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"Taxing Fragmented Aid to Improve Aid efficiency"

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Taxing Fragmented Aid to Improve Aid Efficiency*

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Abstract

We present a model with two donors-principals that provide funds to a unique recipient-agent. Each donor decides how to allocate his aid funds between a pooled and a donor specific unilateral project. Both principals and the agent value the output produced with the principals' pooled and two unilateral funded projects. However the donors have a bias in favor of their own unilateral project, which leads them to over-invest in these projects. The agent establishes a tax on the unilateral projects, which acts as a protection measure against biased allocation by the principals. The optimal tax imposed by the recipient on unilateral projects varies depending on the total amount of aid provided by the donor and on the productivity of his unilateral project. We present empirical support on the donors' preferences for unilateral projects, and how allocations and fragmentation are affected by recipient's characteristics.

Keywords: Aid fragmentation, incentives, multi-principal, Development

JEL codes: D82, D86, F35, O19

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1 Introduction

Until recently the literature on aid has focused on recipient countries and macro-economic issues. After several decades of empirical studies, the effectiveness of aid in promoting growth is still very much debated.[1] One concern with the macro approach is that it aggregates at the country level the different sources of aid and treats them as a single pool. Yet in practice aid is fragmented and this fragmentation, both between donors and channels of delivery, is a major source of inefficiency. Recent papers have thus started to focus on donors behavior and micro-economic issues. This paper contributes to this literature by studying how the introduction of a tax on unilateral aid might be used to increase aid effectiveness. To be more specific we study in a two-principals-agent model how a recipient country (the agent) might use taxation to alleviate the problem of aid fragmentation posed by the donors' uncoordinated competition (the principals). By raising the cost of allocating aid to unilateral projects, relative to pooled aid, the recipient country obliges the donors to internalize the negative externalities they create on development outcome by their uncoordinated behavior. The paper therefore proposes a new, simple tool to improve aid effectiveness. If a donor country insists on pushing its own development goals, it should pay a fee for it. The recipient countries should be allowed to impose a tax on uncoordinated/unilateral aid flows. The money collected could be used to improve recipient's country administrative capacity.

The aid business is a maze. Alongside the official development assistance (ODA), which includes the bilateral aid traditionally provided by OECD-DAC countries, but more recently also by emerging countries such as China, Brazil or the Arab countries,[2] and the multilateral aid provided by multilateral organizations such as the World Bank or the Regional Development Banks, there are thousands of national and international NGOs, foundations and private entities providing aid. Moreover, not only official development assistance is coming from different countries and organizations, but even at a country level it is spread among several agencies. For instance US foreign assistance programs are fragmented across more than 50 bureaucracies and USAID is overseeing only 45% of total US foreign aid (Brainard 2007).[3]

From the point of view of the recipients, aid fragmentation generates huge transaction costs. For example, the Tanzanian government has to prepare over 2000 reports to donors and 1000 delegations every year (Easterly and Birdsall

[1] Many empirical studies suggest that aid has a zero effect on growth or on poverty (Boone 1996; Svensson 1999, 2000; Knack 2001; Brumm 2003; Ovaska 2003; Easterly et al. 2004; Djankov et al. 2006; Easterly 2006; Powell and Ryan 2006; Williamson 2008). Some papers argue that good policy in recipient countries increases the effect of aid (see for instance the papers by Svensson 1999 and Burnside and Dollar 2000), while subsequent studies suggest that the effect is not robust (see for example, Hansen and Tarp 2000, Easterly et al. 2004 and Rajan and Subramanian (2007)). Even surveys of the empirical literature find controversial results (see for instance Doucouliagos and Paldam 2007).

[2] See Waltz and Ramachandran (2011) for a review of the behaviour of emerging donors.

[3] Similarly in Germany the ministry for international cooperation coordinates less than 40% of all German development aid. See http://ipsnews.net/news.asp?idnews=46043

2008). The management of donor visits became such a big problem that the country had to declare a 'mission holiday' – a four month period to take a break from visiting delegations (Birdsall 2005). Each of the donors represents different accountability and procurement rules, and the need to make the project the donors want to fund match with the existing recipient country's portfolio. As a result administrative costs have absorbed 4.7% of gross bilateral ODA in 2005, which is big compared to the 9.6% that went to humanitarian and food aid or the 2.2% that went to NGO's (OECD 2008).

The donor community acknowledges the 'Donor coordination' problem, but efforts so far to fix it have been deficient. In fact, since the Paris Declaration on Aid Effectiveness, fragmentation of aid has increased instead of diminishing.[4] For instance, looking at sector aid data for the Development Assistance Committee (DAC) donors, Frot and Santiso (2010) find that, in 2007, more than 90 000 projects were running simultaneously and that developing countries with the largest numbers of aid projects had more than 2 000 projects in a single year. With such a proliferation of projects and donors it is hard for recipient government representatives to coordinate and manage aid flows. Only a part of the projects are actually known by the different offices, that usually struggle to obtain information on what is really going on in the area. Confusion on available resources and procedures to reach them is common.

If there are unrealized benefits from donors coordination why isn't aid pooled to enable more development projects to be undertaken? There are various possible responses to this question, and the answer may be different in different countries. Some recipient governments may not have the objective of maximizing social well-being, possibly because of inefficient or corrupt implementation of projects, and so donors want to control aid to ensure that it is used efficiently. Perhaps the assumption of donors focusing on development outcomes in recipient country is false in practice. They might have their own agenda such as promoting their exports or maximizing media coverage in their own country, in which case they set their own projects and their own administrative rules, without much consideration for what other donors do. Or perhaps, as the literature has discussed, donors have different preferences than the recipients about development outcomes.[5] Whatever the reasons, most donors want to control the way their aid is spent. It is easier to achieve this goal through bilateral aid (i.e., government-to-government aid) rather than through multilateral aid (i.e., aid given by governments through international organisations such as the UN, the

[4]The Paris Declaration on Aid Effectiveness was signed in 2005 by more than 100 countries to reform the ways in which international aid is delivered and managed. Following the Paris Declaration, the Accra Agenda for Action signatories committed to 'reduce the fragmentation of aid by improving the complementarity of donors' efforts and the division of labour among donors, including through improved allocation of resources within sectors, within countries, and across countries' (source: 2008 report on division of labour: addressing global fragmentation and concentration). In 2005-06, 38 partner developing countries had more than 25 official donors, most of them small (OECD 2008). In 24 of these developing countries, 15 or more donors provided less than 10% of that country's total aid (OECD 2008).

[5]Alesina and Dollar(2000) is the seminal paper on donor's motivations, while Kilby and Dreher (2010) study how donors motives affect aid effectiveness

World Bank, the European Commission). As a result bilateral aid constitutes the vast majority of ODA (e.g., $ 102 billion in 2009), while multilateral aid constitutes a smaller fraction of ODA (e.g. $ 38 billion in 2009).

We develop a model with one recipient-agent and two donors-principals. Each of the donors can choose the share of his funds that he wants to pool and the share that he wants to use in unilateral projects. The production function of development depends positively on the three inputs (pooled funds and each unilateral project). They are complement in the sense that the development good is only produced if a minimum of each of these inputs is provided. However for donors with biased preferences their unilateral project has more value to them than to the recipient. In the limit case the unilateral project has no value for the recipient. To avoid the waste of funds and oblige the donors to internalize the cost imposed by their biased preferences on the production of development, the paper explores the possibility for the recipient to impose a tax on the unilateral projects. So in our setting there are two principals that provide funds to a unique agent and: (i) both principals and the agent value the output produced with the principal's (pooled and unilateral) funded projects and this output is non-excludable and non-rival, (ii) each principal gets a private benefit from the funds to the unilateral project, and (iii) the agent can tax the unilateral projects.

Even if the donors are benevolent, we find that the principals' budgets play an important role on the efficiency of aid. Concretely an unbiased donor focuses on development outcome, while a benevolent recipient maximizes development outcome minus administrative costs (i.e., is trading-off macro-economic objectives with micro-economic constraints). Because of the administrative costs involved in aid management there is a maximum volume of aid that the recipient can handle. Above this threshold the aid is wasted. Moreover, we find that the way the aid budget is distributed between the donors matters. A necessary condition for the uncoordinated outcome to be efficient (i.e., to be the outcome that would be chosen by benevolent, fully coordinated planners) is that the aid budget of each principal is proportional to the relative productivity of his unilateral project. This first result militates against the micro-aid scheme favored by some donor countries. For instance among the 3700 aid relationships tracked down in the OECD Development Co-operation Report (2009), 600 are micro-aid schemes of under USD 250 000 per year each, and amounting to only 0.1% of country programmable aid. Such cosmetic aid should be banned as it creates more problems than it solves.

In addition to the inefficiency generated by an inadequate distribution of budgets among the donors, there is also the fact that some donors have a private agenda and want to favor some projects over others for their own benefit. We show that with biased principals the contributions to unilateral projects are greater than the welfare maximizing levels, even when the agent values the projects and there are no moral hazard issues. The distortion increases with the bias. There is a limit however: the investment made in the unilateral project is constrained by donor's budget (i.e., he cannot spend on unilateral project more than his total budget).

The paper explores next the possibility for the recipient to impose a tax on the unilateral projects to limit the consequences of the uncoordinated behavior by multiple donors. In order to optimize the allocation of funds across the different projects the agent might charge each principal a payment proportional to the amount he wants to invest in his own project. The fee/cost imposed by the recipient for unilateral projects acts as a protection measure. Even if it is a pure waste of resources, it decreases unilateral allocations bringing them closer to the first best level. By taxing the unilateral funds the recipient can thus correct for the principals' biais, and hence the loss of resources due to the transfers requested by the agent is compensated by an allocation of funds which is closer to the coordinated level.

From a policy perspective this mechanism is appealing as it is simple and might help to finance the administrative costs imposed by the management of fragmented aid on the recipient country. The paper studies the optimal taxation scheme from the recipient point of view. The paper shows that the optimal tax rates should be different for different donors. This is a concern for the implementation of such a corrective taxation scheme. Assuming the donor's community agrees on the utility to tax unilateral aid to reduce fragmentation and to strengthen recipients countries administrative capacity, it is unlikely that the donors will agree on different tax rates for different donors.

From an empirical point of view we want to check the existence of donors' biases in aid allocation as these biases are the rationale to implement a taxation scheme on unilateral aid. We are also interested on how the individual behavior of donors depends on the amount and composition of the aid received by the recipient and the behavior of other donors at same recipient. Indeed the model predicts that each donor unilateral contribution is increasing in his private benefits from the unilateral project (i.e., donor's bias) and is also increasing in own and other donor's budget. Unfortunately the available data on aid channel delivery is not great. There is only a 2 years window where the data recording is detailed enough so that we can identify with some confidence unilateral and multilateral aid. Exploiting this 2 years panel the results are consistent with the model prediction. In particular using a methodology proposed by Knack (2013) to assess the extent of donor bias the regressions suggest that donors with a stronger bias allocate more funds trough the unilateral channel. Since the quality of the available data allows only for correlation analysis, we interpret these preliminary results as an encouragement to further explore the possibility to impose administrative fees on donors that insist in pushing their own aid projects with their own accounting rules.

The paper is organized as follows. Section 2 presents a review of the literature. Section 3 presents the model. Section 4 studies the benchmark situation of coordinated principals: principals' funds are pooled and a benevolent planner allocates them to different projects to maximize development returns. Section 5 presents the uncoordinated principal's setting and derives the optimal taxes that the agent should impose for the implementation of the principals' unilateral project. Section 6 presents empirical evidence to assess the relevance of principal biased preferences. Finally section 7 offers some concluding remarks.

2 Relationship with the Literature

The Rome Declaration on Harmonisation (2003) highlights the need to harmonize the operational policies, procedures, and practices of donor institutions with those of partner country systems to improve the effectiveness of development assistance.[6] Transaction costs and problems on the coordination of projects controlled by a pool of donors have been the main concerns in the aid coordination literature, as summarized in Bigsten (2006).

The literature on the adverse effects of donors fragmentation on aid effectiveness is extensive and has looked at the problem from different angles. Knack and Rahman (2007) study the impact of donor fragmentation on bureaucratic quality of aid recipients given the competition for skilled labor. Knack and Rahman (2008) summarize the problems of donors fragmentation highlighting the problem of responsibility diffused between donors and the possible dis-alignment of incentives among them. They emphasize the need for recipients to be able to select a leader donor, and cite examples on recipients declining stand-alone projects. Knack and Smets (2012) analyze the relationship between fragmentation and tying from the donor's side. They show that untying aid and reducing fragmentation turn out to be complementary interests for the donors. Easterly and Pfutze (2008) analyze donor's distribution of funds among the many recipients and how it relates to good aid practices. Djankov et al. (2009) study the impact of aid fragmentation on efficiency and corruption. Dreher and Kilby (2009) show that donors motives matter on aid effectiveness, and hence that private benefits from unilateral projects should be taken into account. Bobba and Powell (2006) open the black box of the cause of aid fragmentation, and show that donors face a trade-off between coordination costs and dilution of individual objectives when choosing between bilateral and multilateral contributions. Achaya et al (2006) analyze donor proliferation. Easterly and Pfutze (2008) and Easterly and Williamson (2010) analyze the best and worse practices of aid agencies and the remedies donors should implement to alleviate the problem.

The literature tends to look at the problems (causes and consequences) of aid fragmentation from the donors community perspective. The novelty of our approach is to look at the fragmentation problem from the recipient's point of view, and not from the donors point of view.[7] Our paper is therefore complementary to the aforementioned literature as we explore the actions the recipient might take to discipline the donors and alleviate the problem posed by aid fragmentation. In our setting the recipient draws taxes (or administrative fees) for

[6] See for example Balogun (2005) for the distinction between harmonization of procedures, alignment of objective and ownership. Acharya, Fuzzo de Lima and Moore (2004) present a good description of the different measures of donor proliferation.

[7] There is a vast literature on aid contracting, including among others Azam and Laffont (2003), Svenson (2003), Morrissey, Clist and Issopi (2012), that works on conditionality. This literature also looks at the problem of aid effectiveness from the donors perspective: The problem is the recipient behavior and aid conditionality is a tool to influence the recipient's use of the aid. Our approach, on the other hand, centers on the donor's biased decision and how it can be corrected by the recipient's taxation policy.

the implementation of unilateral projects as protection measures to inefficient donors' allocations. He does not reject unilateral projects if they are useless, he taxes them to reorient the aid flow where it is most needed. The tax instrument therefore fills a double purpose. First it helps the recipient country to collect funds to strengthen its administrative capacity to overcome the problems illuminated by Roodman (2006 $[a, b]$) and Knack and Rahman (2007). Second it helps to align the interests of the donors with the interest of the recipient, which is a major challenge as shown, for instance, by Bobba and Powell (2006), Knack and Rahman (2008), and Dreher and Kilby(2009). It is a stick used to keep the donors in line and to modulate their aid flows. In that sense, our paper looks at the reverse problem of the investment coordination model presented in Bond and Pande (2007), where taxes were used as an incentive device in a multi-agent moral hazard model.

In our model we prove the existence of an upper bound on the donors' aggregate budget above which the recipient stops using the aid money. This upper bound, above which the utility of the recipient is decreasing, comes from the agent's management costs and the decreasing returns to scale of the development production function. Waste of resources in our case comes both from agent's and principals' choices, in contraposition to the usual approach of only considering administrative burdens on agents, as in Roodman (2006 $[a, b]$). We coincide with Roodman (2006 $[a, b]$) in highlighting that increasing aid budget does not necessarily lead to higher development production, since we coincide with them in giving an upper bound on the budget that can be 'managed' by each recipient: in their paper this bound is given by the administrative capacity, while in ours it is determined both by the productivity of each of the projects, and the recipients's management costs.

We also find that the allocation of funds among projects in one sector can be unbalanced (either due to unbalanced aid budget between the donors or due to bias in donors' preferences). This result is a complement to Halonen-Akatwijuka (2007) who study the allocation of funds among sectors to avoid donor concentration in some sectors and underfunding of others. We look at the allocation of funds inside one sector, and there is no crowding-out of agent's choices due to aid, as in Torsvik (2005). Nevertheless we show that under/over funding of some projects inside a sector is a problem too.

Finally from the empirical point of view, we are interested on how the individual behavior of donors depends on their bias, the amount and composition of the aid received by the recipient and the behavior of other donors at same recipient. We draw heavily on the evidences provided by Knack (2013), which is discussed in section 6.

3 The model

In our setting we have two principals (the donors), denoted by $k = 1, 2$, that provide funds to a unique agent (the recipient), denoted r. We consider two possible channels for the funds delivery:

- Unilateral aid projects, referred to as $a = 1, 2$, implemented by the recipient government according to the principal's $k = 1, 2$ established procurement rules
- Pooling of funds, referred to as $a = p$, where both principals join efforts for the design and implementation of the project and jointly bargain with the agent.

Let B_k be the principal k total aid budget, and let p_k and u_k be the amount contributions to the pool and to the unilateral project respectively. For the proposal of an unilateral project, the principal needs to pay a percentage c_k of the value of the unilateral contribution to the recipient. That is, c_k is the cost of the agent's pre-requisites for unilateral projects. It can be interpreted as a tax to cover the expenses of meetings with the recipient and bargaining. It is a tool to regulate the flow of aid that goes into unilateral aid. Hence, the budget constraint for principal $k = 1, 2$ is given by:

$$B_k = p_k + (1 + c_k)u_k \tag{1}$$

Funds are transferred by each principal to the agent. The total development outcome depends on the volume of aid which is allocated to each project. To keep the analysis simple we focus on a development production function of the Cobb-Douglas form with coefficients $\alpha_a \geq 0$ $(a = 1, 2, p)$:

$$G(u_1, u_2, p) = u_1^{\alpha_1} u_2^{\alpha_2} p^{\alpha_p} \tag{2}$$

where $p = p_1 + p_2$ denotes the total amount of funds in the pool. We rule out the optimization problem linked to non-convexity by assuming decreasing returns to scale.

$$\alpha_1 + \alpha_2 + \alpha_p \leq 1 \tag{3}$$

The Cobb-Douglas function implies that independent projects cannot be successful in absence of the pooled activity, and that the pooled project cannot be successful without the support of the unilateral activities.[8] For example, if pooled funds go to recurrent expenditures for hospitals and dispensaries, one of the donors has a unilateral program to fund medical supplies and pharmaceutical and the other funds a tutoring program for nurses and doctors, the independent projects cannot be successful if the hospitals and dispensaries are not open and running (i.e. if the pooled project is not successful), and the reverse argument also holds. Similarly in a situation where pooled funds go to recurrent education expenditures, one of the donors funds a unilateral nutrition program and the other donor funds a tutoring program, the unilateral projects cannot be successful if the school is not open and running. The output

[8] In this case, the public good is necessary for each donor for his unilateral project to work. The situation is reverse of the incentives on CSR approaches to public goods as Besley and Ghatak (2007). The concern now is more on the public versus private benefit from the contributions, as in Besley and Ghatak (2006).

education is only attained when the three projects work simultaneously. Each donor gets benefit from the development good produced plus additional rents from the unilateral project contributions. Hence, the contribution to the pool is a public good. Each donor has an incentive to wait for the other donor to contribute to get better returns on its own unilateral project. Yet someone has to put something in the pool to get results from the unilateral projects.

Finally in some cases the unilateral project of one principal might have no impact on development. Such useless projects are referred by the international community discussing aid as 'SWEDOW' (for 'stuff-we-don't-want').[9] In this case the coefficient α_a corresponding to this unilateral project will be equal to 0.

Let $B = B_1 + B_2$. Since by virtue of (1) $p = B - (1 + c_1)u_1 - (1 + c_2)u_2$ and since $\alpha_p \leq 1$ the production function $G(.)$ in (2) is increasing and concave in $B = B_1 + B_2$. That is, the greater the budgets the better, with decreasing returns.

3.1 Principal's utility

Principals care about the development outcome produced through their funds allocation but they also may derive utility from the visibility of their unilateral project and from the establishment of procurement rules that directly or indirectly benefit their own commercial and political interests. Principal's $k = 1, 2$ utility has the form:

$$U_k(u_k) = G(u_1, u_2, p) + \zeta_k H(u_k) \tag{4}$$

Term $\zeta_k \geq 0$ is the bias in principal k preference for his own unilateral project. The weight ζ_k decreases with altruism. It would be zero for a perfectly altruistic principal, or unbounded for a perfectly egoistic principal for whom development returns represent a negligible part of the utility.[10] Term $H(u_k)$ is a strictly increasing and concave function of the unilateral contribution u_k:

$$H'(u_k) > 0 \quad \text{and} \quad H''(u_k) \leq 0 \tag{5}$$

Each principal maximizes (4) by choosing the allocation

$$u_k \in [0, \frac{B_k}{1 + c_k}]$$

compatible with his budget constraint (1) and subject to the agent's individual rationality constraint that is derived below.

[9] To illustrate what a SWEDON is see for instance the post Tom Murphy wrote at http://www.humanosphere.org/basics/2013/07/romney-ryan-campaign-lives-on-in-kenya/

[10] As Powell and Bobba (2006) show, donors face a trade-off between coordination costs and dilution of individual objectives when choosing between bilateral and multilateral contributions. We look at this problem from a single recipient problem: proceed with unilateral projects with private benefits or contribute to the pool where each donor preferences are diluted. Milner and Tingley (2011) discuss the choice of multilateralism from a US foreign policy prospective.

3.2 Agent's utility

The recipient chooses the level of the fee $c_k \geq 0$ $(k = 1, 2)$ to be paid by each of the principals for the establishment of unilateral projects in the country. This fee can be a real tax that helps financing public expenses. It might also represent the value of the perks when the agent used part of the received funds for private use (e.g. such as fancy SUV cars, trips, and restaurants). As Williamson and Agha (2008) point out, funding activities parallel to the pooled funds generate multiple material and non-material benefits for the ministers and civil servants of the sectors involved. The important point is that it is lost to the principal k and to the development project.[11] For the agent, this fee represents a reduction of the funds to be managed and hence a reduction in the cost of investment. As discussed in the aid literature, developing countries have limited administrative capacity (see for instance Knack and Rahman (2008), McGillvray and Morrissey (2001), Lloyd, Morrissey, and Ossei (2005)). Managing many unilateral projects is very costly for them. In this context, the fees represent for the agent a relative utility gain when he does not have to manage all the unilateral aid funds, but only a fraction of them.

The agent's cost of investing the received funds depends on the amount of funds to be managed. We assume that the cost of managing funds $\Psi(.)$ is increasing and convex in the flows received.[12] By virtue of (1) $p_1 + p_2 = B - (1 + c_1)u_1 - (1 + c_2)u_2$. Agent's investment cost is given by the increasing and convex function:

$$\Psi(p_1 + p_2 + u_1 + u_2) = \Psi\big(B - u_1c_1 - u_2c_2\big)$$

Similarly $G(u_1, u_2, p) = G(B, u_1, u_2 \mid c_1, c_2)$. The agent's objective is to choose (c_1, c_2), the fees level for handling unilateral funds, to maximize his utility given the principals' funds allocation. The agent's utility in case he chooses to invest the aid funds in the projects is given by

$$U_r(c_1, c_2) = G(B, u_1, u_2 \mid c_1, c_2) - \Psi(B - u_1c_1 - u_2c_2)$$

In case the agent chooses not to invest in any of the projects, his utility is 0. To avoid the funds wasting the agent individual rationality constraint is

$$G(B, u_1, u_2 \mid c_1, c_2) - \Psi\big(B - u_1c_1 - u_2c_2\big) \geqslant 0 \tag{6}$$

The agent receives benefits from the output produced with the transferred funds that cannot be appropriated by the principal. In comparison with the standard moral hazard models, the principal has one instrument less since he cannot choose the share of the 'public good' produced that can be appropriated

[11] We could add to the analysis a function $\Gamma(c_1u_1 + c_2u_2)$, increasing and concave, that would be the utility received by the agent from the fees requested to the principals for the unilateral projects. This would not change our results.

[12] We abstract here of interactions among the different projects on effort costs. For example, Knack and Rahman (2007) study how recipient's bureaucratic quality is affected by donor's preferences and number of projects.

by the agent: here the production of development is enjoyed in a non-excludable way by both principals and by the agent. This is in contrast to what usually occurs in piece rates or sharecropping agreements. Hence, it is likely that when the development outcome is high so that investment gives large returns to the agent, the participation constraint does not bind.

Timing is as follows:

1. The agent announces $c_1 \geq 0$ and $c_2 \geq 0$, the cost to be paid by the principals for the management of their unilateral projects.
2. Each donor chooses simultaneously the share of his budget to be allocated to the pool and the share allocated to the unilateral project.
3. The recipient takes the decision of whether or not to invest the fund in the development project.

In our model, both the agent-recipient and the principals-donors take decisions, namely the costs for unilateral projects and the allocation of funds, that affect the development returns from a given budget. In our case, agent's contribution to the production is his choice of using the aid money in a productive way, and is a necessary ingredient for aid effectiveness, so in contrast to Torsvik (2005) there is no crowding-out of agent's choices due to aid. Moreover, waste of aid resources in the form of a tax comes from agent's choices and is imposed on the principals, in contraposition to the usual approach of only considering administrative burdens on agents, as in Roodman (2006 $[a, b]$). It is a tool to better align donors and recipient interests. Since the objective functions of the recipient and of the donors are not aligned, and since all of them make decisions that influence the development outcome, the solution to the aid allocation game is quite complex. We first solve the benchmark case where principals coordinate their allocation of funds.

4 Benevolent planner's problem

In this section we derive the first best solution from a centralized and benevolent principal point of view. We assume the principals pool all their resources and then choose the allocation to each type of project so as to maximize aggregate development returns G. In this case the budget constraint when both principals funds are merged is

$$B = B_1 + B_2 = (1 + c_1)u_1 + (1 + c_2)u_2 + p \tag{7}$$

where p represents funds that go to the pool and u_1 and u_2 the funds that go to the projects implemented unilaterally by principal 1 and 2 respectively. The principals transfer aid money if the development project is worthwhile for the agent. No funds are transferred otherwise.

On a totally coordinated setting with monitored investment, the planner maximizes development returns. The benevolent planner solves

$$\max_{u_1,u_2} \; G(B,u_1,u_2 \mid c_1,c_2) = u_1^{\alpha_1} u_2^{\alpha_2} \Big(B-(1+c_1)u_1-(1+c_2)u_2\Big)^{\alpha_p}$$

under the aggregated budget constraint (7). Since $\alpha = \alpha_1+\alpha_2+\alpha_p \leq 1$, the optimal allocation of funds is given by

$$u_1^* = \frac{\alpha_1}{\alpha}\,\frac{B}{1+c_1} \tag{8}$$

$$u_2^* = \frac{\alpha_2}{\alpha}\,\frac{B}{1+c_2} \tag{9}$$

$$p^* = \frac{\alpha_p}{\alpha}\,B \tag{10}$$

Development outcome is given by

$$G^*(B,c_1,c_2) = \left(\frac{\alpha_1}{1+c_1}\right)^{\alpha_1}\left(\frac{\alpha_2}{1+c_2}\right)^{\alpha_2}\alpha_p^{\alpha_p}\left(\frac{B}{\alpha}\right)^{\alpha} \tag{11}$$

that is concave in the budget B given the non increasing return to scale assumption $\alpha_1+\alpha_2+\alpha_p \leq 1$. Let

$$\Omega = \frac{\alpha_1^{\alpha_1}\alpha_2^{\alpha_2}\alpha_p^{\alpha_p}}{\alpha^{\alpha}} \tag{12}$$

The agent's utility when he takes into account the planner's optimal allocation is given by:

$$U_r(B,c_1,c_2) = G^*(B,c_1,c_2) - \Psi\left(B - \tfrac{c_1}{1+c_1}\tfrac{\alpha_1}{\alpha}B - \tfrac{c_2}{1+c_2}\tfrac{\alpha_2}{\alpha}B\right) \tag{13}$$

To make the analysis interesting we focus on cases where the agent is willing to take the aid fund and uses it in a productive way rather than to simply turn it down or destroy it. This requires that condition (6) holds for some value of the parameters, and thus that the function $\Psi(B)$ is relatively small compared to $G^*(B,0,0)$, at least for some value of B. We hence assume in the sequel of the paper that $\Psi(0) = \Psi'(0) = 0$ so that there exists a strictly positive value of B, denoted $\overline{B}$, such that

$$\Omega B^{\alpha} = \Psi(B). \tag{14}$$

Under our assumptions ($\alpha \leq 1$ and $\Psi(x)$ strictly increasing and convex), the function $\Omega B^{\alpha} - \Psi(B)$ is strictly concave. Moreover, since $\Psi'(0) = 0$, it is strictly increasing when $B \to 0^+$ so that $\overline{B} > 0$ exists. We also deduce that there exists a value of B, lower than $\overline{B}$ so that $\Omega B^{\alpha} - \Psi(B)$ is maximal. Let $B^{a*} > 0$ be the optimal coordinated budget from the agent's point of view (i.e., taking into account the cost of managing them). It is such that[13]

$$\alpha B^{\alpha-1}\Omega = \Psi'(B). \tag{15}$$

[13]Since $\Psi'(B)$ increases with B and since $\alpha B^{\alpha-1}\Omega$ is not increasing with B (i.e., it decreases if $\alpha < 1$ and is constant if $\alpha = 1$), these two functions cross at most once. It is easy to check that under the assumption $\Psi'(0) = 0$ $\underline{B} > 0$ hence exists and is unique.

We have $0 < B^{a*} < \overline{B}$. For the sake of interpretation it is convenient to assume that $\Psi(B)$ is initially sufficiently small so that $\overline{B} >> 0$ (i.e., $\overline{B}$ is large).[14] The agent has no incentive to waste the money at the optimum whenever $B \leq \overline{B}$ (i.e., agent's individual rationality constraint holds). If the principals choose to give much more than $\overline{B}$ the extra aid money is wasted as the agent is not willing (unable) to handle it. Let $\overline{B}$ be defined by equation (14). The next assumption helps us to rule out corner solutions.

A1 $$B \leq \overline{B}$$

Given the planner's allocation of funds, the agent chooses whether to ask for special fees for unilateral projects, i.e. he optimizes on the choice of c_1 and c_2. The optimal agent's decision depends on the trade-off between the benefits of these fees (i.e., decrease in investment/management costs) and the loss of development outcome.

The agent's utility (13) is not necessarily concave in (c_1, c_2). Indeed the function $G^*(B, c_1, c_2)$, which is decreasing in c_1 and in c_2, is convex in (c_1, c_2), while the function $-\Psi(B - \frac{c_1}{1+c_1}\frac{\alpha_1}{\alpha}B - \frac{c_2}{1+c_2}\frac{\alpha_2}{\alpha}B)$ is increasing and concave in (c_1, c_2). This implies that we do not necessarily get an interior solution.

Proposition 1 (Agent's requests with coordinated principals) *Under assumption A1 the agent sets a uniform $c_1 = c_2 = c^* > 0$ solution to*

$$\Psi'\left(B\frac{\alpha + \alpha_p c}{\alpha(1+c)}\right) = \alpha B^{\alpha-1}\Omega(1+c)^{1-\alpha_1-\alpha_2} \tag{16}$$

if and only if $B \in [B^{a*}, \overline{B}]$ where B^{a*} is defined equation (15) and $\overline{B}$ equation (14). He sets $c_1 = c_2 = c^* = 0$ otherwise.

Proof. See the appendix 8.1. ■

[14] For instance if $\alpha = 1$ and $\Psi(B) = \frac{B^2}{2\psi}$, ψ is a large number so that $\overline{B} = 2\Omega\psi$ is large too.

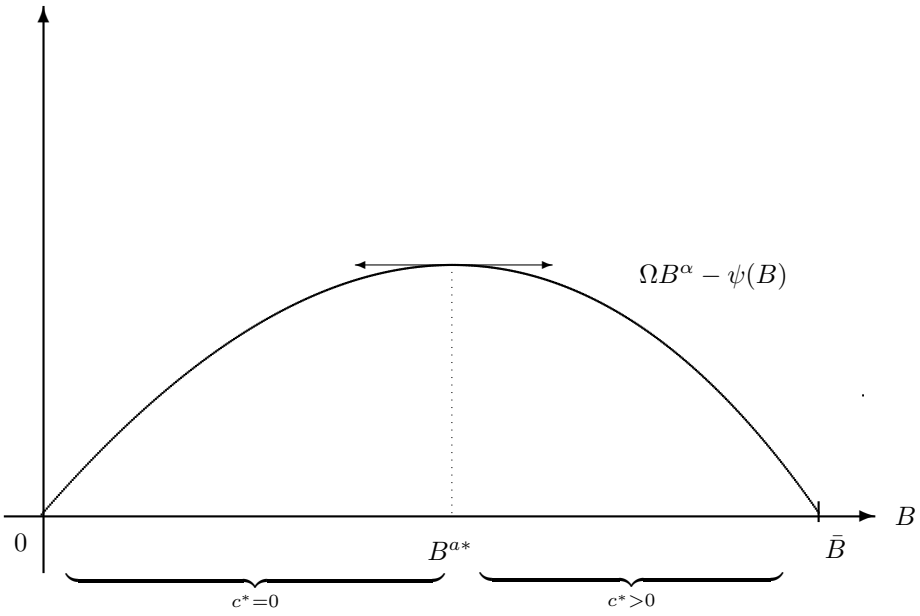

Figure 4

Figure 4 illustrates the result of Proposition 1. The agent would be willing to choose different $c's$ for the two unilateral projects according to their relative productivity, but that is already accounted for by the coordinated principal's allocation so that at the optimum they are equal. When the total budget of the principals is lower than B^{a*} the cost of managing the fund is sufficiently low so that the agent does not want to charge positive fees. The agent puts a distortion on the allocation to unilateral projects when the marginal benefit from increasing c over zero in terms of investment cost reduction is greater than the marginal loss in terms of development outcome, which occurs when $\Psi'(B) > \alpha B^{\alpha-1}\Omega$. For instance with $\alpha = 1$ (i.e., constant returns to scale) the condition is simply $\Psi'(B) > \Omega$. The condition holds more easily when the global budget B is large and/or when the unilateral projects have a relative low effect on the development production function (i.e., when either α_1 or α_2 are small so that $\Omega = \alpha_1^{\alpha_1}\alpha_2^{\alpha_2}(1-\alpha_1-\alpha_2)^{1-\alpha_1-\alpha_2}$ is small). This first result illustrates that, even if the principals are fully coordinated and altruistic, there is a benefit for the recipient to charge strictly positive fees. The principals focus on development outcome and they neglect the administrative burden the management of these funds impose on the recipient. The later imposes a tax on the unilateral funds to oblige the principals to internalize this cost.

From a policy perspective Proposition 1 implies that, everything else being equal recipients getting more aid (i.e., larger B) should request strictly positive fees $c^* > 0$, even in the fully coordinated case. Moreover totally differentiating (16) one can check that the fee c^* is increasing with B. In other words, Proposition 1 implies that the fee requested by the recipient should be increasing with

the amount of aid received.

5 Independent principal's choice

We are now turning to the more realistic case of independent principals. Our goal is to compare the independent principals' choice with the first best outcome derived in the previous section where all funds were pooled and allocated to the three projects by an output-maximizing planner. In doing so, we want to study how principals' and agent's choices affect development outcomes. On the one hand, we look at the loss in output due to the distribution of budgets among the donors and their biased preferences towards unilateral projects. On the other hand, we want to check in which situations the taxes on unilateral projects imposed by the agent are output increasing and hence their 'waste' is compensated by a better choice of channel of delivery by the principals.

When choosing the channel of delivery for aid funds, the principal's problem differs from the benevolent planner's in several aspects:

1. Each principal is constrained by his own budget to allocate to the unilateral and pooled project, while the benevolent planner may use the sum of funds to allocate to the three alternatives.

2. Principal's preferences may differ from the benevolent planner's preferences: The principals may have biased preferences as they obtain special benefit from their own unilateral projects.

3. The pooled funding is a public good for both principals, which increases the productivity of the unilateral projects. Hence, there may be a problem of free riding when each principal optimizes his objective function independently.

We present a special case of common agency: we have two principals that use a common agent to achieve a development goal. In our case, common agency is not a problem of which actions to incentive, as in Berheim and Whinston (1986),[15] but a problem of how funds are allocated by each principal to maximize his investment returns and how these decisions affect the agent's incentive to charge positive fees on the unilateral projects. Given the complementarity among the different projects, the principals agree on that the agent should use the funds to finance all projects. They might however disagree on the amounts that should be invested in each of them.

[15]The literature on common agency is extensive, especially on common agency with adverse selection. For instance Khalil, Martimort and Parigi (2007) study monitoring coordination, Martimort and Stole (2009) study principal's coalitions, and Alonso, Dessein and Matouscheck (2008) study when coordination requires centralization.

5.1 Principals' allocation problem

We start the analysis with the case of altruistic principals: $\zeta_1 = \zeta_2 = 0$. The principals' objective functions are identical but the budget constraints are different because in general $B_1 \neq B_2$:

$$\max_{u_k} G(B_k + B_j, u_k, u_j \mid c_k, c_j)$$
$$s.t. \text{budget constraint}$$
$$B_k = p_k + (1 + c_k)u_k \quad (1)$$
$$\text{agent's IR}$$
$$G(B_k + B_j, u_k, u_j \mid c_k, c_j) - \Psi\big(B - u_k c_k - u_j c_j\big) \geqslant 0 \quad (6)$$

We next show that even if the principals have exactly the same objective function an uneven distribution of aid budget can generate inefficiency.

Proposition 2 (Uncoordinated allocation with altruistic principals) *Let assumption A1 hold. When principals are altruistic the allocation of resources coincides with the coordinated optimal choice if and only if*

$$\frac{\alpha_1}{\alpha_2 + \alpha_p} \leqslant \frac{B_1}{B_2} \leqslant \frac{\alpha_1 + \alpha_p}{\alpha_2} \quad (17)$$

Proof. See the appendix 8.2. ■

Condition (17) is intuitive: to reach the first best allocation in the uncoordinated case it is necessary that the funds are distributed among donors proportionally to the productivity of their different projects. Hence, inefficiencies might arise not because of divergence in preferences between principals but simply because of an unbalanced distribution of funds with respect to the relative productivity of the unilateral projects.

We now turn to the case where the principals have biased preferences, due for example to good publicity of the initiative, or to the extra benefit a principal gets from using his own procurement rules. The parameter $\zeta_k > 0$ determines the value for principal k of his own unilateral project. Principal's k problem is

$$\max_{u_k} G(B_k + B_j, u_k, u_j \mid c_k, c_j) + \zeta_k H(u_k) \quad (18)$$
$$s.t. \text{ budget constraint } (1)$$
$$\text{agent's IR } (6)$$

Proposition 3 (Unilateral allocations as strategic substitutes) *When the principals have biased preferences towards unilateral projects, principal's contributions to their unilateral projects, first, are strategic substitutes and, second, are increasing with the principals' bias.*

Proof. See the appendix 8.3. ■

Contribution to the pool is a public good, and given that unilateral projects provide private benefits, it is in the interest of a principal to decrease its pool contribution when the amount contributed by the other principal increases. Since everything else being equal contribution to the pool increases with a donor budget, we deduce from Proposition 3 that donors with large aid budget contribute more to the pool than donors with small budget. Distortion with respect to the coordinated allocation is greater the greater is the principal's benefit from unilateral projects (i.e., the larger $\zeta_k \geq 0$). Indeed if the principal has a bias for his unilateral project, he will put more ressources into it and less into the common pool: everything else being equal, a biased principal will contribute less often to the pooled than an altruistic one.

We deduce from this analysis two testable implications. *First, the principal's allocation of funds towards unilateral projects is increasing with the principals' bias (i.e., u_k is increasing in ζ_k). Second, everything else being equal, large donors contribute more to the pool than small one (i.e., u_k is increasing in B_k).*

5.2 Agent's reaction: choice of (c_1, c_2)

Proposition 1 establishes that the fees are symmetric when both principals are altruistic. An important issue from a policy perspective is whether this result still holds when the principals have biased preferences. It is indeed important to check whether the recipient should be allowed to apply different administrative fees to different donors or not. The agent needs to decide whether to ask for special fees for the unilateral projects to one, both or neither of the principals. To do so, the agent takes into account the type of the pair of principals he is facing. When he faces two altruistic principals, the agent's problem is the same as in the benevolent planner's case of section 4 as long as the distribution of budgets is such that first best allocation is attainable. In order to study the impact of bias in principals preference, we assume in this section that condition (17) holds. If distortion in the choice of (c_1, c_2) occurs compared to the solution of Proposition 1 it is because the principals have biased preferences. Moreover we also assume that the bias in principals' utility function is linear in the amount invested in the unilateral project: $H(u) = u$. The linearity assumption simplifies the exposition. By continuity our result holds for a strictly concave function.

Proposition 4 (Asymmetric fees with symmetric biais) *Assume that condition (17) holds, that $H(u) = u$, and that the principals have symmetrically biased preferences towards their unilateral projects, $\zeta_1 = \zeta_2 = \zeta$. Then $c_1 = c_2$ if and only if $\alpha_1 = \alpha_2$.*

Proof. See the appendix 8.4. ■

Proposition 4 shows that the optimal fees are not symmetric with biased principals. Although the two principals have symmetrical preferences the fact that they are biased towards their unilateral project generally kills the symmetry

of the recipient solution in fees because the unilateral projects are not equally beneficial in terms of the development outcome.

To illustrate this result we present here the extreme case where the unilateral project provided by one of the principals, principal 2 without loss of generality, has no effect on development outcome (i.e., it is a SWEDOW): $\alpha_2 = 0$. The development production function is $G(u_1, p) = u_1^{\alpha_1} p^{\alpha_p}$ with $\alpha_1 + \alpha_p \leq 1$. Even if $\zeta_1 = \zeta_2 = \zeta > 0$, it is intuitive that the agent will choose a fee for project 2 that is higher than for project 1, simply to discourage the waste of investing in project 2. The agent sets a fee for principal 2 as big as necessary to ensure that his contribution to the unilateral project is zero.[16]

From the principal 1 point of view, there is then in the pool an amount B_2 of funds as budget support, which allocation is exogenous of any strategic interest. This situation is equivalent to the case where there is only one principal and one agent. The principal 1 optimization problem is the following:

$$\max_{u_1} \; u_1^{\alpha_1} p^{\alpha_p} + \zeta H(u_1) \tag{19}$$

$$s.t. \; p = B_2 + B_1 - (1 + c_1)u_1 \tag{20}$$

$$u_1 \leqslant \frac{B_1}{1 + c_1} \tag{21}$$

where (20) is the principal's budget constraint, and (21) sets the constraint on the maximum unilateral allocation feasible for the principal. Let's substitute (20) into the principal objective function:

$$\max_{u_1} \; u_1^{\alpha_1} \left(B_2 + B_1 - (1 + c_1)u_1\right)^{\alpha_p} + \zeta H(u_1) \tag{22}$$

Neglecting (21) we define $\hat{u}_1$ as the unconstrained solution to (22). Deriving (22) we obtain that $\hat{u}_1$ is solution to:

$$\alpha_1 u_1^{\alpha_1 - 1} p^{\alpha_p} - (1 + c_1)\alpha_p u_1^{\alpha_1} p^{\alpha_p - 1} + \zeta H'(u_1) = 0 \tag{23}$$

Let $\hat{u}_1$ be defined in equation (23). The principal investment in the unilateral project is

$$u_1^* = \min \left\{ \hat{u}_1, \frac{B_1}{1 + c_1} \right\}. \tag{24}$$

Replacing $p = B_2 + B_1 - (1 + c_1)u_1$ by its value and totally differentiating (23), under the assumption $H''(u) \leq 0$, it is straightforward to check that $\hat{u}_1$ increases with ζ, and with B_2. The principal contribution to the pool decreases with ζ (i.e., $\hat{u}_1$ increases with ζ). This result is a reminiscence of the result in Proposition 3 (i.e., when the strategic interactions between the two principals are taken into account). Moreover $\hat{u}_1$ increases with B_2 which means that his contribution to the pool decreases with the exogenous amount of funds available in the pool. In fact the principal contributes to the pool only when the resources that are already in the pool are relatively small in comparison to his budget.

[16] To get $u_2^* = 0$ requires c_2 to be so that $\frac{\partial U_2(u_1, u_2)}{\partial u_2} = -(1+c_2)\alpha_p u_1^{\alpha_1} p^{\alpha_p - 1} + \zeta H'(u_2) < 0$.

This result is robust if the principal is unbiased.[17] We deduce from this analysis one testable implication. *A principal contributes more to the pool when the resources already there (i.e., from multilateral aid and from others exogenous sources) are small.*

We have shown in Proposition 4 that unless everything is symmetrical (i.e., the bias and the productivity of the unilateral project) the optimal solution is asymmetric. This result is reinforced when the bias are different. This is a case where the optimal fees statistically are never equal. We deduce the following result.

Corollary 5 *If at least one of the principal has biased preferences then in general* $c_1^* \neq c_2^*$.

We elaborate on the previous example to illustrate Corollary 5. We assume that $\alpha_2 = 0$ and we add that $\zeta_1 \neq \zeta_2 > 0.5$. To derive a closed-form solution we further assume that $\alpha_1 = \alpha_p = 0.5$, $H(u) = u$, and $B_1 = B_2 = B/2 < B^{a*}/2$ with $B^{a*} = \Psi'^{-1}(0.5)$ being computed from (15). That is, at the first best solution the optimal investment levels are $u_1^* = B/2$, $u_2^* = 0$ and $p^* = B/2$, which yields a utility for the recipient: $U_r(u_1^*, u_2^*, p^*) = \frac{B}{2} - \Psi(B)$. We next show that the agent can by differentiating c_1 and c_2, decentralize this first best solution.

The agent needs first to set a fee for principal 2 as big as necessary to ensure that his contribution to the unilateral project is zero. We are thus left with a corner solution where $u_2^* = 0$ which requires c_2 to be such that

$$\frac{\partial U_2(u_1, u_2)}{\partial u_2} = -\frac{1 + c_2}{2}\sqrt{\frac{u_1}{p}} + \zeta_2 < 0 \tag{25}$$

The best response functions of principal 1 is

$$\frac{\partial U_1(u_1, u_2)}{\partial u_1} = \frac{1}{2}\sqrt{\frac{p}{u_1}} - \frac{1 + c_1}{2}\sqrt{\frac{u_1}{p}} + \zeta_1 = 0 \tag{26}$$

Substituting $u_2^* = 0$ in (26) we deduce that[18]

$$u_1^{**} = \frac{B}{2\left(1 + c_1 + \zeta_1^2 - \zeta_1\sqrt{1 + c_1 + \zeta_1^2}\right)} \geqslant \frac{B}{2(1 + c_1)} \tag{27}$$

but u_1^{**} is not feasible: principal 1 would be willing to spend more than his funds in his unilateral project since he obtains private benefits from it and principal

[17] When $\zeta = 0$, (23) yields $\hat{u}_1 = \frac{\alpha_1}{\alpha_1 + \alpha_p}\frac{B_2 + B_1}{1 + c_1}$ so that $\hat{u}_1$ increases with B_2, while for (21) to be satisfied it requires that $B_1 \geqslant \frac{\alpha_1}{\alpha_p} B_2$.

[18] We set $x = \sqrt{\frac{p}{u_1}}$ and solve the second order equation (26): $x^2 + 2\zeta_1 x - (1 + c_1) = 0$. Taking the square of the only positive root, yields $\frac{p}{u_1} = \left(\sqrt{1 + c_1 + \zeta_1^2} - \zeta_1\right)^2$. Substituting $p = B - (1 + c_1)u_1$ in this equation and solving it yields u_1^{**} in (27).

2 is already allocating all his budget to the pool. Hence, he is constrained by his ressources so that

$$u_1^* = \frac{B}{2(1+c_1)}, u_2^* = 0$$

will be the equilibrium as long as

$$c_2 > 2\zeta_2\sqrt{1+c_1} - 1$$

The optimal solution is then $c_1^* = 0$ and $c_2^* \geq 2\zeta_2 - 1 > 0$.

By differentiating c_2 from c_1 the recipient is able to decentralize the first best outcome. This result is not robust when both unilateral projects are needed for the production of development. In this case there is no taxes structure that permits to decentralize the first best outcome, because to discourage the principals to over-invest in their unilateral projects the recipient has to tax the aid money invested unilaterally. This is a waste of ressources compared to the first best outcome and the development level is lower. Nevertheless the creation of taxes on unilateral projects helps to bring the equilibrium closer to the first best. It improves the development outcome compared to a situation purely managed by donors.

In this section we have shown that the recipient is able to improve the decentralized equilibrium by taxing unilateral projects. The correction that the agent needs to implement to move the equilibrium closer to his preferred solution depends on the size of the principals' bias and on the productivity of the unilateral investments on the development outcome. Even when the principals have symmetrical preferences the optimal fees are generally different. This is a concern from a policy perspective as donors are unlikely to accept to pay different fees for the management of their unilateral aid projects. One solution could be for the recipient countries to prepare a list of development projects that are prioritized by their government. For the unilateral projects falling in this needed category the fee could be lower than for unilateral projects not prioritized by the government. Similarly the fee could be decreasing with the amount of funds transferred. Very small aid volumes should be taxed more heavily so as to discouraged aid fragmentation and the associated problem of aid unbalance analyzed in the paper. Taking action against poverty through micro aid projects can make it appear as if something has been done to address the issue of economic development, while in reality it would be more efficient to address the problem by pooling funds. And clearly, it does not make much sense to introduce an inconsistent or dysfunctional aid strategy unless it is merely a window-dressing initiative intended to impress voters. If the donor community is sincere in its willingness to fight fragmentation and improve aid efficiency it should explore the possibility for recipient countries to tax uncoordinated aid. The tariffs should not be linear in the volume of aid transferred. It should also vary with the importance of the projects funded.

6 Empirical Evidences: Donors' choice of Aid channel of delivery

Donor fragmentation is at the center of the Aid Effectiveness Debate: the existence of multiple (uncoordinated) donors and their choices of channel of delivery of their funds are important determinants of aid effectiveness. As has been pointed out both by academics and by practitioners, data for the study of donor fragmentation and choice of channel of delivery is very limited. Calls for more transparency on aid activities, specially on the channels of delivery used, are an old request from both communities. The 2008 OECD survey on monitoring the Paris Declaration was the first big attempt to measure donor coordination problems from the recipient's perspective. We present in Table 1 a summary of the data published in this survey. This information is only available for a small cross-section of countries in 2007 selected by the publication,[19] but it is worth looking at it due to its detail: we observe that only 21.5% of donor missions are coordinated, and only 37% of aid uses country systems, hinting an important lack of joint efforts both at the planning and implementation of development projects.

In the theoretical part of this paper we analyzed how donors' budgets, preferences towards unilateral projects, the recipient's taxation for their implementation and the behavior of other donors to the same recipient affect the donors' choice of channel of aid delivery. In practice recipients of aid have not yet experimented with the tax instrument to reduce aid fragmentation.[20] We lack therefore data on how such a tax might curb fragmentation and improve aid efficiency. By contrast we have some information on the channel of aid delivery decomposed by donor and by recipient. We focus on this information to asses the relevance of the model main assumptions, and therefore the relevance of experimenting with a taxation scheme to reduce fragmentation. There are two main testable implications from our model. First, the model predicts that the principal's allocation of funds towards unilateral projects will be increasing with the principal's bias towards his own projects. And second, the principal's allocation of funds towards unilateral projects will be increasing with other sources of funds, for example multilateral transfers, that the recipient is perceiving (i.e., for a donor with biased preferences investment in the pooled fund is strategic substitute with other principals' investment in the pool). One challenge is to find a suitable proxy for the donors' bias, which is not directly observable. We rely on the analysis by Knack (2013) to find a reasonable proxy.

The work of Knack (2013) is to the best of our knowledge the unique contribution to the literature using detailed data to analyze the choice of channel of delivery considering both the recipient country system characteristics and the donor's preferences. To be more specific Knack (2013) aims to explain donors

[19] For details on the sampling, see the OECD 2008 Report on Monitoring the Paris Declaration.

[20] They can sometimes turn down some aid schemes when the costs involved are higher than the benefit. But they are not taxing aid, whether bad or good.

Table 1: Donor Coordination Data

Variable	**Obs**	**Mean**	**Std Dev**	**Min**	**Max**
Technical assistance coordinated with country programs (% of total aid)	47	55.5	20	15	95
How much aid uses recipient's country systems (% of total aid)?	47	37	20.5	0	81
How many donor missions are coordinated (% of missions number)?	47	21.5	11	5	65
To what extent country analysis is coordinated (% of reports)?	47	44	15.5	17	78

Source: Own calculation with data from the 2008 Paris Declaration Monitoring Survey covering year 2007

decisions to trust (or not) recipients' country systems. He conducts empirical tests using data from three Paris Declaration Monitoring Surveys (PDMS), designed to monitor progress toward Paris Declaration goals, covering years 2005, 2007 and 2010. He approaches the trust in country systems as a public good: benefits to use and contribute to improve country systems are external (benefit other donors) and long term, while the costs are short term and covered by the donor using these systems. In his empirical analysis, the construction of the variables makes the results very interesting, given the originality of the combination of several unique datasets. His tests show that a donors use of the recipient countrys systems is correlated positively to the donors share of aid provided to the recipient, negatively to perceptions of corruption in the recipient country, and positively to public support for aid in the donor country. In other words, recipient country systems are more used by donors with a strong popular support in favor of aid in their home country, a big share of the recipient's aid market, and for recipients with better institutional and trustworthy systems.

The results of Knack (2013) empirical analysis match the testable results of our model: first less-biased donors (e.g., donors with less pressure at home to justify how their aid was used) make more use of recipient country systems, and second donors whose transfers are an important part of the recipient's budget make also more use of recipient country systems. For instance, 84.7% of 2007 Sudan's Official Development Assistance came from bilateral donors, and from it 60% was managed through multilateral coordination. But when looking at the channel choice of each donor, we find that while Germany, a relatively small donor to Sudan, pooled 20% of its budget, Netherlands, one of the top donors, did pool 83.7% of his. Angola, on the other hand, received 66.7% of his ODA as bilateral in 2007, and only 16% of it was coordinated. When looking at the

detail, Japan, a top donor, poled 50% of his funds, while Switzerland, a small donor to Angola, only pooled 0.7% of its aid.

In the present study we use the OCED-DAC-CRS dataset, accessed throught AidData.org. We center our analysis on Sub-saharan Africa as it is the region with the best quality data (i.e., the more comparable data across countries). Moreover it is a pool of countries which is more homogeneous than would be a set including recipients from other world regions. The region represents around 30% of the Development Aid flows.[21]

AidData.org, compiling information from several sources among which there is the OCED-DAC-CRS dataset, provides useful information on channel of aid delivery. From the definition of the channels used we can see an improvement on the reporting systems: from 2006 to 2009, the main channels were NGO (local-regional and international), Multilateral institutions and Public Sector (donor, recipient, other). Public Sector Channel was the most used for Sub-Saharan African recipients: 46%, 51%, 42% and 38.84% of their aid funds used this channel for the years 2006-2009 respectively. It is impossible with such crude categories to identify the way a donor is delivering his aid. Fortunately the reporting improves after 2009, with the introduction of a new channel defined as 'Donor Government'. This new category allows us to identify in the funds managed by the Public Sector the funds managed directly by the donor and the funds managed by the recipient. This is an important improvement in the information available. However many problems subsist. The description of the channel of delivery over the aggregate categories cited above is not detailed enough. There are problems of consistency of the definitions of variables both across donors and across time. Reporting of development aid flows by donors is voluntary, and the homogenization of reporting rules has been a decades long debate. Only a few of the donors, notably Austria, France, Portugal and UK, provide detailed enough information to trace the exact management of the funds. And the concern becomes more important when different levels of administration at the donor country (municipalities, regional governments,...) get involved in implementation of their funded projects. The quality of the data should therefore be seen as poor. Measurement errors are known to lead to inconsistent and biased estimates. Conclusions from this study need to be qualified by this provision.

We use the dataset for the periods 2010 and 2011 when the Donor Government channel is defined, and we use all aid projects received by Sub-Saharan African countries from multilateral and bilateral donors. We are aware that the time span is short due to the changes in data definition, that make these two year the only comparable available information. And we are also aware of the differences in reporting by the different donors, that lead to a very unbalanced dataset. We try to control for these problems by including year and donor fixed effects in our estimations. From the existing donor-recipient relationships in 2010, an average of 15.04 % (std: 0.15) of the funds were transferred using the

[21] Source: OECD-DAC. Sub-saharan Africa received 30.11% of the Development Aid flows (ODA) in 2013, and 31% of flows in 2008

'donor government' channel, and for 2011 the average increased to 18.43% (std: 0.184). The significant variance on the use of this channel across donor-recipient relationships and the important share of funds that use this channel make us think it is worth pursuing the exercise to check the empiric relevance of the predictions of our model.

Our goal is to study how donors' choice to allocate funds to unilateral projects (i.e., donor government channel) relates to the the use of the unilateral channel by the other donors giving to the same recipient, the alternative sources of aid received by the recipient, and the donors' preferences towards unilateral projects. In the model, the measurement of the share of Donor Government Managed aid is the share of the aid budget allocated by the donor to his unilateral project. This information is available in the data, and we use it, but for completeness we also consider another measure of funds fragmentation, which is the share of projects between a donor and a recipient that use the unilateral channel. Both indicators, at the light of the project proliferation literature,[22] are interesting and follow similar patterns. The maximum share of aid using donor channels is 45%, while the maximum share of projects is 33%.

Knack (2013) shows that biased donors allocate more of their funds through the unilateral channel. Donors who are less biased (e.g., Nordic countries, DAC members, countries with popular support for aid) allocate more funds through recipients system. Based on the available data, we therefore use as a proxy of donor's bias toward their own domestic interest the share of total funds given by this donor on a given year to all his recipients using this channel. The preferences of the donor towards the unilateral channel is captured by his aggregate behavior. Given the short time span of the data and the changes in the definition of channels of delivery, we are no able to use the lagged measure of this variable, that would be an even better proxy of the donor's bias towards unilateral projects. We control for the behavior of other donors to the same recipient, with the share of aid to the recipient coming from other donors. That gives us an idea of the relative importance of the donor for the portfolio of the recipient. Finally we use the recipient's share of aid that is bilateral to measure the importance of bilateral aid for the donor.

Our estimated equation has the form:

$$DGM_{dry} = \beta_1 X_{dry} + \beta_2 X_{ry} + \beta_3 X_{dy} + \alpha_1 FE_d + \alpha_2 FE_r + \alpha_3 FE_y + \varepsilon_{drt} \quad (28)$$

where DGM_{dry} is the share of donor d to recipient r using donor channel of aid delivery in year y, X_{dry} is a regressor that vary by donor, recipient, and year (i.e., share of bilateral aid to recipient from other donors), X_{ry} are regressors that vary by recipient and year but are donor invariant (share of recipients' aid that is bilateral, share of recipient's aid managed unilaterally by donors) X_{dy} is a regressor that vary by donor and year but is recipient-invariant (share of donor's aid using unilateral channel). Finally we also include recipient (FE_r), donor (FE_d) and year (FE_y) fixed effects.

[22] See for instance Roodman 2006 (a, b)

Table 2: Share of aid in each relationship using donor channel

Share of aid to recipient using donor channel	(1)	(2)	(3)	(4)
Share of donor's aid using unilateral channel	0.00246***	0.00250***	0.00185***	0.00187***
	(0.000360)	(0.000367)	(0.000583)	(0.000588)
Share of bilateral aid to recipient from	-8.58e-06	-2.86e-06	-1.84e-05	-1.81e-05
other donors	(3.11e-05)	(3.20e-05)	(4.30e-05)	(4.34e-05)
Share of recipient's aid managed unilaterally	0.00711***		0.00653***	
by donors	(0.000864)		(0.00127)	
Share of recipients' aid that is bilateral		1.34e-05		-9.72e-06
		(1.46e-05)		(3.35e-05)
Constant	0.000671	-0.000490	0.00119	0.00170
	(0.00302)	(0.00337)	(0.00488)	(0.00575)
Donor, Recipient, and Year Fixed Effects	No	No	Yes	Yes
Observations	1,824	1,824	1,823	1,823
Number of donors	26	26	26	26
Number of recipients	51	51	51	51
R-squared	0.060	0.025	0.073	0.059

Data source: OECD-DAC years 2010-11; Standard errors in parentheses: *** $p < 0.01$, **$p < 0.05$, * $p < 0.1$

In Table 2 we present the results of the econometric exercise using share of funds as dependent variable (columns (1) and (2) are without fixed effects and columns (3) and (4) are with the fixed effects). The regression with the share of projects as dependent variable is in table 3 in the appendix. These results are consistent with those of Knack (2013) and with the model predictions. We see that donor's bias, measured by the share of donor's total aid using unilateral channel, is significantly (i.e., at the 1% level) and positively correlated with the use of the Donor Managed channel of delivery. This result is robust to the inclusion of recipient, donor and year fixed effects. Everything else being equal, biased donors are channeling to any recipient a greater share of their aid unilaterally. We also find that recipients are not all treated in the same way by the donor community. There is indeed a strong positive correlation between the fact that any donor use more the donor managed channel and the share of total recipient's aid that is managed unilaterally. This result is also consistent with Knack (2013) findings that recipients are treated differently depending on whether they are perceived as trustworthy or not. Knack (2013) shows that recipient country systems are more used for recipients with lower level of perception of corruption. We find here that donors tend to deal with recipients in a similar fashion. Some recipients received a big share of their aid through the donors' managed channel, which reveals a low level of trust on the part of the donors community, while other recipients received a lower share of their aid in this way. Finally we also find a hint of Knack (2013) result that donors whose transfers are an important part of the recipient's budget make more use of recipient country systems. Indeed the correlation between our dependent variable and the share of aid to the recipient provided by other bilateral donors

is negative, even if not significant. It is consistent with larger donors relying more on recipient managed channel. The results are robust to the introduction of donor-recipient-year fixed effects, that control for different reporting behavior across years and across donors.

7 Discussion

In this paper we analyzed a two donors - one recipient model where both donors and recipients value the development project. Donors have to decide how to allocate their budget between a pool of funds and their unilateral project. The former implies using the recipient's procurement procedures and the later imposes special procurement rules linked to the donor project. The originality of our approach is to study how the recipient through his choice of taxes on the implementation of unilateral projects can affect the donors choice of channel of delivery and through that the development returns and hence the effectiveness of the funds transferred.

We find that, even when the donors are altruistic, their allocation of funds may differ from the fully integrated benevolent social planner's choice due to an unbalanced distribution of resources between them. This result illuminates that even if the donors are unbiased and benevolent their heterogeneity and lack of coordination in funds yields inefficiencies. This result militates against micro-aid schemes (i.e., cosmetic aid) and for a better coordination of donors ahead of the transfer of funds to help the recipient to allocate the aid ressources efficiently. The Nordic Plus group, which include Denmark, Finland, Norway, Sweden, Ireland, the Netherlands, and the United Kingdom, is a good example of this type of donors coordination. The group is committed to improve aid effectiveness through Joint Financing Arrangements, Joint Procurement Policy, and Complementary Principles. The purpose is to exploit complementarities among the members of the group, through division of labor based on comparative advantages, to reduce the number of sectors and countries each donor operates in (NORAD, 2006).[23] The donors want to reduce transactions costs for recipients and to increase aid effectiveness, even if it comes at the cost of reduced visibility for them.

By contrast when the donors are biased, they tend to 'free ride' on each other's contribution to the pool of funds. They increase their contribution to their unilateral project in an inefficient way as it provides greater private benefits to them than to the recipient. To correct this over investment bias the recipient might impose taxes on the unilateral projects. Even if the taxes are lost to the development project, they help to correct the distortions imposed by the principals' biased preferences. They increase aid efficiency.

The empirical evidences presented in section 6 suggest that donors are quite heterogenous in their level of altruism. Our analysis implies that the tax rates

[23] http://www.norad.no/globalassets/import-2162015-80434-am/www.norad.no-ny/filarkiv/vedlegg-til-publikasjoner/nordic-plus—practical-guide-to-delegated-cooperation1.pdf

imposed on unilateral aid should be different depending on donors' bias and on the productivity of his unilateral projects. This raise the question of why such a tax scheme is not implemented. It is a simple and effective tool to correct for negative externalities. One challenge to the design of an efficient taxation scheme is that the tax rates have to be different from one donor to the next. In the theory the recipient is in charge of designing the tax rate, which is fine because the recipient objective function is to maximize the development outcome net of the management/administrative costs. However the recipients are not all benevolent. In practice section 6 shows that the donor community deals with the problem of bad governance and low trustworthiness by relying on the unilateral channel of aid delivery. They control the way their aid is spend when they fear that it can be diverted into bribes. Allowing the recipient country to tax the unilateral aid with arbitrary tax rates will simply provide corrupt officials with a new tool to extract more money. A better solution would be to negotiate these corrective taxation rates at the international level. Coordination at a more preliminary stage of country program design, allocating task to donors according to their comparative advantage and budgets, and allowing recipients of aid to tax unilateral aid and micro-aid scheme, could greatly improve the development returns of the flows of funds.

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8 Appendix

8.1 Proof of Proposition 1

The agent chooses c_k $(k = 1, 2)$ to maximize:

$$U_r(B, c_1, c_2) = G^*(B, c_1, c_2) - \Psi(B - u_1^* c_1 - u_2^* c_2)$$

where u_1^* and u_2^* are given by the planner's allocation (8) and (9). Differentiating $U_r(B, c_1, c_2)$ with respect to c_k yields:

$$\frac{\partial U_r(B, c_1, c_2)}{\partial c_k} = \frac{\alpha_k}{1 + c_k} \left(-G^*(B, c_1, c_2) + \frac{B}{\alpha(1 + c_k)} \Psi'(B - u_1^* c_1 - u_2^* c_2) \right)$$

Since for a given c_k the expression in the bracket is the same for $k = 1$ and $k = 2$, the optimal choice for c_k is necessarily symmetrical: $c_1^* = c_2^* = c^*$.

We can thus re-write the agent optimization problem as:

$$\max_c \; U_r(B, c) = G^*(B, c) - \Psi(B - u^* c) \tag{29}$$

where

$$u^* c = (u_1^* + u_2^*)c = \frac{\alpha_1 + \alpha_2}{\alpha} \; \frac{c}{1 + c} B$$

and where

$$G^*(B, c) = \Omega \frac{B^\alpha}{(1 + c)^{\alpha_1 + \alpha_2}}$$

with $\Omega = \frac{\alpha_1^{\alpha_1} \alpha_2^{\alpha_2} \alpha_p^{\alpha_p}}{\alpha^\alpha}$.

When there is an interior solution, the first order condition, $\frac{\partial U_r(B,c)}{\partial c} = 0$, is thus given by

$$\frac{(\alpha_1 + \alpha_2)\, B}{\alpha(1 + c)^2} \left[-\frac{\alpha\Omega \; B^{\alpha - 1}}{(1 + c)^{\alpha_1 + \alpha_2 - 1}} + \Psi' \left(B \frac{\alpha + \alpha_p c}{\alpha(1 + c)} \right) \right] = 0 \tag{30}$$

We deduce that $c^* > 0$ satisfies

$$\Psi' \left(B \frac{\alpha + \alpha_p c}{\alpha(1 + c)} \right) = \alpha B^{\alpha - 1} \Omega (1 + c)^{1 - \alpha_1 - \alpha_2} \tag{31}$$

Using the envelop theorem, at the optimum c^* the second order condition is

$$\frac{\partial U_r^2(B,c)}{\partial c^2} = \frac{(\alpha_1 + \alpha_2)B}{\alpha(1+c)^2} \left[-\Psi' \left(B \frac{\alpha + \alpha_p c}{\alpha(1+c)} \right) \frac{1 - \alpha_1 - \alpha_2}{1+c} - \Psi'' \left(B \frac{\alpha + \alpha_p c}{\alpha(1+c)} \right) \frac{\alpha_1 + \alpha_2}{\alpha(1+c)^2} B \right] < 0$$

Second order condition holds as we postulate non increasing return to scale (i.e., $\alpha = \alpha_1 + \alpha_2 + \alpha_p \leq 1$) and an increasing and convex cost function Ψ. Since the right hand side of (31) is increasing in c and the left hand side is decreasing in c, we have that $c^* > 0$ whenever $\frac{\partial U_r(B,c)}{\partial c}_{c=0} > 0$. This is equivalent to

$$\Psi'(B) > \alpha\Omega \; B^{\alpha - 1}$$

Let $F(B) = \Omega B^\alpha - \Psi(B)$. Under the assumptions $\alpha = \alpha_1 + \alpha_2 + \alpha_p \leq 1$ and $\Psi''(x) > 0$ it is straightforward to check that $F''(B) < 0$. Moreover the assumption $\Psi(0) = \Psi'(0) = 0$ implies that $F(0) = 0$ and $F'(0) > 0$. We deduce that it exists a unique $\underline{B} > 0$ such that $F'(B) = 0$. QED

8.2 Proof of Proposition 2

We want to show that even in the case of principals with unbiased preferences, uncoordinated choices may lead to inefficiencies dues to the distribution of budgets among the principals. When $\zeta_k = 0$ principal's k problem is:

$$\max_{u_k} G(B_k + B_j, u_k, u_j \mid c_k, c_j)$$
$$s.t. \text{feasibility constraint } u_k \in [0, \frac{B_k}{1+c_k}]$$

First order condition yields $k, j = 1, 2\ k \neq j$:

$$\left[\frac{\alpha_k}{u_k} - \frac{(1+c_k)\alpha_p}{B - u_k(1+c_k) - u_j(1+c_j)}\right] G(B, u_k, u_j \mid c_k, c_j) = 0 \tag{32}$$

The best response functions have hence the form

$$u_1 = \frac{\alpha_1}{\alpha_p + \alpha_1} \frac{[B_1 + B_2] - u_2(1+c_2)}{1+c_1} \tag{33}$$
$$u_2 = \frac{\alpha_2}{\alpha_p + \alpha_2} \frac{[B_1 + B_2] - u_1(1+c_1)}{1+c_2} \tag{34}$$

and their intersection gives

$$u_1 = \frac{\alpha_1}{\alpha_1 + \alpha_2 + \alpha_p} \frac{[B_1 + B_2]}{1+c_1}$$
$$u_2 = \frac{\alpha_2}{\alpha_1 + \alpha_2 + \alpha_p} \frac{[B_1 + B_2]}{1+c_2}$$

whenever feasible. So in order to get an interior solution we need to check that

$$(1+c_1)u_1 \leqslant B_1$$
$$B_1 \geqslant \frac{\alpha_1 B_2}{\alpha_2 + \alpha_p}$$

and

$$(1+c_2)u_2 \leqslant B_2$$
$$B_1 \leqslant \frac{(\alpha_1 + \alpha_p)\, B_2}{\alpha_2}$$

QED

8.3 Proof of Proposition 3

We first show that when the principals have biased preferences towards unilateral projects, principal's contributions to their unilateral projects are increasing

with their bias. Principal's k problem is:

$$\max_{u_k} G(B_k + B_j, u_k, u_j \mid c_k, c_j) + \zeta_k u_k$$
$$s.t. \qquad u_k \in [0, \frac{B_k}{1+c_k}]$$

First order condition yields

$$\left[\frac{\alpha_k}{u_k} - \frac{\alpha_p(1+c_k)}{B - u_k(1+c_k) - u_j(1+c_j)}\right] G(B, u_k, u_j \mid c_k, c_j) + \zeta_k = 0 \tag{35}$$

Let $p = B - u_k(1+c_k) - u_j(1+c_j)$. We deduce from (35) that

$$\frac{\alpha_p(1+c_k)}{p} - \frac{\alpha_k}{u_k} = \frac{\zeta_k}{G(B, u_k, u_j \mid c_k, c_j)} > 0 \tag{36}$$

We first show that, independently of the other principal aid allocation strategy, principal $k = 1, 2$ allocation to his unilateral project is increasing with ζ_k. Differentiating the principal's First Order Conditions (35) to get the sign of $\frac{du_k}{d\zeta_k}$, yields:

$$du_k \left\{ \left[\left(\frac{\alpha_k}{u_k} - \frac{(1+c_k)\alpha_p}{p}\right)^2 - \frac{\alpha_k}{u_k^2} - \frac{(1+c_k)^2\alpha_p}{p^2} \right] G(B, u_k, u_j \mid c_k, c_j) \right\} + d\zeta_k = 0$$

We deduce that:

$$\frac{du_k}{d\zeta_k} = \frac{1}{\left[\frac{\alpha_k(1-\alpha_k)}{u_k^2} + \frac{(1+c_k)^2\alpha_p(1-\alpha_p)}{p^2} + \frac{2\alpha_k\alpha_p(1+c_k)}{pu_k}\right] G(B, u_k, u_j \mid c_k, c_j)} > 0$$

We next show that when the principals have biased preferences towards unilateral projects, principal's contributions to their unilateral projects are strategic substitutes. From the principal's First Order conditions (35) we have

$$\left[\frac{\alpha_k}{u_k} - \frac{\alpha_p(1+c_k)}{p}\right] u_j^{\alpha_j} u_k^{\alpha k} p^{\alpha_p} + \zeta_k = 0 \rightarrow BR_k(u_j) \tag{37}$$

that gives principal $k's$ best response $BR_k(u_j)$ to principal $j's$ allocation. Implicitly deriving $BR_k(u_j)$ we have $\frac{du_k}{du_j} = \frac{Den}{Num}$, where

$$\begin{aligned}
Num &= \left[\frac{\alpha_k}{u_k} - \frac{\alpha_p(1+c_k)}{p}\right]^2 - \left[\frac{\alpha_k}{u_k^2} + \frac{\alpha_p(1+c_k)^2}{p^2}\right] \\
Num &= -\frac{\alpha_k}{u_k^2}(1-\alpha_k) - \frac{\alpha_p(1+c_k)^2}{p^2}(1-\alpha_p) - 2\frac{\alpha_k}{u_k}\frac{\alpha_p(1+c_k)}{p} < 0 \\
Den &= \frac{\alpha_p(1+c_k)(1+c_j)}{p^2} - \left[\frac{\alpha_k}{u_k} - \frac{\alpha_p(1+c_k)}{p}\right]\left[\frac{\alpha_j}{u_j} - \frac{\alpha_p(1+c_j)}{p}\right] \\
Den &= \frac{\alpha_p(1+c_k)(1+c_j)}{p^2}(1-\alpha_p) + \frac{\alpha_p(1+c_j)}{p}\frac{\alpha_k}{u_k} + \left[\frac{\alpha_p(1+c_j)}{p} - \frac{\alpha_k}{u_k}\right]\frac{\alpha_j}{u_j} > 0
\end{aligned}$$

by virtue of (36). Hence

$$\frac{du_k}{du_j} = \frac{Den}{Num} < 0$$

i.e. contributions to the unilateral project are strategic substitutes (best response functions are decreasing) and contribution is increasing with principal's preferences towards the unilateral project.

8.4 Proof of Proposition 4

Let $\zeta_1 = \zeta_2 = \zeta > 0$. The principal's first order conditions for $k = 1, 2$ are given by substituting in (35) $\zeta_k = \zeta$:

$$\left[\frac{\alpha_k}{u_k} - \frac{(1+c_k)\alpha_p}{B - u_k(1+c_k) - u_j(1+c_j)}\right] G(B, u_k, u_j \mid c_k, c_j) + \zeta = 0 \tag{38}$$

Their intersection gives us $\big(u_1^*(c_1, c_2), u_2^*(c_1, c_2)\big)$, which must satisfy:

$$\frac{\alpha_1}{u_1} - \frac{(1+c_1)\alpha_p}{B - u_1(1+c_1) - u_2(1+c_2)} = \frac{\alpha_2}{u_2} - \frac{(1+c_2)\alpha_p}{B - u_1(1+c_1) - u_2(1+c_2)} \tag{39}$$

The agent's problem becomes:

$$\max_{c_1, c_2} U(B, c) = u_1^{*\alpha_1} u_2^{*\alpha_2} \left[B - u_1^*(1+c_1) - u_2^*(1+c_2)\right]^{\alpha_p} - \Psi(B - u_1^* c_1 - u_2^* c_2) \tag{40}$$

and the first order conditions are (for $k, j = 1, 2$)

$$\frac{du_k^*}{dc_k}\frac{1}{u_k^*}\left[-\zeta + c_k\Psi'(B - u_k^* c_k - u_j^* c_j)\right] + \frac{du_j^*}{dc_k}\frac{1}{u_k^*}\left[-\zeta + c_j\Psi'(B - u_k^* c_k - u_j^* c_j)\right]$$
$$-\frac{\alpha_p\left[u_1^{*\alpha_1} u_2^{*\alpha_2}\left[B - u_1^*(1+c_1) - u_2^*(1+c_2)\right]^{\alpha_p}\right]}{B - u_k^*(1+c_k) - u_j^*(1+c_j)} + \Psi'(B - u_k^* c_k - u_j^* c_j) = 0$$

Putting together the first order conditions for both unilateral projects $k, j = 1, 2$ we have that

$$\frac{du_1^*}{dc_1}\frac{1}{u_1^*}\left[-\zeta + c_1\Psi'(B - u_1^* c_1 - u_2^* c_2)\right] + \frac{du_2^*}{dc_1}\frac{1}{u_1^*}\left[-\zeta + c_2\Psi'(B - u_1^* c_1 - u_2^* c_2)\right]$$

$$= \frac{du_2^*}{dc_2}\frac{1}{u_2^*}\left[-\zeta + c_2\Psi'(B - u_1^* c_1 - u_2^* c_2)\right] + \frac{du_1^*}{dc_2}\frac{1}{u_2^*}\left[-\zeta + c_1\Psi'(B - u_1^* c_1 - u_2^* c_2)\right] \tag{41}$$

First note that if $\alpha_1 = \alpha_2$ then $c_1 = c_2 = c$ is solution to (39) and to (41) so that in equilibrium $u_1 = u_2$.

Second we assume that $c_1 = c_2 = c > 0$ is the solution of the agent optimization problem and we show that necessarily $\alpha_1 = \alpha_2$. For the symmetric

Share of aid in each relationship using donor channel	(1)	(2)	(3)	(4)
Donor's share of aid using	0.00128***	0.00130***	0.000500***	0.000514***
unilateral channel	(0.000352)	(0.000353)	(0.000551)	(0.000551)
Share of aide to recipient from	2.14e-06	6.76e-06	-2.36e-05	-2.47e-05
other donors	(3.04e-05)	(3.07e-05)	(4.06e-05)	(4.07e-05)
Share of recipient's aide that	0.00333***		0.00130***	
is managed unilateraly by donors	(0.000843)		(0.00120)	
Share recipients' aide that is		1.35e-05		-1.72e-05
bilateral		(1.40e-05)		(3.14e-05)
Constant	0.000178	-0.000105	0.00128	0.00274
	(0.00295)	(0.00324)	(0.00460)	(0.00539)
Observations	1,824	1,824	1,823	1,823
R-squared	0.016	0.008	0.091	0.090
Number donors	26	26	26	26
Number recipients	51	51	51	51
Don-Rec-Year FE	No	No	Yes	Yes

Standard errors in parentheses: *** $p < 0.01$, **$p < 0.05$, * $p < 0.1$

equilibrium $c_1 = c_2 = c > 0$ to be the optimal solution of the agent's problem requires from (41) that

$$\left[\frac{du_1^*}{dc_1} + \frac{du_2^*}{dc_1}\right]\frac{1}{u_1^*} = \left[\frac{du_1^*}{dc_2} + \frac{du_2^*}{dc_2}\right]\frac{1}{u_2^*} \qquad \text{at } c_1 = c_2 \tag{42}$$

This is equivalent to:

$$\frac{\frac{d(u_1^*+u_2^*)}{dc_1}}{\frac{d(u_1^*+u_2^*)}{dc_2}} = \frac{u_1^*}{u_2^*} \qquad \text{at } c_1 = c_2 \tag{43}$$

Yet at $c_1 = c_2$ we have that $\frac{d(u_1^*+u_2^*)}{dc_1} = \frac{d(u_1^*+u_2^*)}{dc_2}$ so that it needs to be the case that $1 = \frac{u_1^*}{u_2^*}$. Moreover from the principal's intersection of the best response functions (39), $c_1 = c_2 = c > 0$ implies that

$$\frac{u_1^*}{u_2^*} = \frac{\alpha_1}{\alpha_2}. \tag{44}$$

So for $c_1 = c_2 = c > 0$ to be the solution of the agent optimization problem it is necessarily the case that $\alpha_2 = \alpha_1$.QED

Table 3: Share of projects in each relationship using donor channel