Budget Support versus Project Aid: a Theoretical Appraisal*

Comments welcome

Tito Cordella
IMF - Research Department

Giovanni Dell'Ariccia
IMF - Research Department

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Abstract

We compare the effectiveness of conditional budget support and project aid in poverty reduction programs, in a model in which altruistic donors have preferences not perfectly aligned with those of recipient governments. We find that project aid is a better (worse) instrument to alleviate poverty than budget conditionality when: (i) aid programs are relatively large (small) with respect to the recipient's country resources; and (ii) recipient governments are relatively less (more) socially committed. In addition, we show that when donors cannot observe the recipient's type, they may impose a higher level of conditionality on budget support programs as a device to separate socially committed governments form uncommitted ones.

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> The shift in development thinking from a government-led accumulation strategy to a focus on fundamentals, effectiveness and efficiency [...] requires reorienting the instrument of aid. In particular, it means reconsidering the method of financial assistance (project and program) [...] and how they can be adapted to support the new development strategy (World Bank 1998, p.96)

1 Introduction

The record of foreign aid has been, at best, a mixed one. As World Bank (1998) candidly recognizes, "if foreign aid has at times been a spectacular success...[it] has also been, at times, an unmitigated failure" (p.1). In view of this fact, the donor community (multilateral agencies, NGOs, bilateral donors), which generally disagrees on the causes of such failure, seems to agree on one basic principle: aid alone (be it debt relief or developmental assistance) does not insure the implementation of successful poverty reduction policies.[1] The corollary of this is that aid policies should be designed in a way that provides the right incentives for an effective implementation of social programs, and minimizes the risk that external assistance be mishandled.

Traditionally, donors have disbursed aid funds either through providing aid directly linked to specific projects (project aid), or through providing support to the recipient government's budget (budget support, or project financing) while imposing conditionality on how to allocate the available resources. In spite of a large literature on the pros and cons of project aid and conditional budget support, to our knowledge, there has not been an attempt to compare these two instruments in a formal model. The contribution of this paper is to provide a theoretical framework to study under which conditions either form of aid is preferable from the donor's point of view, when the donor's and the recipient government's preferences differ.

Conditional budget support and project aid have both their own shortcomings. On the one hand, the effectiveness of general budget support under conditionality is limited by the donors' ability to monitor the actual final destination of budget expenses. To the extent that not all government activities are monitorable, conditionality involves a potential ineffi-

[1] There is a quite vast empirical literature supporting such a view. Boone (1996) provides evidence that, on average, aid does not foster growth. Burnside and Dollar (2000) find that while in countries with sound economic policies aid promotes growth; in countries with bad policy environments, aid is dissipated in unproductive government consumption. World Bank (1998) finds that large amounts of aid in countries with a poor policy environment, by delaying reforms implementation, can even potentially reduce growth.

ciency in that donors are forced to impose higher levels of expenditure for the monitorable components of the budget.[2] More generally, the need to monitor the recipient's reform effort may force donors to focus on "observable" reforms rather than on those reforms that would be considered a priority under symmetric information. On the other hand, project aid carries the risk of merely crowding out social expenditure that the local government would have undertaken in the absence of the donor's intervention (the widely recognized fungibility problem).[3] Hence, per se, it does not eliminate the risk of aid misplacement.

The framework developed in this paper takes into account these problems. In our stylized model, the donor's only concern is the effective implementation of social programs,[4] while the recipient government obtains utility both from the realization of such programs and from other non socially-oriented expenses, such as military outlays. We assume that the donor can provide budget support, but that only a subset of inputs employed in the "production" of social programs can be subject to conditionality. Alternatively, the donor may opt for project financing and have direct control over the allocation of aid funds, but doing so it loses the ability to affect the overall allocation of resources.

The main finding of this paper is that the relative effectiveness of these two forms of aid depends crucially on the size of the aid program (relative to the recipient government's own resources) and on the degree of misalignment between donors' and recipients' objectives (which could be interpreted as a measure of "lack of program ownership"). In particular, we find that program financing is preferable when total aid is small relative to the recipient's own resources; while project aid results superior for relatively large programs. In addition, project aid is preferable to program financing when the preferences of the donor and those of the recipient government are relatively far apart.

The intuition for these results is the following. Aid flows associated with project aid are fungible only to the extent that the recipient government is able to reallocate its own budget

[2] Conditionality in international lending is a widely discussed and controversial issue. Sachs (1989) provides a critical assessment of IFIs' conditionality in the context of international debt crises. Killick (1997) focuses on the difficulties of properly enforcing conditionality, while Collier et al. (1997) analyze how the imposition of increasingly detailed conditions may create serious incentive problems. The idea that excessive conditionality, by absorbing an excessive amount of scarce domestic resources (such as administrative capacity), can be distortionary is also made by Berg (1997).

[3] The problem of aid fungibility is discussed at length in World Bank (1998). See also Pack and Pack (1993), Khilji and Zampelli (1994), Feyzioglu et al. (1998), and Devarajan and Swaroop (1998), Lahiri and Raimondos-Moller (2000).

[4] In what follows, we focus on a single and fully altruistic donor. These assumptions are not meant to be realistic and are discussed in greater detail in the concluding section.

resources away from similar projects. Hence, aid fungibility is high for small projects but decreases with the magnitude of the aid program.[5] At the same time, it increases with the social commitment of the recipient, as more socially oriented governments allocate a larger share of their resources to social projects. On the contrary, the distortions involved with conditional budget support do not increase with the size of the program and do decrease with the social commitment of the recipient government.

Two main lessons can be drawn from our analysis: First, in presence of conflicts of interest between the donor and the recipient government, aid policy should be tailored according to the recipient government's characteristics. Second, the distinction between micro and macro policies may be misleading as small aid programs should be part of a broader strategy at the general budget level, and large ones should be implemented through direct project financing.

From a policy perspective, one limitation of this simple framework is that arguably it is often difficult for recipient governments to signal credibly their commitment to social issues and poverty reduction programs. Hence, in a more realistic model their objective function is, to a large extent, unobservable to the donor. This we deal with in the second part of the paper where we assume that donors cannot observe recipients' preferences, and hence, aid policy cannot be tailored upon the type of recipient government.

In that context, we show that the features of the donor's optimal aid policy depend on the values of the parameters in the problem. In particular, while under some circumstances the donor may be able to achieve "separation" between recipient types at no cost; in other cases, it may have to impose on budget support programs a level of conditionality higher than under symmetric information. This, in order to discourage recipients with a low degree of social commitment to benefit from an aid policy directed to recipients with a high propensity to social spending.

This paper relates to the theoretical literature on the effectiveness of aid in the presence of strategic interaction between donors and recipient governments, that has remained surprisingly limited despite the widespread interest for incentive compatible aid contracts.[6] Murshed and Sen (1995) examine the issue of aid negotiation under asymmetric information when the reduction of military spending in the recipient country enters the donor's objec-

[5] Pack and Pack (1993) compare the effectiveness of aid programs in the Dominican Republic and Indonesia. Their main finding is that "the more important foreign aid as a source of public resources [...], the more likely are the recipients to reflect donor's intentions" (p.264).

[6] See Drazen (2000).

tive function. Their focus is on problems brought about by the presence of multiple and heterogeneous donors or of donors with multiple and conflicting objectives. In our paper, the focus is instead on the conflict between donors and recipients and the heterogeneity is on the recipients' side.

Svensson (2000a) develops a game theoretic rent-seeking model to assess the effect of aid windfalls on the provision of public goods when social groups compete over common-pool resources. In such a set-up, the mere expectation of aid, by affecting the recipient country political equilibrium, may lower the provision of public goods. More closely related to the present paper is Svensson (2000b), who studies the strategic interaction between a donor and two recipients in a model in which the donor cares uniquely about the welfare of the poor, while the recipients also pursue other goals. Since, as in our model, the effectiveness of poverty alleviation programs depends on a non-verifiable implementation effort on the part of the recipient, the first best aid contract is non enforceable. While our set-up shares some of the key features of Svensson's, the focus of the analysis is different. In fact, while our interest is in designing an ex-ante optimal aid contract which depends on the characteristics of recipient governments, in Svensson recipients are ex ante identical, and the main problem the donor faces is one of commitment.

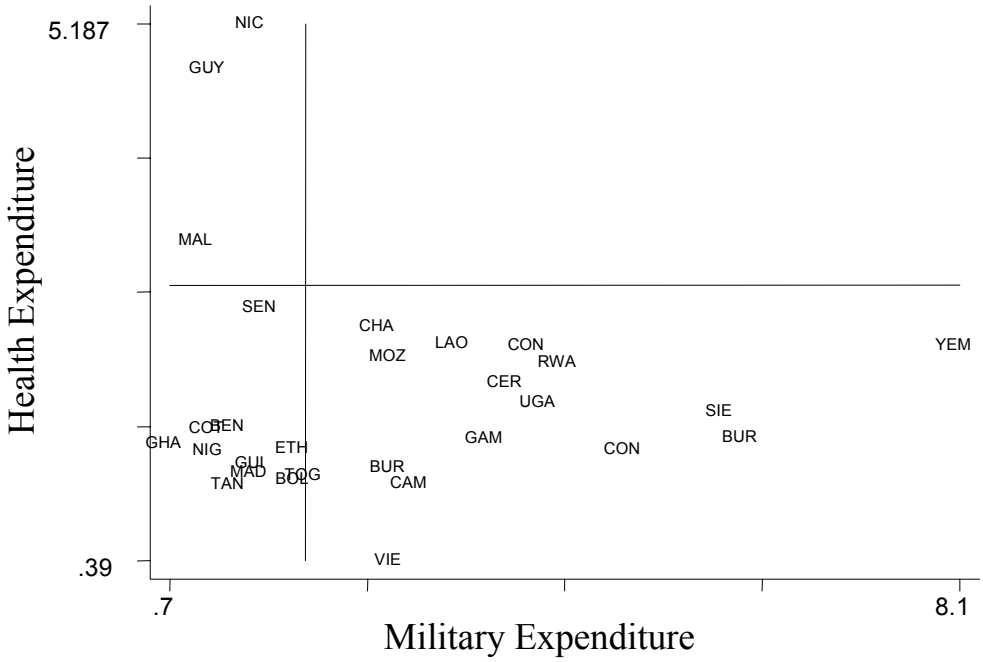
With regard to the case where the recipient's type is not observable, Marchesi and Thomas (1999) explore the idea of screening by conditionality in the context of IMF programs aimed at maximizing the expected repayment of the debt. In the present paper, a similar concept emerges as one possible equilibrium outcome. However, here the objective of the principal is the maximization of the social impact of aid rather than the repayment of the debt.

The remainder of the paper is organized as follows: the next section presents few stylized facts that support the main assumptions of the model; section 3 introduces the model; section 4 extends the analysis to the case where the recipient's type is not observable; section 5 discusses the limits of our framework and concludes.

2 A Few Stylized Facts

The discussion in this section is not meant to provide an evaluation of the policies embraced by aid recipient governments. Rather, it presents some stylized facts that support the view that donor and recipient countries are likely to have different objectives and that among potential recipients there is significant heterogeneity with regard to the allocation of public

Figure 1: Expenditure Allocation in Selected HIPCs (in percent of GNP, 1997)



expenditure.

The simple observation of data on social and military expenditure in highly indebted poor countries, HIPCs (which we consider a representative sample of aid recipient countries), reveals three striking, but not surprising, facts. First, in a large number of HIPCs the share of national product allocated to the military is above that of the average of OECD countries. More precisely, according to World bank data for 1997, 21 out of 37 countries for which data is available spent for the military more than the OECD average of about 2.0 percent of GNP. Second, still according to 1997 data, in all HIPCs the share of national product allocated to public health expenditure was well below the OECD average. In particular, 28 out of 31 countries for which data is available spent less than fifty percent of the OECD average of about 5.7 percent. Finally, there is substantial heterogeneity in how HIPCs allocate public resources between military and social expenditures (here represented by health). In 1997, the ratio of health to military expenditure varied from the 0.13 of Vietnam to the 4.3 of Guyana (data are available for 29 HIPCs). Figure 1 summarizes this information. The vertical line represents the OECD average military expenditure in percent of GNP. The horizontal line marks the fifty percent of the OECD average public expenditure in health.

It is difficult to evaluate precisely what level of social and military spending donor countries would find acceptable for granting aid/debt relief to a developing country. However, it would be probably difficult for a donor government to find public support for aid programs that allowed recipient countries to spend large sums in military, or more generally in non socially valuable, expenses. In particular, it seems reasonable to assume that donor governments would use their own expenditure allocation as a general benchmark of what is the "right" allocation. In that context, the stylized facts presented in this section suggest that for most of the HIPCs a conflict between donors' and recipients' objectives is quite likely. However, such conflict varies quite significantly across the sample.

Despite this heterogeneity in the characteristics of recipient countries, there is little evidence that donors have tailored their assistance to different types of countries. For example, Burnside and Dollar (2000) found that bilateral donors were not favoring countries with good policies in their aid allocation. In addition, World Bank (1998) observed that donors tended to provide the same assistance package across countries. Finally, Collier and Dollar (1999) find that aid is not allocated optimally across poor countries.

In the next section, we develop a theoretical model to analyze optimal aid policies when recipients are heterogeneous and their objectives are in potential conflict with those of the donors.

3 The Model

We consider a stylized framework in which the international community (the donor, from now on) is willing to implement an aid program that substantially increases the resources that a developing country government (the recipient, from now on) could devote to poverty reduction programs. Adopting standard notation, we denote by G the recipient tax revenue, and by A, the amount of aid which, for the sake of simplicity, we assume to be fixed. The recipient (denoted by subscript R) devotes its budgetary resources to developmental and non developmental consumption. In particular, we assume that it maximizes the following additively separable objective function:

$$U_R = \alpha V(s) + (1 - \alpha)V(m), \tag{1}$$

where m denotes non developmental consumption (military expenses, from now on), s the consumption of a social good (for instance, social programs such as poverty alleviation,

primary education, access to safe water, etc.) and $\alpha \in [0,1]$ the recipient's "social preferences." In our set-up, the social good is produced out of two inputs: capital (k) which is observable and verifiable by the donor, and effort (e) (e.g., administrative and managerial outlays, and other costly supportive policies) that, instead, is not observable. We also assume that the social good production function, $s = s(k,e)$, is symmetric in its arguments, i.e., $s(x,y) = s(y,x)$, linear homogenous,[7] twice continuously differentiable, and that, $s(0,y) = 0$, $s_x(\cdot) > 0$, $s_{xx}(\cdot) < 0$, and $s_{xy}(\cdot) > 0$. We further assume that $V(0) = 0$, $V'(\cdot) > 0$, $\lim_{x \to 0} V'(x) = \infty$, $V''(\cdot) < 0$, and that the government runs a balanced budget,[8] both in the case in which aid is granted and in the case it is not, that is,

$$m + k + e \leq G + \delta A, \text{ with} \tag{2}$$

$$\delta = \begin{cases} 1, & \text{if aid is granted;} \\ 0, & \text{otherwise.} \end{cases}$$

We are interested in the case where the donor's and the recipient's preferences on budget allocations differ. In particular, we consider a situation where the donor, if in power, would choose, for any budget, a consumption of the social good higher than that chosen by the recipient. For simplicity, we assume that the donor only cares about the success of social programs so that its objective function may be written as

$$W = s(k,e). \tag{3}$$

In what follows, we first characterize the effect of aid in the absence of any form of conditionality. Then, we briefly discuss the characteristics of the "optimal" aid contract when all the components of the social programs are observable and contractible upon, and then analyze the more interesting (and realistic case) in which the donor is unable to contract upon some of the actions of the recipient. Finally, we discuss the project aid case in which the donor decides to directly finance projects or provide resources to implementing agents, such as NGOs, that share its same objectives, and compare this case with conditional budget support.

[7] The symmetry assumption is not essential for our main results, but substantially simplifies the math. The linear homogeneity assumption is only necessary for a non arbitrary comparison between program and project aid, see below.

[8] We loosely indicate with V' the first derivative of V with respect to any of its arguments, and with V'' the second derivative.

3.1 Unconditional budget support

As a useful benchmark, we first consider the case in which the donor imposes no restriction on the recipient's budget allocation. In the absence of conditionality, the government will allocate resources to maximize its objective function (1) subject to the budget constraint (2). After substituting (2) into (1), the problem of a recipient of type α, with $\alpha \in [0,1)$ can be written as[9]

$$\underset{k,e}{Max} \ \left[\alpha V(s(k,e)) + (1-\alpha)V(G+\delta A - k - e)\right]. \tag{4}$$

It is straightforward to check that, since the technology for the production of the social good is convex and symmetric in the two inputs, in equilibrium, the recipient government allocates an equal amount of resources to the capital and the managerial component of social expenditure. The solution of problem (4) is given by $k^* = e^*$, with

$$k^* = \left\{\mathbf{x} : \alpha V'(s(\mathbf{x}))s'(\mathbf{x}) - (1-\alpha)V'(G+\delta A - 2x) = 0\right\}, \tag{5}$$

where $\mathbf{x} = (x, x)$.

If $\delta = 0$, the solution of problem (4) gives the values k^{NA} and e^{NA} that the recipient government would choose in absence of aid, with NA denoting the no-aid scenario. This also identifies the recipient's reservation utility that can be written as

$$U^{NA}(\alpha) = \alpha V(s(k^{NA}, e^{NA})) + (1-\alpha)V(G - k^{NA} - e^{NA}). \tag{6}$$

When, instead, $\delta = 1$, the solution of problem (4) yields the capital and managerial expenditure chosen by the recipient when aid is granted but no conditionality is imposed, which we denote k^{NC} and e^{NC}, respectively.

Finally, from a simple inspection of (5) it is evident that aid increases the amount of resources that the recipient is willing to devote to social spending, that is

$$s(k^{NC}, e^{NC}) \geq s(k^{NA}, e^{NA}), \tag{7}$$

with the strict inequality for $\alpha > 0$. However, for any $\alpha < 1$, the objectives of the recipient and those of the donor are not perfectly aligned and the latter should be able to obtain a larger production of the social good by imposing conditionality when granting aid. This brings us to the next section.

[9] For a recipient of type $\alpha = 1$, the problem should be written as $\underset{k}{Max} \ \left[V(s(k, G+\delta A - k))\right]$.

3.2 Conditional Budget Support

Should the donor have full control over all the components of social spending in the recipient country or, alternatively, should it be able to contract on both capital and managerial expenditures, then the first best would be implementable. The optimal contract would be one that maximizes the donor's utility (3) subject to the individual rationality constraint (IR) of the recipient. Then, at the equilibrium, k and e would be efficiently chosen to yield the highest level of production of the social good for which the recipient is exactly as well off as in absence of aid.

In what follows, we consider the more reasonable and interesting case in which the donor can only observe, and make aid disbursement conditional upon, the capital component of social programs, k, and thus the recipient is free to choose any non negative amount for the other component, e. This means that the donor will have to take into account the response of the recipient when setting conditionality on k.

Admittedly, in the real world, conditionality is much more complex than setting a minimum level on some budget component. For example, conditionality may come in the form of the implementation of banking reforms and transparency laws, or the application of labor or environmental standards. Nevertheless, we believe that as long as the implementation of such reforms involves activities on the part of the recipient governments that are not monitorable by the donors, our framework captures one important shortcoming of conditionality, namely, the fact that the scope of reform programs is limited by the ability of the donor of monitoring the recipient's activities. The informational structure of the problem may force donors to design reforms focusing on what is monitorable rather than what is more needed, and by so doing, they may impose an inefficiency on the overall reform program: in Stiglitz's words: conditionality may involve "the subordination of matters of substance to matters of process."[10]

Returning to the model, for any fixed level of $k > k^{NC}$, the recipient will set the unobserved component e of social spending so that

$$\widehat{e}(k) = \arg\max_{e} \ [\alpha V(s(k,e)) + (1-\alpha)V(G + A - k - e)],$$

[10] In the context of macro-stabilization programs, the choice between inflation targeting and monetary policy approaches based on the explicit targeting of some observable intermediate objectives provides a good example of the problem.

and the problem of the donor becomes

$$\underset{k}{Max}\ W = s(k, \widehat{e}(k)),$$

$$s.t. \tag{8}$$

$$\alpha V(s(k, \widehat{e}(k))) + (1-\alpha)V(G + A - k - \widehat{e}(k)) \geq U^{NA}(\alpha),$$

where the last expression is the IR constraint of the recipient. We denote by k^{IR} the value of k for which the IR is exactly binding, that is,

$$k^{IR} \equiv \{k : \alpha V(s(k, \widehat{e}(k))) + (1-\alpha)V(G + A - k - \widehat{e}(k)) = U^{NR}(\alpha)\}.$$

Note that k^{IR} is always increasing in α. To characterize the solution of problem (8) we first prove the following results.

Lemma 1 *(i) For any $k > k^{NC}$, $\widehat{e}(k) < k$. (ii) For any $\alpha \in (0,1)$, there exists a $\widetilde{k} \in \left(k^{NC}, k^{IR}\right)$ such that $s(\widetilde{k}, \widehat{e}(\widetilde{k})) > s(k^{NC}, \widehat{e}(k^{NC}))$.*

Proof. See Appendix.

The previous lemma shows that even if some components of the budget cannot be contracted upon, the donor can generally strictly improve on aid effectiveness by imposing conditionality on the contractible component of social spending. However, since for any $k > k^{NC}$, $\widehat{e}(k) < k$, *conditionality imposes a distortion in the allocation of the resources devoted to the production of the social good.* In fact, both the donor and the recipient would be better off if it were possible to contract upon e and to reallocate part of the social spending from the capital to the managerial component.

We are now able to characterize the optimal level of conditionality that the donor would impose upon a recipient government of type α in order to maximize the production of the social good. Formally, the optimal level of conditionality $k^C(\alpha)$ is given by

$$k^C(\alpha) = \min\{k^{IR}; \hat{k}\}, \text{with},$$

$$\hat{k} \equiv \arg\max_{k}\ s(k, \widehat{e}(k)).$$

$\hat{k}$ can be interpreted as the level of conditionality the donor would choose if it were to disregard the recipient's IR constraint, and thus it is the optimal amount of conditionality

when the IR constraint is slack. Of course, when the recipient's IR constraint is binding the maximum level of conditionality that the donor is able to impose is given by k^{IR}.

To further characterize the solution, one should establish the sign of the relationship between $\widehat{k}$ and α. Our conjecture, based on a series of simulation[11] is that $\frac{\partial \widehat{k}}{\partial \alpha} \leq 0$. The intuition behind such conjecture is the following: because of the convexity in the production function of the social good, the donor will want to abstain from imposing excessive conditionality on governments that would, by themselves, choose a high level of social spending. A too high level of conditionality on a highly social committed government would only crowd out the recipient's non monitorable effort.

3.3 Project Aid

One obvious alternative to budget support and its shortcomings is direct project aid. In what follows, with project aid we refer to a situation where the donor is fully in control of all the inputs required in the production of some portion of the social good. One typical example of this kind of aid is the realization of large public infrastructures. Another, is the financing of a number of different small projects, implemented directly the donor, by NGOs, local communities, etc.. By assuming that the donor (or its agents) are in full control of the projects, we implicitly assume that through project financing it is possible to avoid that aid funds are diverted by the recipient. Of course, this is not necessarily always the case, and there are several instances in which funds intended for project have indeed been diverted. However, it is our conjecture that fund diversion is easier under budget support than under project financing. This is what we do need for our results to hold. Accordingly, the above assumption has to be interpreted in a relative sense.

Project aid has its own shortcomings: unlike the case of budget support programs, with project aid donors have no control over the overall allocation of resources. Then, nothing prevents recipients from reallocating their own resources away from the social sector once projects are financed. As an example, a government that would have allocated resources to build a school may decide to use the resources elsewhere, if donors decide to build the school themselves. This issue is generally known as the aid "fungibility" problem and has

[11] We simulated the problem with a number of commonly used utility functions, and were never able to obtain an upward sloping $\widehat{k}(\alpha)$. In particular, we found that for Cobb-Douglas utility functions $\frac{\partial \widehat{k}}{\partial \alpha} = 0$, and for CES-type utility functions $\frac{\partial \widehat{k}}{\partial \alpha} < 0$.

been largely analyzed in the literature.[12]

In this section, after computing the level of production of the social good associated with project aid, we compare it with the level associated with conditional budget support. In order to make the results comparable with those in the previous section we assume that a donor is willing to provide the same amount of aid, A, under both schemes. Since the donor is now able to control the implementation of the project, inputs will be chosen efficiently ($k = e$). However, we do not rule out the possibility that "the capital expenditures funded by donor project aid are not perfect substitutes for capital expenditures funded out of government's own domestic budget,"[13] and that there are advantages associated with a holistic approach to aid. We thus assume that, in the case of project financing, the maximum amount of social good that can be produced with an amount A of aid is $\lambda s(\mathbf{A}/2)$, where $s(\cdot)$ is the same production function as in the previous section, $\mathbf{A} = (A, A)$, and $\lambda \in (0, 1]$, denotes the degree to which the donor's project fits the overall poverty reduction strategy of the recipient government. Hence, $(1 - \lambda)\, s(\mathbf{A}/2)$ is the cost associated with the potential imperfect fit of the project within the recipient's social strategy.

Under such assumption, the problem of the recipient becomes that of

$$\underset{k,e}{Max} \ \left[\alpha V(s(k, e) + \lambda s(\mathbf{A}/2)) + (1 - \alpha)V(G - k - e)\right], \tag{9}$$

and that the solution of problem (9) is given by $k^A = e^A = y^A$, with

$$y^A = \max\left\{0; \mathbf{y} : \alpha V'(s(\mathbf{y}) + \lambda s(\mathbf{A}/2))s_{\mathbf{y}}(\mathbf{y}) - (1 - \alpha)V'(G - 2y) = 0\right\}, \tag{10}$$

where $\mathbf{y} = (y, y)$. We are now in a position to compare the level of production of the social good under conditional budget support and project aid. In particular, we can prove that

Proposition 1 *For any $A > 0$ and $\lambda \in (0, 1]$: (i) for any $\alpha \in (0, 1)$, there is a $\widehat{G} \in [0, \infty)$ such that conditional budget support implements a higher level of production of the social good than project aid if, and only if, the recipient's resources, G, are larger than $\widehat{G}$; (ii) for any $G > 0$, there is an $\widehat{\alpha} \in (0, 1)$ such that conditional budget support implements a higher level of production of the social good than project aid if, and only if, the recipient's social commitment is such that $\alpha > \widehat{\alpha}$.*

[12] See, for example, Devajaran and Swaroop (1998), and Khilji and Zampelli (1994).

[13] As noted by a senior official of a major aid recipient country.

Proof. See Appendix .

Note that $\widehat{G}$ is strictly positive only if the costs associated with the implementation of project financing are small enough (in other words, only for λ large enough). For low values of λ, conditional budget support will be the optimal aid policy for "socially committed" recipients, irrespective of the size of their budget.

The intuition for this result is easy to grasp. For small aid programs, the recipient is able to reallocate its budget so to obtain its own preferred allocation of resources. However, when the resources associated with the aid program are large relative to the country's budget, aid fungibility is necessarily limited. Similarly, it is difficult to relocate resources away from social spending for countries that would freely dedicate very little of their own budget to such activities. According to Proposition 1, donors should design aid policies so to offer budget support (BS) to relatively richer and more socially oriented governments and to provide project aid (PA) to poorer and less socially oriented ones. Figure 2 plots the level of production of the social good under conditional budget support and project aid (as a function of α, and as a function of G) for the case of Cobb-Douglas utility, with $\lambda = 1$, and where the parameters A and G are such that the recipient's IR is never binding.[14]

We can complement Proposition 1 with the following results.

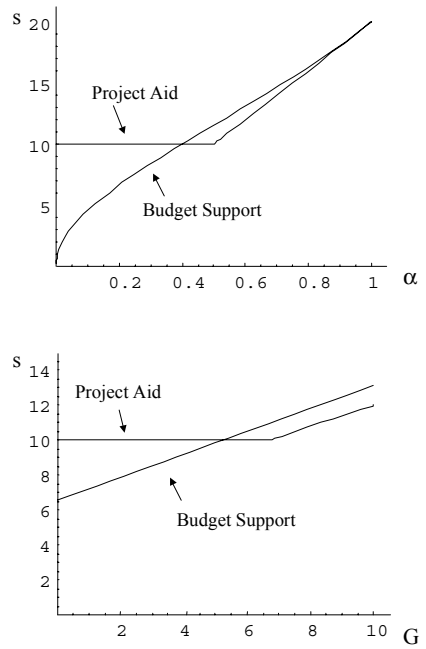
Corollary 1 *For any $A > 0$, (i) the budget threshold for which $BS \succ PA$ is decreasing in α ($\frac{d\widehat{G}}{d\alpha} < 0$) and the social commitment threshold for which $BS \succ PA$ is decreasing in G ($\frac{d\widehat{\alpha}}{dG} < 0$); (ii) both thresholds are decreasing in λ, ($\frac{d\widehat{G}}{d\lambda} < 0$, and $\frac{d\widehat{\alpha}}{d\lambda} < 0$).*

Proof. See Appendix.

Again the intuition is straightforward. More socially oriented governments will allocate a relatively larger share of own resources to social spending. Hence, for a given amount of aid and own resources, they will have "more room" to reallocate resources away from socially valuable activities. Similarly, for given preferences, richer governments will have relatively more resources to reallocate. Obviously, both thresholds decrease when project aid becomes more efficient.

[14] In the Cobb-Douglas case, $\widehat{k} = \frac{A+G}{2}$ for all αs. Hence, for $A \leq G$ the IR is never binding in equilibrium. The figures are plotted for $s(k, e) = 2k^{\frac{1}{2}}e^{\frac{1}{2}}$ and $A = 10$; in the first panel, $G = 10$; in the second panel $\alpha = 0.6$.

Figure 2: Social Good Production under Project Financing and Budget Support



3.4 Conditional Project Aid

The previous analysis helped us shedding some light on the conditions under which a donor interested in the effective implementation of social programs should rely on conditional budget support or on project aid. The reason why we focused our attention on these two aid instruments is two-fold. First, they account for a large share of donor financial assistance.[15] Second, while there is a large literature on the pros and cons of each of such instruments, to our knowledge there is no formal model that allows a comparison of project and program aid in a rigorous way.

Most aid practitioners wouldn't object that the comparison between budget support and project aid is a relevant one. However, from a theoretical point of view, one might argue on why a donor should be limited to the use of these two instruments and should not be able to combine them, making project aid conditional on some policy actions taken by the recipient. Before analyzing the effects of such conditional project aid, we want to stress that such a policy would be difficult to put in practice. This for at least two reasons. First, once a donor opts for delivering aid through projects, it is in a much weaker negotiating position

[15] The other important component is technical assistance.

with respect to the recipient government. In particular, while under budget support it is (relatively) easy for a donor to stop disbursements if the recipient doesn't properly implement conditionality, the opposite is true for project aid. For example, it would be hardly credible for a donor to threaten to stop a vaccination program half a way (or the distribution of food in areas severely affected by a famine) because the recipient refused to carry out some fiscal decentralization measures. This, despite the fact that such measures could be crucial for a general poverty reduction strategy. Second, the cases in which the donor prefers project aid are those cases in which it deals with socially uncommitted recipient governments. In such situations, it can very well be the case that for political reasons the donor wants to completely bypass the central government and deliver aid directly to certain targeted groups, or use NGOs as implementing agencies.

With the above caveats in mind, let us now discuss the extent to which our main findings hold when conditional project aid is indeed an option. In particular, consider now the case where the donor makes project aid conditional on a level of capital expenditure k^{CA} on the part of the recipient, where the superscript CA, stands for conditional project aid. Since for any $\alpha > 0$, in the case of project aid, the recipient's IR constraint is slack at $k^{CA} = 0$, the donor cannot be worse off by imposing some conditionality. This would in turn imply that, whenever the donor prefers project aid to conditional budget support, a fortiori it also prefers conditional project aid. Thus, the interesting case is the one in which the donor prefers conditional budget support to unconditional project aid. Would this be also the case if the alternative was conditional project aid? In our framework, this depends on the degree of social commitment of the recipient government (α) and on the costs associated with the potential imperfect fit of the donor's project within the overall recipient's social strategy (λ). In particular, it is easy to show that: (i) for any value of $\lambda \in (0, 1)$, for a sufficiently committed government, conditional budget support yields a higher level of production of the social good than conditional project aid; (ii) For any value of $\alpha \in (0, 1)$, if the cost associated with the lack of project ownership are sufficiently large, conditional budget support yields a higher level of production of the social good than conditional project aid.[16]

This in turns implies that most of our main findings are robust to the introduction of

[16] The proof of such statements is straightforward if one notices that: (i) as long as there are inefficiencies associated with project aid, ($\lambda < 1$), for values of α close to one, conditional budget support yields a higher level of production of the social good than conditional project aid; (ii) As long as $\alpha > 0$, for values of λ close to zero, $BS \succ PA$.

more elaborated aid contracts: Even allowing the imposition of conditional project aid, one cannot get rid of the trade-offs that exist between program or project-based poverty reduction strategies.[17] Thus, in the remaining of the paper, we focus our attention on conditional budget support and unconditional project aid.

4 Program and project financing with α not observable

The analysis in the previous sections showed that the features of "optimal" aid policies should depend upon the preferences and the resources of the recipient government. However, important characteristics of recipient governments are often not observable. In particular, it may be difficult for recipients to signal credibly their commitment to social issues. Similarly, it may be difficult for donors to evaluate that commitment on the basis of the recipients' track record. Hence, in what follows, we extend the analysis to the case where the type of the recipient government is not observable.

The situation we have in mind is one where, because of political changes or regime switches (like the end of a war), the recipient government's track record is not available or cannot be used to infer its preferences with regard to social expenditure. More precisely, we consider a donor facing a recipient government whose exact type α is unobservable. We assume that α is private information of the recipient government, and that it is distributed according to some function $F(\alpha)$ over a support $[\underline{\alpha}, \overline{\alpha}]$ which is common knowledge. In addition, the donor can also observe the amount of internal resources, G, available to the recipient.

While it is relatively easy to set up the general problem for a donor maximizing the expected production of social good under this form of asymmetric information, it is not possible to fully characterize its solution without imposing further structure on the model (in particular, we would need to determine an explicit recipient's utility function and the value of the various parameters). Hence, in what follows, we opted for providing a simple example that illustrates some interesting characteristics of the optimal solution for the case with two types only.

[17] One exception is part (i) of Proposition 1. Under conditional project aid, for recipient with low levels of social commitment (small values of α) it can be the case that project aid is always preferable to budget support, irrespective of the ammount of their own resources G.

4.1 A Simple Example

Consider the case where there are only two types $\alpha_0 = 0$ and $\alpha_1 = 1$, with probability $1-p$ and p, respectively.[18] In this case, we know that type α_0 will prefer budget support (BS) to project aid (PA) whenever $k < A$; it will be indifferent between the two schemes (and between the two schemes and no aid) when $k = A$; and it will prefer PA (or no aid) to BS when $k > A$. Assume for simplicity that, in case of indifference, the α_0 type will choose project aid over either budget support or no aid.

From the properties of the production function $s(\cdot)$, the optimal level of conditionality for type α_1 is $\widehat{k} = \frac{G+A}{2}$, or more precisely, any $\widehat{k} \leq \frac{G+A}{2}$. Indeed, it is always technically efficient to use both inputs, k and e, in the same proportions, and in the absence of a conflict of objectives with the recipient, the donor has no reason to alter that allocation of resources. Then, we have two possible scenarios.

1) For $G \geq A$, $\frac{G+A}{2} \geq A$, which implies that by just imposing the optimal level of conditionality on budget support the donor will be able to separate the two types obtaining an expected production of the social good equal to

$$E(s) = p \cdot s(\frac{\mathbf{G}+\mathbf{A}}{2}) + (1-p) \cdot \lambda s(\frac{\mathbf{A}}{2}),$$

with $\mathbf{G} = (G, G)$.

2) For $G < A$, we have $\frac{G+A}{2} < A$, which implies that the donor will not be able to separate the two types by imposing $\widehat{k} \leq \frac{G+A}{2}$, as type α_0 would also choose BS. Under these circumstances the donor has three options:

i) It may choose to pool the two types on the BS policy, with $\widehat{k} = \frac{G+A}{2}$. In that case the expected social good production would be

$$E(s) = p \cdot s(\frac{\mathbf{G}+\mathbf{A}}{2}) \tag{11}$$

as type α_0 would not allocate any resource to social programs.

ii) The donor can pool both types on the PA policy and obtain

$$E(s) = p\left(s(\frac{\mathbf{G}}{2}) + \lambda s(\frac{\mathbf{A}}{2})\right) + (1-p) \cdot \lambda s(\frac{\mathbf{A}}{2}). \tag{12}$$

iii) The donor may try to separate the two types by imposing a higher level of conditionality, $\overline{k}$, on the budget support policy. In order to keep type α_0 out of the BS policy it

[18] Under such assumptions, we can, without loss of generality, limit the analysis to the case where the donor provides the same amount of resources for both financing schemes.

needs to be $\overline{k} \geq A$. Note that, since for a recipient of type α_1 the production of the social good is decreasing in k, for $k \geq \frac{G+A}{2}$, the optimal separating policy will involve BS with $\widehat{k} = A$. Hence, the expected product will be

$$E(s) = p \cdot s(A, G) + (1 - p) \cdot \lambda s(\frac{\mathbf{A}}{2}). \tag{13}$$

Which one of these three options delivers the higher expected level of social good production depends on the parameters of the model. For example, when A is very close to G, the efficiency loss from imposing $\overline{k} = A$ is relatively small, and the separating policy in (iii) is likely to be the best solution. Less formally, to separate "good" recipients from "bad" ones is relatively easier and "cheaper" when the maximum conditionality accepted by "bad" recipients is not too far away from the what constitutes optimal conditionality for "good" ones. This is the case when donors can require some unnecessary "small" reform that is inessential for good governments, but results unacceptable to bad ones.

On the contrary, for p close to 1, the pooling strategy in (i) is probably best, as the loss associated with providing budget support to type α_0 is weighted by a very small probability. Here, the intuition is straightforward, when donors' expectations about the recipient's type are very optimistic, it would be unwise to suffer the costs associated with a separating strategy just in order to screen out recipients that exist only with some remote probability.

Finally, for $A >> G$, a relatively small p, and a relatively large λ, the pooling strategy in (ii) is the most likely solution, as the inefficiency required to achieve separation and the expected loss associated with providing budget support to type α_0 are large, while the cost linked to project aid is small.

The results in this section show that under asymmetric information the use of conditionality as a screening device comes to a cost; namely, the fact that donors may be forced to impose a level of conditionality which is higher than that they would choose if they could observe the recipient's type. Note that this higher level of conditionality cannot be properly defined as "excessive". Indeed, given the informational structure of the problem, donors are still following an optimal strategy. In other words, this extra conditionality represents the cost "good" recipients have to pay in order to separate themselves from "bad" ones. We discuss this issue in some greater detail in the next section.

A second point worth mentioning pertains to the limitations of conditionality as a screening device. In this model, the recipients' individual rationality constraint (in terms of the

maximum amount of conditionality each type is willing to accept) is increasing in the recipient's social commitment, α. For such reason, donors can use conditionality not only to separate recipients which are granted budget support from those which are given project financing, but also to screen out "bad" types (recipients with particularly low values of α) altogether. This works because our "simple" donor is interested solely in the absolute level of the social good production. However, one could argue that should a more sophisticated donor decide to give aid exclusively to some recipients, these would not necessarily be those with higher levels of α. Rather, that donor would try to target recipients on which aid would make the maximum impact and so give the donor the maximum benefit. In that case, conditionality could prove an ineffective screening device as the "worthy" recipients could be those with intermediate values of α.[19]

5 Concluding Remarks

According to Easterly (2001), the ultimate reason behind many of the failures of developmental efforts is that aid policies often "did not take the heed of the basic principle of economics: people respond to incentives" (p. 143). From that point of view, poverty reduction policies are deemed to fail if they do not, at least to some extent, take into account the reaction of recipient governments to foreign aid. Starting from this assumption, we analyzed the relative effectiveness of conditional budget support and project aid, in the presence of a conflict of interests between the donor community and recipient governments. We considered a situation where recipient countries were heterogeneous along two dimensions: the social preferences of their government, and the amount of their own resources. In that context, we showed that the relative costs and benefits of the two alternative forms of conveying aid depend upon the characteristics of the recipient. On the one hand, the distortions stemming from the fact that in a budget support program not all recipients' actions are perfectly monitorable decrease as recipients' preferences become closer to those of the donors. On the other hand, aid fungibility in project financing increases with the amount of the recipient's own resources. Then, from an altruistic donor's point of view, project aid is preferable for recipients characterized by small amounts of own resources and social preferences far apart from those of the donor; budget support is instead preferable for recipients with relatively

[19] We thank Susan Collins for pointing out this issue.

large own resources and preferences relatively close to those of the donor.

The framework in this paper has some limitations. First, in the analysis, we assumed that the donor community only cares about poverty reduction, and thus that its motivations are purely altruistic. In the model, it is only the recipients' "fault," if aid increases unproductive public consumption. Of course, this is not necessarily the case. Indeed, very few observers would disagree on the fact that aid policies have often been motivated by reasons other than poverty alleviation. For instance, Alesina and Dollar (2000) find considerable evidence that aid patterns are dictated by political and strategic considerations, and that donor governments differ substantially in their degree of altruism. In this respect, the flavor of our analysis is more normative than positive: It does not address questions related to the motivations behind actual (or past) aid disbursements; it addresses the question of how aid should be disbursed in order to maximize poverty alleviation or, more generally, to maximize the donor's objectives – whatever such objective are – provided that they are not perfectly aligned with those of the recipient.

A second important point is that by restricting our attention to how to allocate a given amount of aid, we explicitly disregarded the problem of how to allocate aid across different countries. Also, by assuming a single donor, we abstracted from problems arising in presence of multiple principals with conflicting objectives, studied by Murshed and Sen (1995), as well as from donors' coordination issues. From that point of view, our analysis is probably more pertinent to developmental aid packages managed by multilateral organization than to bilateral aid.

Finally, a natural solution to the trade-off between conditional budget support and project aid examined in this paper would be to make aid conditional on the track record of recipient governments. In that context, conditionality would still involve distortions, but only to the extent that only a subset of the government actions were ex-post observable and to the extent that the government policies could not be fully evaluated by assessing their results. Such "ex-post" conditionality would, hence, be more efficient than the one studied in our framework. However, with resource-constrained recipient countries, this ex-post conditionality could potentially lead to a Catch-22 situation, where aid would be disbursed if social expenditures were substantially increased, but social expenditures could not be increased if aid were not disbursed first. Furthermore, as Svensson (2000b) points out, ex-post conditionality would likely be time inconsistent on the donor's part (especially for more altruistic

donors), as to deny relief to countries with a bad track record but in desperate need of aid would constitute a non credible threat.

The framework developed in this paper could be easily applied to the analysis of debt relief policies. In that context, the general agreement in the donor community is that the benefits of unconditional debt relief in terms of poverty alleviation might be limited, and thus that some form of conditionality should be imposed. According to CISDE-Caritas International (1999) "Because not all governments can be counted on to use resources freed through debt relief to invest in the poor and marginalized sectors of society, there is a case for making a strong link between investment in human development and debt cancellation." Our analysis is consistent with that view. Furthermore, as any debt reduction is intrinsically a budget support instrument, and as many indebted countries seem to have preferences far apart from those of the creditor community, the results in this paper suggest that it would be unwise to grant these countries new resources, through debt relief, without also providing them with a system of incentives to guarantee a "proper" allocation of those resources.[20] Our findings also suggest that, in the absence of such system of incentives, creditor countries would do better by focusing on other forms of aid policy.

Finally, a remark on "excessive" conditionality. The analysis in this paper makes large use of terms like "the level of conditionality", "higher conditionality", etc. Hence, one could be naturally led to associate this paper to issues pertaining to the debate on the streamlining of conditionality. In that context, it is argued that "too much" program conditionality (often in the form of excessively detailed programs) is actually detrimental to the recipient country, and it reduces the effectiveness of the program itself, by imposing an unnecessary administrative burden. The model in this paper completely abstracts from that issue. Donors always choose a level of conditionality that is optimal given the informational structure of the problem. In this model, conditionality *needs* to be higher under imperfect monitoring relative to when donors can monitor all the actions of the recipient. Similarly, if conditionality serves as a screening device, it *needs* to be higher than when donors can observe recipients' types. A more complex model would be needed to incorporate the streamlining debate into the analysis. We leave that task to future research.

[20] From this point of view the HIPC initiative seems to be a step in the right direction.

Appendix

Proof of Lemma 1

Consider $\alpha \in [0,1)$. (i) Since for any $k > k^{NC}$ conditionality is binding,

$$\frac{\partial U}{\partial k}\Big|_{k>k^{NC},} = \alpha s_k(\cdot)V'(s(k,\widehat{e}(k))) - (1-\alpha)\,V'(G+A-k-\widehat{e}(k)) < 0. \tag{14}$$

Suppose $\widehat{e}(k) > k^{NC}$. Since $V'(0) > 0$, and $V''(.) < 0$, a necessary condition for $\widehat{e}(k) > k$ is that

$$\frac{\partial U}{\partial e}\Big|_{e(k)=k,}\ \alpha s_e(\cdot)V'(k\widehat{e}(k)) - (1-\alpha)\,V'(G+A-k-\widehat{e}(k)) > 0.$$

However, because of the symmetry of the production function, at $e(k) = k > k^{NC}$ the latter expression can be written as

$$\frac{\partial U}{\partial e}\Big|_{e(k)=k>k^{NC}}\ \alpha s_k(\cdot)V'(k,\widehat{e}(k)) - (1-\alpha)\,V'(G+A-k-\widehat{e}(k)) > 0,$$

which contradicts (14).

(ii) Now, consider the best response of the recipient under conditionality:

$$\max_e\left[(1-\alpha)\,V\left(G+A-k-e\right) + \alpha V(s(k,e))\right],$$

yielding the first order condition[21]

$$\alpha s_e(\cdot)V'(s(k,\widehat{e}\,(k))) - (1-\alpha)\,V'\left(G+A-k-\widehat{e}\,(k)\right) = 0. \tag{15}$$

Totally differentiating (15), we obtain

$$\frac{d\widehat{e}\,(k)}{dk} = -\frac{\alpha V''(\cdot)s_k(\cdot)s_e(\cdot) + \alpha V'(\cdot)s_{ek}(\cdot) + (1-\alpha)\,V''\left(G+A-k-\widehat{e}\,(k)\right)}{\alpha V''(\cdot)(s_e(\cdot))^2 + \alpha V'(\cdot)s_{ee}(\cdot) + (1-\alpha)\,V''\left(G+A-k-\widehat{e}\,(k)\right)}. \tag{16}$$

Since, at equilibrium, $\widehat{e}\,(k) \leq k$,then it should be that $s_k(\cdot) \leq s_e(\cdot)$ Hence, since $s_{ek}(\cdot) > s_{ee}(\cdot)$, from (16) we have that for $\alpha > 0$,

$$\frac{d\widehat{e}\,(k)}{dk} > -1. \tag{17}$$

Now consider the donor's first order conditions

$$\frac{d\left(s(\widehat{e}\,(k)\,,k)\right)}{dk} = s_k\left(\cdot\right) + s_e\left(\cdot\right)\frac{d\widehat{e}\,(k)}{dk} = 0. \tag{18}$$

[21] Note that the Inada conditions on $V(\cdot)$ guarantee that the first order conditions can always be satisfied for a $k < G + A$, so that a corner solution is excluded.

At k^{NC}, we have $\widehat{e}\left(k^{NC}\right) = k^{NC}$. Hence, from (18) it follows that

$$\left.\frac{d\left(s(\widehat{e}\left(k\right),k)\right)}{dk}\right|_{k=k^{NC}} = s_k\left(\cdot\right) + s_e\left(\cdot\right)\frac{d\widehat{e}\left(k\right)}{dk} = s_k\left(\cdot\right)\left(1+\frac{d\widehat{e}\left(k\right)}{dk}\right),$$

which is positive because of (17). Hence, a necessary condition for the donor's f.o.c. to be verified is that $\widehat{k} > k^{NC}$. Finally, as for any $A > 0$ the IR constraint is not binding at $k = k^{NC}$, the existence of a $\tilde{k} \in \left(k^{NC}, k^{IR}\right)$, such that $s(\tilde{k}, \widehat{e}(k)) > s(k^{NC}, \widehat{e}(k^{NC}))$, follows directly from a continuity argument. ■

Proof of Proposition 1

First we prove the following lemma

Lemma 2 (i) *For any* $\alpha \in (0,1)$, $A > 0$, *and* $\lambda \in (0,1]$ *there is a* $\widetilde{G}$ *such that for* $G > \widetilde{G}$, *project aid is not preferred to unconditional budget support.* (ii) *For any* $A > 0$, *and* $G > 0$, *there is a* $\widetilde{\alpha}$ *such that for* $\alpha > \widetilde{\alpha}$, *project aid is not preferred to unconditional budget support.*

Proof: Define as $2x_\alpha^{A+G}$ the amount of resources that a government with preferences α and budget $A+G$ would devote to social programs. That is

$$\mathbf{x}_\alpha^{A+G} = \{\mathbf{x} : \alpha V'(s(\mathbf{x}))s_{\mathbf{x}}(\mathbf{x}) - (1-\alpha)\,V'\left(G + A - 2x\right) = 0\}$$

where $\mathbf{x}_\alpha^{A+G} = (x_\alpha^{A+G}, x_\alpha^{A+G})$. For any $\alpha \in (0,1)$, and $A > 0$, we have that: for $G = 0$, $x_\alpha^{A+G} < A/2$; for $G \to \infty$, $\lim_{G\to\infty} x_\alpha^{A+G} = \infty > A/2$. Hence, since $\frac{dx_\alpha^{A+G}}{dG} > 0$, there exists a $\widetilde{G}$ such that $x_\alpha^{A+G} > A/2 \Leftrightarrow G > \widetilde{G}$. Similarly, for any $A > 0$, and $G > 0$, we have that $x_{\alpha=0}^{A+G} = 0$, and $x_{\alpha=1}^{A+G} = \frac{A+G}{2}$. Hence, since $\frac{dx_\alpha^{A+G}}{d\alpha} > 0$, there exists a $\widetilde{\alpha}$ such that $x_\alpha^{A+G} > A/2 \Leftrightarrow \alpha > \widetilde{\alpha}$.

Then, for $x_\alpha^{A+G} > A/2$, we can write $\mathbf{x}_\alpha^{A+G} = \frac{\mathbf{A}}{2} + \mathbf{y}_\alpha^{A+G}$, with $\mathbf{y}_\alpha^{A+G} = (y_\alpha^{A+G}, y_\alpha^{A+G})$, so that the first order conditions for the recipient government become

$$\alpha V'(s(\mathbf{A}/2 + \mathbf{y}_\alpha^{A+G}))s_{\mathbf{y}}(\mathbf{A}/2 + \mathbf{y}_\alpha^{A+G}) - (1-\alpha)\,V'\left(G - 2y_a^{A+G}\right) = 0. \tag{19}$$

The first order conditions for a government receiving A in project financing are

$$\alpha V'(\lambda s(\mathbf{A}/2) + s(\widetilde{\mathbf{y}}))s_{\mathbf{y}}(\widetilde{\mathbf{y}}) - (1-\alpha)\,V'\left(G - 2\widetilde{y}\right) = 0, \tag{20}$$

with $\widetilde{\mathbf{y}} = (\widetilde{y}, \widetilde{y})$. Now, for any $A > 0$, remembering that $s(\cdot)$ is a linear homogeneous function, a necessary and sufficient condition for project aid to be preferred to unconditional budget support is

$$\frac{\mathbf{A}}{2} + \mathbf{y}_\alpha^{A+G} < \lambda\frac{\mathbf{A}}{2} + \widetilde{\mathbf{y}}; \tag{21}$$

which implies

$$\mathbf{y}_{\alpha}^{A+G} < \widetilde{\mathbf{y}}. \tag{22}$$

Assume that (22) holds true. Then, since the production function is linear homogeneous, $s_{\mathbf{y}}(\widetilde{\mathbf{y}}) = s_{\mathbf{y}}(\mathbf{A}/2 + \mathbf{y}_{\alpha}^{A+G})$. Then, from the concavity of $V(\cdot)$, we have that

$$\alpha V'(s(\mathbf{A}/2+\mathbf{y}_{\alpha}^{A+G}))s_{\mathbf{y}}(\cdot)-(1-\alpha)\,V'\left(G-2y_{a}^{A+G}\right) > \alpha V'(\lambda s(\mathbf{A}/2)+s(\widetilde{\mathbf{y}}))s_{\mathbf{y}}(\cdot)-(1-\alpha)\,V'\left(G-2\widetilde{y}\right),$$

so that it cannot be the case that both (19) and (20) hold true. This in turn implies that (22) cannot be verified when $G > \widetilde{G}$, and $\alpha > \widetilde{\alpha}$. ■

From the same argument as in the proof of Lemma 2, it follows that, for any $G < \widetilde{G}$ or $\alpha < \widetilde{\alpha}$, it needs to be $\widetilde{\mathbf{y}} = 0$. Hence, we have $\frac{ds^{PA}}{dG} = 0$ for $G < \widetilde{G}$, and $\frac{ds^{PA}}{d\alpha} = 0$, for $\alpha < \widetilde{\alpha}$.

Now, we can prove the main proposition.

(i) We know that $s^{PA} \geq \lambda s(\frac{\mathbf{A}}{2})$, with the superscript PA denoting the project aid scenario. Thus, for any $\alpha < 1$, at $G = 0$, two cases are possible depending upon the value of λ. First, for λ large enough, $s^{PA} = \lambda s(\frac{\mathbf{A}}{2}) > s^{C} > s^{NC}$. In this case, from Lemmas 1 and 2, we know that for any $G > \widetilde{G}$, $s^{PA} < s^{NC} < s^{C}$. Since s^{C}, and s^{PA} are continuous functions, there exists a $\widehat{G} \in (0, \widetilde{G})$ such that, if $G < \widehat{G}$, $s^{C} < s^{PA}$. The uniqueness of $\widehat{G}$ follows from the fact that $\frac{ds^{C}}{dG} > 0$, and that, for any $G \in (0, \widetilde{G})$, $\frac{ds^{PA}}{dG} = 0$. Second, for small values of λ, at $G = 0$, $s^{PA} = \lambda s(\frac{\mathbf{A}}{2}) < s^{C}$. In that case $\widehat{G} = 0$.

(ii) For $\alpha = 0$, $s^{C} = 0 < s^{PA} = \lambda s(\frac{\mathbf{A}}{2})$. From Lemmas 1 and 2, we know that for any $\alpha > \widetilde{\alpha}$, $s^{PA} < s^{NC} < s^{C}$. Since s^{C}, and s^{PA} are continuous functions, there exists a $\alpha \in (0, \widetilde{\alpha})$ such that if $\alpha > \widehat{\alpha}$, $s^{C} > s^{PA}$. The uniqueness of $\widehat{\alpha}$ follows from the fact that $\frac{ds^{C}}{da} > 0$, and that, for any $\widehat{\alpha} \in (0, \widetilde{\alpha})$, $\frac{ds^{PA}}{d\alpha} = 0$.■

Proof of Corollary 1.

The proof descends directly from the fact that $\widehat{\alpha} < \widetilde{\alpha}$ and $\widehat{G} < \widetilde{G}$, or in loose words, from the fact that s^C intersects s^{PA} in its "flat" portion. Hence, at $\widehat{\alpha}$, $\frac{ds^{PA}}{d\alpha} = 0$, while for any α, $\frac{ds^C}{d\alpha} > 0$. Then, as $\frac{ds^C}{dG} > 0$, it has to be that $\frac{d\widehat{\alpha}}{dG} < 0$. Similarly, we have that at $\widehat{G}$, $\frac{ds^{PA}}{dG} = 0$, while for any G, $\frac{ds^C}{dG} > 0$. Hence, as $\frac{ds^C}{d\alpha} > 0$, it has to be that $\frac{d\widehat{G}}{d\alpha} < 0$. The proof of part (ii) is straightforward.■

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