_1^*(\rho_1)$ and $G_2^*(\rho_2)$ to see how the donor changes his aid allocation based on the difference between ρ_1 and ρ_2. This is because there is an asymmetric feature of our two-period model that implies $G_1^*(\rho_1) > G_2^*(\rho_2)$ even if $\rho_1 \leq \rho_2$.[17] And, as noted above, we focus on the proportion of project aid in period 2 because this is what is influenced by the quality of governance observed by the donor in period 1.

To conclude this section, we note that in the literature on the efficiency properties of cash and in-kind transfers, the comparison is usually made as a choice between only a cash transfer and only an in-kind transfer. But, as noted earlier, Gahvari and de Mattos (2007) show that combining a conditional cash transfer with an in-kind transfer can reduce or eliminate the deadweight losses of in-kind transfers. One could see our framework as a complementary but different framework to theirs. Theirs is a model with adverse selection (hidden types) but no moral hazard (hidden action). Our model has both moral hazard and adverse selection.

2.2 Remarks on Robustness

It is important to note that although we assume in our analysis that that all of program aid can be embezzled but project aid cannot be embezzled, this assumption is not crucial to the

[17] To see this, note that all things being equal (i.e., $\rho_1 = \rho_2$) the fact that a dishonest leader *will* necessarily embezzle all program aid in period 2 makes the donor more cautious in period 2 than he is in period 1. And so, the size of program aid is bigger in period 1 than in period 2 if $\rho_1 = \rho_2$. Therefore even if $\rho_1 < \rho_2$, the size of project aid in period 2 will be higher than the corresponding size in period 1, if ρ_2 is not sufficiently higher than ρ_1.

analysis. What matters is that the proportion of program aid that can be embezzled is *bigger* than the proportion of project aid that can be embezzled. To see this, suppose the donor gives G_1 dollars of program aid in period 1 and only a proportion $\lambda \in (0,1]$ can be embezzled. Then since a proportion $(1-\lambda) \geq 0$ *cannot* be embezzled, the signalling game analyzed in appendix A will involve a leader choosing some amount of program aid $D_1 \in [(1-\lambda)G_1, G_1]$ to spend on public goods in period 1. Clearly, this will not affect our analysis except to reduce the corrupt leader's choice set. For example, if 40% of program aid cannot be embezzled, then a leader will simply choose to spend $D_1 \in [(0.4)G_1, G_1]$ on public goods in the signalling game. Without loss of generality, we have simply assumed that $\lambda = 1$, so that the leader chooses $D_1 \in [0, G_1]$.

Because λ is a constant, there will only be a minor modification in the donor's payoff function. We suppose that program aid is used to provide a public good that has several sub-components or is used to produce a series of public goods. If a component of program aid cannot be embezzled, then we assume that the recipient country has no private information over this component of program aid. Suppose the associated per unit cost of this component of the public good is β. Then the leader of the recipient country will finance a minimum of $(1-\lambda)G_t/\beta$ units of the public good using program aid in period t, t =1,2. We can construct an equilibrium similar to lemma 1 when a corrupt leader pools with an honest leader when $\theta = \theta_L$ and separates when $\theta = \theta_H$. Then the donor's payoff function is

$$\begin{aligned} W(\rho_1,\lambda) = {} & \rho_1\left((1-q)\log\left(\frac{\lambda G_1}{\theta_L}+\frac{(1-\lambda)G_1}{\beta}+\frac{B_1}{\alpha}\right)+q\log\left(\frac{\lambda G_1}{\theta_H}+\frac{(1-\lambda)G_1}{\beta}+\frac{B_1}{\alpha}\right)\right)+ \\ & (1-\rho_1)\left((1-q)\log\left(\frac{\lambda G_1}{\theta_H}+\frac{(1-\lambda)G_1}{\beta}+\frac{B_1}{\alpha}\right)+q\log\left(\frac{(1-\lambda)G_1}{\beta}+\frac{B_1}{\alpha}\right)\right) \end{aligned} \tag{6}$$

It is straightforward to modify the donor's payoff in period 2. If $\frac{\lambda}{\theta_H}+\frac{(1-\lambda)}{\beta}>\frac{1}{\alpha}$, then project aid has a deadweight loss; that is, a dollar of program aid increases welfare by more than a dollar of project aid. Then our analysis goes through.

One may argue that project aid need not always lead to a deadweight loss (e.g., Moffit, 1989). Consider the case of $\lambda = 1$. Then if $\theta_L < \alpha = \theta_H$, there is no deadweight loss of project aid if $\theta = \theta_H$. This does not affect the analysis because, *all things being equal*, there is no state of the world in which program aid is less efficient than project aid.

As in Pedersen (2001), Svensson (2003) and other theoretical models of foreign aid, we have treated total aid, $\overline{A}$, as exogenous. This meant that when the donor's belief results in a decrease in program aid, this results in an increase in project aid with no effect on total aid. Indeed, given that for sufficiently high beliefs that the leader is honest, $G_1^*(\rho_1) = \phi\overline{A}$ and $G_2^*(\rho_2^H) = \gamma\overline{A}$, where γ and ϕ are positive constants which are independent of $\overline{A}$, it follows that the size of aid has no effect on the composition of aid (i.e., proportion of project aid or the proportion of program aid). However, in our empirical analysis we included variables in the foreign aid literature that have been shown to affect the total size of aid for two reasons: (a) there may be scale effects for reasons not captured in the theory; and (b) ignoring scale effects, the theory says that bad governance is punished with a higher proportion of project aid. Consider variables such as population or debt which have been shown to affect the size of aid. It is conceivable that a donor may use the proportion of project aid differently to punish a country with a higher population or debt than he will punish a country with a smaller population or debt.

3. Econometric Analysis

3.1 Econometric Specification

The key prediction of the model is that the better the behaviour of the recipient in terms of public good provision, the smaller the proportion of project aid in total aid (Proposition 1). We test this prediction by estimating the following econometric specification:

$$PRJ\_aid_{it} = \alpha_0 + \varphi G_{it-1} + \omega X_{it-1} + \mu_i + \lambda_t + \varepsilon_{it} \qquad (7)$$

Where PRJ_aid_{it} denotes country i's proportion of project aid at time t; G_{it-1} is a measure of public good provision at time t-1; which is used to capture the moral hazard behaviour of the recipient in period 1; and X_{it} denotes all the other control variables which are likely to affect the composition of aid, μ is an unobservable (to the econometrician) country specific time invariant effects, λ are time specific shocks common to all countries, and ε is a standard error term. We are interested in the coefficient φ. The model predicts that $\varphi < 0$ when the recipient behaviour improves.

3.2 Data

To test the prediction of the model, we use a sample of aid recipient countries. For our dependent variable, we use the proportion of project aid in total aid (project aid + program aid). The aid data is from the OECD-CRS online database. To capture public good provision, although the literature on public good provision provides various proxies (e.g. power generating capacity, transport network, telecommunication network, etc) we limit ourselves to those we believe will attract donors' attention. More specifically, we focus on three types of public goods for which data is in relative abundance across countries and over time in the WDI database. The first two can be considered as proxies of desirable public goods, namely expenditure on health and education goods (as a percentage of GDP). To the extent that a donor is not likely to see expenditure on military goods (e.g., arms) as an expenditure that will enhance the welfare of the citizens of the recipient country because such an expenditure implies that expenditure on other valuable public goods is reduced, we also use military expenditure as an alternative measure of "public good" provision where higher military expenditure implies a smaller public good provision and so, consistent with our theory, we expect a higher military expenditure to result in a higher proportion of project aid. Ensuring a sample across the two databases for which we have observations on these three governance measures, as well as the proportion of project aid received and other control variables, leaves us with a necessarily unbalanced panel of 62 countries over the period 1991-2007.[18]

Turning to the potential choice of other controls it must be noted that although the aid allocation literature has used various control to investigate aid allocation determinants,[19] in the present case (where the dependent variable captures the composition of aid) these variables are hard to justify. The control variables included in X_{it} are income per capita, population, a measure of governance (democracy) and technical assistance grants. Income per capita is included to capture the level of development and we expect the proportion of project aid to decline as the country develops. With regard to population, the higher the value of this variable the higher the need for more project aid. The variable democracy is introduced in our specification on the ground that the donor could also use it as a signal to alter the composition of aid, where a higher value indicates a lower level of democracy. In terms of this variable one would expect that the higher the index the higher will be the proportion of project aid a country receives. Income per capita data and population are obtained from the WDI (2010-*online version*) whilst democracy is taken from the Freedom House. We additionally include a measure of technical assistance grants (obtained from the OECD-CRS online database) as a potential explanatory variable of the composition of aid, on the grounds that some donors, as has been argued, technical assistance is used as a way of promoting employment in their own country to meet the expectations of tax payers. This variable is expected to affect positively the dependent variable. Finally, we also include country specific dummies to take account of time invariant unobservables at the country level, we country specific dummies in order to take account of time invariant country specific unobservables that could be

[18] The countries included are Albania, Angola, Armenia, Azerbaijan, Bangladesh, Benin, Bolivia, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Congo, Rep., Cote d'Ivoire, Djibouti, Ecuador, Egypt, Arab Rep., El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Gambia, The, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Honduras, India, Jamaica, Jordan, Kenya, Kiribati, Kyrgyz Republic, Lao PDR, Lesotho, Macedonia, FYR, Madagascar, Malawi, Mali, Mauritania, Moldova, Mozambique, Nepal, Nicaragua, Niger, Pakistan, Peru, Rwanda, Senegal, Sierra Leone, Solomon Islands, Sudan, Tajikistan, Tanzania, Togo, Uganda, Vietnam, Yemen, Rep., Zambia, Zimbabwe.

[19] In these studies the focus is on the size of aid.

correlated with our regressors. Moreover, we include year specific dummy variables to control for time varying factors common to all countries.[20]

We provide summary statistics of all our variables in Table 1. As can be seen, there is considerable variation in our governance proxies as well as the proportion of project aid variables. We also graphed the proportion of project aid for all recipients in Figure 1. As can be seen, the proportion of project in total aid has been increasing since the early 1990s, by 2004 standing at over 90 per cent.

3.3 Estimation Method

One way of testing a donor's motive for using project aid is to code the dependent variable as 1 if a donor used either project aid or both and 0 if and only if he used only program aid, and then use logit or probit model to estimate the probability that project aid will be used. However, such qualitative response regression models require that the choice of one alternative precludes the choice of all other alternatives. This situation does not apply to our case because a donor can simultaneously choose a combination of project and program aid. More importantly, donors in our sample chose some mix of project and program aid for almost all years and for all recipients. Thus our dependent variable (i.e., the proportion of project aid) is a continuous variable that is bounded between 0 and 1.

In order to deal with the bounded and continuous nature of our dependent variable we employ the fractional logit estimator introduced by Papke and Wooldridge (1996), which was specifically developed to deal with fractional response variables. Papke and Wooldridge (1996) consider the following model for the conditional expectation of the fractional response variable:

$$E(y_i|x_i) = H(x_i\beta),\ i = 1, \dots, N, \qquad (8)$$

[20] Another variable that could be included is corruption. However, the introduction of this variable reduces considerably the sample size due to missing values; so we decided against its inclusion.

where $0 \leq y_i \leq 1$ denotes the dependent variable and (the $1 \times k$ vector) x_i refers to the explanatory variables of observation i. Typically, $H(.)$ is a distribution function like the logistic function $H(z) = exp(z)/(1 + exp(z))$ which maps z to the (0, 1) interval. Papke and Wooldridge (1996) suggest to maximize the Bernoulli log likelihood with the individual contribution given by:

$$l_i(\beta) = y_i \log[H(x_i\beta)] + (1 - y_i) \log[1 - H(x_i\beta)] \tag{9}$$

The authors provide valid (robust) estimators of the asymptotic variance of β based on the well known sandwich formula[21]and the non-linear conditional mean H(.). They then extend Ramsey's (1969) RESET test for $H_0 : \delta_1 = 0, \delta_2 = 0$ in the augmented model $H[x_i\beta + \delta 1(x_i\beta)^2 + \delta 2(x_i\beta)^3]$.[22]

3.4 Results

The estimation of Equation (7), using a quasi-maximum likelihood estimator (QMLE),[23] are presented in Table 2 and 3. As a baseline specification we start with simply including our public good provision proxies, country dummies[24], and time dummies in Table 2. One should not that we include the public good measures at t-1 in order to reduce any simultaneity biases in aid receipt and public good financing. One finds that spending on health and education both decrease the proportion of project aid from foreign donors. This thus suggests that, indeed, countries that show signals of good public behaviour – here measured as the expenditure on 'desirable' public goods – receive lesser project aid. Comparing the relative size of the coefficients indicates that foreign donors are more likely to respond to spending on the health rather than the education sector. In contrast, if a country has a high level of military expenditure, foreign donors are more

[21] see Cameron and Trivedi, 2005.

[22] For more details on the calculation of the RESET test see Papke and Wooldridge (1996: 623-625).

[23] QMLE was introduced by Papke and Wooldridge (1996) to obtain a robust method to estimate fractional response models without an ad hoc transformation of boundary values.

[24] See Hausman and Leonard (1997) and Wagner (2003) as examples of including dummies to capture fixed effects in a fractional logit model.

likely to allocate project aid. The relative size of the coefficients that it is in fact this sort of public good that foreign donors respond to more than the aforementioned ‘desirable’ public good.

In Table 3 we then include our set of explanatory variables.[25] As can be seen, the proportion of project aid received is independent of a country’s wealth, while larger countries are more likely to receive less project aid. In terms of the other variables, the role is dependent on which public good proxy is used. For instance, lower levels of democracy do, as expected increase the proportion of project aid received, but only in the health and education expenditure specifications.

4. Conclusion

In this paper we explored the idea that restricted transfer can be used to control moral hazard behaviour of the recipient. To this end we present a model in which the composition of donor choice of restricted and unrestricted transfer is affected by the behaviour of the recipient. The main prediction of the model is that donor reduces the proportion of restricted transfers in total transfers as the moral hazard behavior of the recipient declines. We then test the model empirically using cross-border transfers (foreign aid). We find strong evidence that the provision of public good by the recipient country affects the donor’s decision to alter the composition of these transfers.

A limitation of our analysis is our inability to separately test our proposition for bilateral and multilateral donors. Subject to the availability of data, it would be worthwhile to undertake such a disaggregated analysis. However, this may not be a major problem given that a large share of bilateral aid is contingent upon recipient countries being on good terms with multilaterals, particularly the World Bank and IMF.

[25] As with the public good variables these are included at t-1 to reduce any simultaneity and endogeneity biases.

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Proportion of Project Aid	0.87	0.17	0	1
Public Health Expenditure (%GDP)	2.68587	1.562658	0.030	12.741
Public Education Expenditure (%GDP)	4.54654	2.221	0.43	17.81
Military Expenditure (%GDP)	2.38069	3.414788	0.001	39.6154
Democracy	4.14472	1.573807	1	7
Real GDP Per capita (in US dollars)	3832.883	3493.544	170.555	19665.11
Population (in thousands)	38624.8	149428.7	62.41	1294846
Tech. Assist. (Millions of US)	106	85.392	9.08	635

Table 2 Dependent variable Project Aid/(Project Aid + Programme Aid)

	(1)	(2)	(3)
Public Spending on Health(-1)	-.3817493**		
	(.0451328)		
Public Spending on Education(-1)		-1.691734**	
		(.1475251)	
Public Spending on Military(-1)			3.339464**
			(.0571323)
Observations	*368*	*368*	368
Log likelihood	*-200.312*	*-202.387*	-186.271

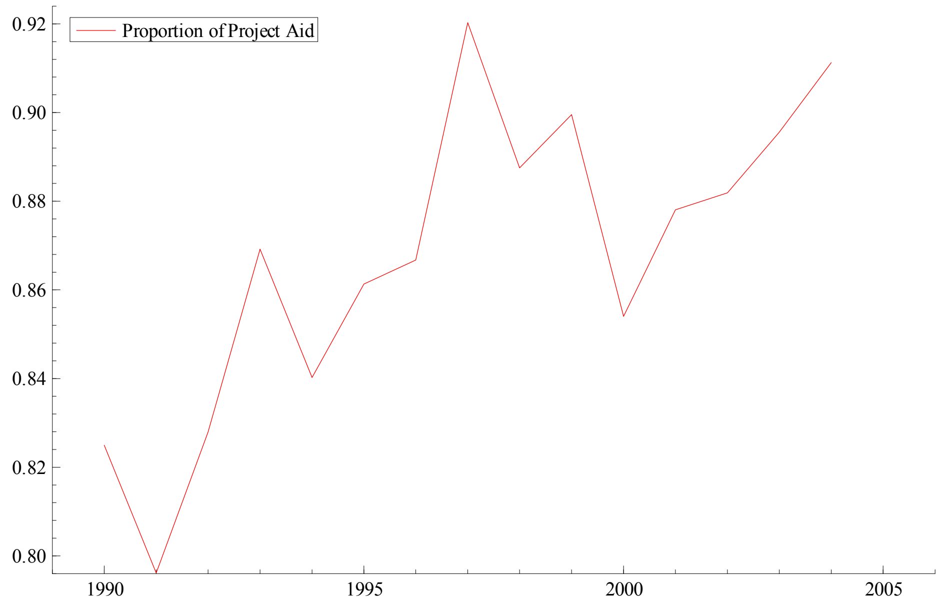
*Notes: (1) Standard errors in parentheses are adjusted for clustering of observations within countries; (2) ** and * indicate 1 and 5 per cent significance levels, respectively; (3) Time and country dummies included.*

Table 3 Dependent variable Project Aid/(Project Aid + Programme Aid)

	(1)	(2)	(3)
Public Spending on Health(-1)	-.1632879*		
	(.0770815)		
Public Spending on Education(-1)		-1.212862*	
		(.6125574)	
Public Spending on Military(-1)			.3238942**
			(.0530033)
log(Income per capita)(-1)	-1.159247	.6666309	-.0394003
	(1.346848)	(.9504314)	(.8987538)
Technical Assistance(-1)	-1.73e-09	3.22e-08**	3.11e-08**
	(6.24e-09)	(6.41e-09)	(5.54e-09)
Democracy(-1)	1.894716**	.9584511**	1.100933
	(.2203212)	(.2200376)	(.8409606)
Log(Population)(-1)	-25.3877**	-4.48715**	-5.732514**
	(5.289712)	(.3776586)	(.4270286)
Observations	*368*	*368*	368
Log likelihood	*-198.012*	*-198.599*	-185.320

*Notes: (1) Standard errors in parentheses are adjusted for clustering of observations within countries; (2) ** and * indicate 1 and 5 per cent significance levels, respectively; (3) Time and country dummies included.*

Figure 1: Proportion of Project Aid in Total Aid



Appendix A: Proof of Lemma 1

In what follows, public good refers to the units of the public good that is financed from program aid. The equilibrium in lemma 1 says that a dishonest leader mimics (i.e., pools with) an honest leader when $\theta = \theta_L$ but separates when $\theta = \theta_H$.

As explained in the main text, given the strategies of dishonest and honest types in lemma 1, the donor chooses G_t in periods 1 and 2 to maximize equations (1) and (2) in the main text, t = 1,2.

Note that if the donor observes any level of the public good in period 1 such that $G_1/\theta_H < g_1 < G_1/\theta_L$, then he knows that the leader got a cost draw of θ_L since $g_1 > G_1/\theta_H$ is not possible if $\theta = \theta_H$. But since $g_1 < G_1/\theta_L$, he can correctly infer that the leader has embezzled some funds and is therefore corrupt. Also, if $g_1 < G_1/\theta_H$, the donor can correctly infer that the leader is dishonest (i.e., embezzled some funds) and will therefore embezzle all aid in period 2. Therefore, given that in period 1, the honest type chooses $g_1^H \equiv G_1/\theta_H$ when $\theta = \theta_H$ and $g_1^L \equiv G_1/\theta_L$ when $\theta = \theta_L$, a reasonable out-of-equilibrium belief for the donor is $\rho_2(h|g_1) = 0$ if $g_1 \notin \{g_1^H, g_1^L\}$.[26] In this case, the donor uses *only* project aid in period 2, since we have assumed that the leader cannot embezzle project aid.

Suppose for now that $q \leq 0.5$. Then given the equilibrium strategies of honest and corrupt types, we get $\rho_2\left(h|g_1^H\right) = q\pi/(q\pi + (1-\pi)(1-q)) \leq \pi = \rho_1$. So $\rho_1 \geq \rho_2$ if $g_1 = G_1^*(\rho_1)/\theta_H$. Then

[26] This belief satisfies the intuitive criterion. The honest type has no incentive to deviate from the equilibrium. Hence, when the donor sees a deviation, he must believe that the leader is corrupt. One might argue that for $G_1/\theta_H < g_1 < G_1/\theta_L$ it may be optimal for the donor to use program aid in period 2 even if he knew that that leader was corrupt. In this case, a corrupt leader will exercise more restraint by setting g_1 such that $G_1/\theta_H < g_1 < G_1/\theta_L$ instead of $g_1 = G_1/\theta_H$, if $\theta = \theta_L$. The problem with this strategy is that it is not credible because the donor cannot commit to not using project aid in period 2 given his posterior belief of $\rho_2(h|g_1) = 0$.

it follows that $G_1^*(\rho_1) \geq G_2^*(\rho_2)$ if the donor observed $g_1 = G_1^*(\rho_1)/\theta_H$ in period 1.[27] If

$g_1 = G_1^*(\rho_1)/\theta_L$, so that $\rho_2\left(h \middle| g_1^L\right) = 1 > \rho_1$, then $G_1^*(\rho_1) < G_1^*(\rho_2) = \overline{A}$.

Consider a leader in the recipient country. Given that honest leaders are non-strategic, we focus on dishonest leaders. Since period 2 is the last period of this game, it is optimal for a dishonest leader to embezzle all program aid in period 2. Consider period 1 and suppose that $\theta = \theta_L$. In the equilibrium in lemma 1, a corrupt leader exercises restraint in period 1 by spending X_1 dollars of program aid on the public good and providing $X_1/\theta_L = G_1/\theta_H$ units of the composite public good using program aid, if $\theta = \theta_L$. This restraint by the leader is the *discipline effect* of the donor conditioning program aid in period 2 on good governance in period 1. For this to be an equilibrium choice, we require that

$$\delta G_2(\rho_2) + \left(G_1(\rho_1) - X_1\right) \geq G_1(\rho_1). \tag{A1}$$

Noting that we can write $X_1 = \theta_L G_1(\rho_1)/\theta_H$ allows us to rewrite (A1) as

$$\delta G_2(\rho_2) \geq \frac{\theta_L}{\theta_H} G_1(\rho_1) \tag{A2}$$

As argued above, $G_1^*(\rho_1) \geq G_2^*(\rho_2)$ if the donor observed $g_1 = G_1^*(\rho_1)/\theta_H$ in period 1. Then a necessary condition for (A2) to hold is $\delta \geq \theta_L/\theta_H < 1$.[28] If (A2) holds, then the donor's out-of-equilibrium belief that $\rho_2\left(h \middle| g_1\right) = 0$ if $g_1 \notin \{g_1^H, g_1^L\}$, a corrupt leader will not deviate from the strategy in lemma 1 if $\theta = \theta_L$

Now suppose that $\theta = \theta_H$. Given the donor's out-of-equilibrium beliefs, there is no point in embezzling less than G_1 dollars of program aid in period 1 if $\theta = \theta_H$. Suppose instead that a corrupt leader deviates from the equilibrium strategy in lemma 1 by pooling with an honest type in period

[27] This is a consequence of this two-period model. To see this, note that all things being equal (i.e., $\rho_1 = \rho_2$) the fact that a dishonest leader *will* necessarily embezzle all program aid in period 2 makes the donor more cautious in period 2 than he is in period 1. And so, the size of program aid is bigger in period 1 than in period 2 if $\rho_1 = \rho_2$. Therefore, even if $\rho_2 > \rho_1$ but ρ_2 is not sufficiently higher than ρ_1, then the size of project aid in period 2 will be higher than the corresponding size in period 1.
[28] This is not sufficient. We shall construct an example that satisfies (A2).

1 and providing G_1/θ_H units of the public good by spending G_1 dollars of program aid. That is, if $\theta = \theta_H$, he will *not* embezzle any program aid in period 1. Noting that G_1/θ_H is on the equilibrium path gives $\rho_2\left(h|g_1^H\right) = q\pi/(q\pi + (1 - q)(1 - \pi)) \leq \pi = \rho_1$. Then $\rho_1 \geq \rho_2$ implies that $G_1^*(\rho_1) \geq G_2^*(\rho_2)$. A corrupt leader's discounted payoff, if he does not embezzle any aid in period 1, is $\delta G_2^*(\rho_2)$. But $G_1^*(\rho_1) \geq G_2^*(\rho_2)$ implies $G_1^*(\rho_1) > \delta G_2^*(\rho_2)$. Hence if $\theta = \theta_H$, a corrupt leader is better off if he embezzles all aid in period 1.[29] It follows that a corrupt leader will not deviate from the equilibrium in lemma 1.

Now suppose $q > 0.5$, $\rho_2\left(h|g_1^H\right) = q\pi/(q\pi + (1-\pi)(1-q)) > \pi \equiv \rho_1$. A corrupt leader will not deviate from the equilibrium in lemma 1 if (A2) holds and $G_1^*(\rho_1) > \delta G_2^*(\rho_2)$; the first condition requires a corrupt leader to pool with an honest leader when $\theta = \theta_L$ and the second requires him to embezzle all aid if $\theta = \theta_H$. These two conditions give $\dfrac{\theta_L G_1^*(\rho_1)}{\theta_H G_2^*(\rho_2)} \leq \delta < \dfrac{G_1^*(\rho_1)}{G_2^*(\rho_2)}$.

Given his beliefs, the donor's choices of program aid, $G_1^*(\rho_1)$ and $G_2^*(\rho_2)$ maximize equations (1) and (2) in the main text (respectively). Later we construct examples for $q \leq 0.5$ and $q > 0.5$.

It would appear that it may be optimal for the donor to choose a sufficiently large G_1, so that the inequality in (A2) will be violated. That way, a bad leader will reveal his type and therefore the donor can make sure that he does not lose money in period 2.[30] In pursuing this strategy, the donor must balance the expected cost of losing *all* of G_1 in period 1 against the expected benefit of knowing, for sure, that the leader is corrupt in period 2. In this case, the donor gives a sufficiently large G_1 in period 1 such that even if a corrupt leader draws $\theta = \theta_L$, $G_2^*(\rho_2^H)$ is

[29] This means that there exists no equilibrium in which a dishonest leader provides G_1/θ_H units of the public good from program aid in period 1 regardless of the value of θ.
[30] This does not contradict proposition 1 because the donor still reduces the proportion of program aid in period 2 if his belief that the leader is corrupt increases.

not big enough to satisfy (A2). In this case, a corrupt leader embezzles all program aid in any state of the world in period 1, so there is full revelation of types in period 2.[31]

To investigate the above strategy, we proceed as follows: the donor knows that conditional on ρ_2, he will choose $G_2^*(\rho_2)$ in period 2, which is the program aid that maximizes equation (2) in the main text. We know that if lemma 1 holds, then (A2) holds if and only if $\theta = \theta_L$ in which case the donor's belief is $\rho_2^H \equiv \rho_2\left(h|g_1^H\right)$. Hence, conditional on $G_2^*(\rho_2^H)$, let (A2) hold with strict equality and solve to get

$$G_1^{**} = \frac{\delta\theta_H}{\theta_L} G_2^*(\rho_2^H). \tag{A3}$$

Then to violate (A2), the donor will choose $\hat{G}_1 = G_1^{**} + \varepsilon$, where ε is a very small but positive number.

To determine the profitability of this strategy relative to the equilibrium strategy in lemma 1, the donor must compute, from the standpoint of period 1, the sum of his expected payoff over periods 1 and 2 because the decision to follow the strategy in lemma 1 or the strategy under consideration must be made in period 1. Noting that $\rho_1 = \pi$ and given that the strategy under consideration results in a corrupt leader revealing his type in any state of the world, the donor's expected payoff over periods 1 and 2 is

$$\begin{aligned}\widetilde{W}_{12} = {} & \pi\left((1-q)\log\left(\frac{\hat{G}_1}{\theta_L} + \frac{\overline{A} - \hat{G}_1}{\alpha}\right) + q\log\left(\frac{\hat{G}_1}{\theta_H} + \frac{\overline{A} - \hat{G}_1}{\alpha}\right) + (1-q)\log\left(\frac{G_2^*(1)}{\theta_L}\right) + q\log\left(\frac{G_2^*(1)}{\theta_H}\right)\right) + \\ & (1-\pi)\left(\log\left(\frac{\overline{A} - \hat{G}_1}{\alpha}\right) + \log\left(\frac{\overline{A}}{\alpha}\right)\right)\end{aligned} \qquad \text{A4)}$$

From the standpoint of period 1, we have to compute the sum of the donor's expected payoff over periods 1 and 2 when the equilibrium in lemma 1 holds. We do this by computing the

[31] It is not necessary to consider this strategy in the political agency models of Besley and Smart (2007) and Besley and Prat (2006) because G_t is exogenous in those models, t = 1,2.

payoffs depending on the state of the world. Given the equilibrium in lemma 1, if the state of the world is $\theta = \theta_H$, then the donor knows that he will have full information about types in period 2.[32] If the state of the world is $\theta = \theta_L$, then he knows that in period 2, his belief will be $\rho_2\left(h \middle| g_1^H\right)$. Note that a leader's type in period 1 carries over to period 2 but nature draws a new unit cost in each period.[33] With these facts in mind, we write the donor's expected payoff over periods 1 and 2, from the standpoint of period 1, as follows: If the state of the world is $\theta = \theta_L$ in period 1, his expected payoff over the two periods is

$$\hat{W}_{12}^{L} = \left[\begin{array}{l} \pi\left(\log\left(\frac{G_1^*(\pi)}{\theta_L} + \frac{\bar{A} - G_1^*(\pi)}{\alpha}\right) + (1-q)\log\left(\frac{G_2^*(\rho_2^H)}{\theta_L} + \frac{\bar{A} - G_2^*(\rho_2^H)}{\alpha}\right) + q\log\left(\frac{G_2^*(\rho_2^H)}{\theta_H} + \frac{\bar{A} - G_2^*(\rho_2^H)}{\alpha}\right)\right) + \\ (1-\pi)\left(\log\left(\frac{G_1^*(\pi)}{\theta_H} + \frac{\bar{A} - G_1^*(\pi)}{\alpha}\right) + \log\left(\frac{\bar{A} - G_2^*(\rho_2^H)}{\alpha}\right)\right) \end{array}\right]$$

Now suppose the state of the world is $\theta = \theta_H$ in period 1, then the expected payoff over periods 1 and 2 is:

$$\hat{W}_{12}^{H} = \left[\begin{array}{l} \pi\left(\log\left(\frac{G_1^*(\pi)}{\theta_H} + \frac{\bar{A} - G_1^*(\pi)}{\alpha}\right) + (1-q)\log\left(\frac{G_2^*(1)}{\theta_L} + \frac{\bar{A} - G_2^*(1)}{\alpha}\right) + q\log\left(\frac{G_2^*(1)}{\theta_H} + \frac{\bar{A} - G_2^*(1)}{\alpha}\right)\right) + \\ (1-\pi)\left(\log\left(\frac{\bar{A} - G_1^*(\pi)}{\alpha}\right) + \log\left(\frac{\bar{A})}{\alpha}\right)\right) \end{array}\right]$$

Therefore, the donor's expected payoff over periods 1 and 2 is:

$$\hat{W}_{12} = (1-q)\hat{W}_{12}^{L} + q\hat{W}_{12}^{H} \tag{A5}$$

The equilibrium in lemma 1 is indeed an equilibrium if

$$\Delta \equiv \hat{W}_{12} - \widetilde{W}_{12} \geq 0\,. \tag{A6}$$

[32] Note we cannot add equations (1) and (2) in the main text to find the donor's expected payoff over the two time periods because those payoffs were computed on the assumption that the donor actually observed the leader's choice in period 1 before making his decision in period 2. In this case, he has to find his expected payoff over both time periods from the standpoint of period 1 (i.e., before the leader's choice is revealed).

[33] Assuming the cost drawn in period 1 carries over to period 2 simplifies the analysis. Following Besley and Smart (2007), we assume that nature draws a cost again in period 2.

We evaluate the expression in (A6) by taking the limit of $\widetilde{W}_{12}$ as $\varepsilon \to 0$ which means that $\hat{G}_1 \to G_1^{**}$. Consider the following two examples:

Example 1: suppose that $q = 0.8 > 0.5$, $\rho_1 = \pi = 0.5$, $\alpha = 3$, $\theta_L = 1$, $\theta_H = 1.5$, and $\rho_2\left(h \middle| g_1^H\right) = q\pi/(q\pi + (1-\pi)(1-q)) = 0.8$. Then $G_1^*(\rho_1) = 25.00\overline{A}$, $G_2^*(\rho_2^H) = 62.652\overline{A}$, and (A2) holds if $\delta \geq 0.266$. Recall that $G_2^*(0) = 0$, $G_2^*(\rho_2^L) = \overline{A}$, and $B_t^* = \overline{A} - G_t^*$, t = 1, 2.

Suppose $\overline{A} = 100$. Then given $\delta = 0.266$, we find that $\Delta \equiv \hat{W}_{12} - \widetilde{W}_{12} = 0.188$.

Example 2: Suppose $q = 0.48 < 0.5$, $\rho_1 = \pi = 0.7$, $\alpha = 3$, $\theta_L = 1$, $\theta_H = 2.9$, $\overline{A} = 100$, and $\rho_2\left(h \middle| g_1^H\right) = q\pi/(q\pi + (1-\pi)(1-q)) = 0.683$. Then $G_1^*(\rho_1) = 54.944\overline{A}$, $G_2^*(\rho_2^H) = 30.177\overline{A}$, and (A2) holds if $\delta \geq 0.674$.

Suppose $\overline{A} = 100$. Then given $\delta = 0.674$, $\Delta \equiv \hat{W}_{12} - \widetilde{W}_{12} = 0.247 > 0$. Therefore, given these parameter values, the equilibrium in lemma 1 is indeed a perfect Bayesian equilibrium.

Finally, it is easy to see that the honest type will not deviate from this equilibrium. Hence, any deviation must be by the corrupt type. Then the beliefs satisfy the intuitive criterion. **QED**

Note that since $\rho_2\left(h \middle| g_1^L\right) > \rho_2\left(h \middle| g_1^H\right) > \rho_2\left(h \middle| g_1 = 0\right)$, it follows that $\rho_2\left(h \middle| g_1\right)$ is increasing in g_1 in equilibrium. If q is sufficiently high, then $\rho_2\left(h \middle| g_1^H\right)$ is sufficiently high. This is the basis of part of condition (c) in proposition 1.

B2: Other equilibria (NOT FOR PUBLICATION)

A typical signalling game has several equilbria. Hence, the equilibrium we have focused on is not unique. Note that since an honest type embezzles no aid and a corrupt type embezzles all aid in period 2, the equilibria in this game will only differ in the behaviour of a corrupt type in period 1.

In any equilibrium, it is reasonable for the donor, given the equilibrium strategy of an honest type, to hold the out-of-equilibrium belief of $\rho_2(h|g_1) = 0$ if $g_1 \notin \{g_1^H, g_1^L\}$. Given this out-of-equilibrium belief, a corrupt type would choose either $g_1 \in \{0, G_1/\theta_H, G_1/\theta_L\}$ in any equilibrium. Also, in any equilibrium, $\rho_2(h|g_1 = 0) = 0$.

In any equilibrium, the level of the public good chosen by a corrupt type depends on the value of θ. Conditional on θ, we consider only pure strategies by a corrupt type. We do not consider hybrid equilibria in which, conditional on θ, a corrupt type adopts a strictly mixed strategy over the actions in the set $\{0, G_1/\theta_H, G_1/\theta_L\}$.

There are then nine possible equilibria to consider where the first entry in a set is the g_1 chosen by a corrupt leader when $\theta = \theta_L$ and the second entry is the g_1 chosen when $\theta = \theta_H$:

(a) $\{G_1/\theta_H, 0\}$, (b) $\{G_1/\theta_H, G_1/\theta_H\}$, (c) $\{G_1/\theta_L, G_1/\theta_L\}$, (d) $\{0, 0\}$, (e) $\{0, G_1/\theta_L\}$, (f) $\{G_1/\theta_H, G_1/\theta_L\}$, (g) $\{G_1/\theta_L, G_1/\theta_H\}$, (h) $\{0, G_1/\theta_H\}$, and (i) $\{G_1/\theta_L, 0\}$,

The equilibrium in lemma 1 is the equilibrium in (a). We have shown that (b) cannot be an equilibrium. It is obvious that (c) cannot be an equilibrium since $g_1 = G_1/\theta_L$ is not feasible when $\theta = \theta_H$. In (d), a corrupt type embezzles all aid (i.e., chooses $g_1 = 0$) in period 1 regardless of the value of θ. This cannot be an equilibrium because the donor will give *only* project aid in periods 1 and 2 if a corrupt leader adopted this strategy.

Obviously, (e) and (f) cannot be equilibria since $g_1 = G_1/\theta_L$ is not feasible when $\theta = \theta_H$.

In (g), a corrupt type follows the strategy of an honest type and embezzles no aid. But this cannot be an equilibrium because he is better off embezzling some aid.

In (h), $\rho_2\left(h|g_1^H\right) = \pi q/(\pi q + (1-\pi)q) = \pi > 0$. Suppose $\theta = \theta_H$, then a corrupt type will produce $g_1 = G_1/\theta_H$ if $\delta G_2 \geq G_1$. However, this cannot hold because $G_1 > G_2$, given that $\rho_2\left(h|g_1^H\right) = \pi = \rho_1$. Hence (h) is not an equilibrium.

In (i), $\rho_2\left(h\middle|g_1^L\right) = \pi$. Suppose $\theta = \theta_L$. In this case, $\rho_1 = \pi = \rho_2\left(h\middle|g_1^L\right)$. Hence if $\theta = \theta_L$ and a corrupt type produces $g_1 = G_1/\theta_L$, then the strategy in (i) is an equilibrium if $\delta G_2 > G_1$. However, this is not possible because, given that $\rho_1 = \pi = \rho_2\left(h\middle|g_1^L\right)$, $G_1 > G_2$

In sum, when the donor's belief that the leader is honest is too low then there is a unique pure-strategy equilibrium in which the donor gives no program aid in both periods. The equilibrium in lemma 1 is unique if π, δ, and q are sufficiently high and the inequality in (A6) holds.

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