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**AID EFFECTIVENESS: REVISITING THE
TRADE-OFF BETWEEN NEEDS AND
GOVERNANCE**

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Abstract

This paper aims at elucidating the issue of inter-country aid allocation by a single donor when the latter is sensitive to both needs and governance considerations and is moreover able to influence local governance through his own disciplining effort. In a one-donor-two-recipient framework and in conformity with observations from the real world, the poorer recipient country is assumed to be less well governed than the richer one. Many rich insights are gained from the analysis. In particular, the poorer and less well governed country is more likely to receive a higher share of aid if governance is endogenized through external disciplining by the donor. And the share of a country will always increase if it has succeeded in improving its internal governance, or discipline, thanks to its own effort. This is true even in the case where this effort leads to a fall of aggregate governance as a result of an overcompensating reaction of the donor when setting the level of external discipline. Finally, a decrease in the cost of external discipline will favor the poorer and less well governed country but only provided that the inter-country governance gap is large enough.

JEL Classification: D02, D86, O22, F35

Keywords: Aid effectiveness, aid allocation, Monitoring, governance

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Aid Effectiveness: Revisiting the Trade-off Between Needs and Governance

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Abstract

This paper aims at elucidating the issue of inter-country aid allocation by a single donor when the latter is sensitive to both needs and governance considerations and is moreover able to influence local governance through his own disciplining effort. In a one-donor-two-recipient framework and in conformity with observations from the real world, the poorer recipient country is assumed to be less well governed than the richer one. Many rich insights are gained from the analysis. In particular, the poorer and less well governed country is more likely to receive a higher share of aid if governance is endogenized through external disciplining by the donor. And the share of a country will always increase if it has succeeded in improving its internal governance, or discipline, thanks to its own effort. This is true even in the case where this effort leads to a fall of aggregate governance as a result of an over-compensating reaction of the donor when setting the level of external discipline. Finally, a decrease in the cost of external discipline will favor the poorer and less well governed country but only provided that the inter-country governance gap is large enough.

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1 Introduction

A criticism that is frequently levelled against prevailing patterns of aid allocation is the concentration on 'aid darlings' at the expense of 'aid orphans'. This is the logical consequence of an approach that emphasizes policy dialogue, country ownership and the need to get rid of conditionalities and reform overload or high transaction costs. Heralded by the Paris Declaration (March 2005) and the Accra Agenda for Action (September 2008), this approach also favors new aid modalities, General Budget Support (GBS) in particular, considered to be especially suitable to meet the above objectives. Yet, because conditionalities associated with GBS are more politically sensitive, arguable and hard to enforce than those associated with project and programme aid, they also tend to cause more frustration among donor agencies with the attendant risk of eventually dropping out the failing countries (Dijkstra, 2013). Not only does such a situation give rise to aid concentration, but also, to the extent that the worse-governed countries are generally poorer (Collier, 2007, Chap. 5; Kanbur and Sumner, 2012), it creates a serious equity problem.

Running counter to this tendency is the attitude of some aid donors such as DFID, the British Agency for International Development, which abandoned GBS and recently decided to focus their aid effort on weak states or fragile countries. The question arises as to whether such a daring approach can be rationalized in conditions where fragile countries are not only very poor but also badly governed. Upholders of a strictly need-based approach would certainly approve of the strategic re-orientation of DFID. According to Thirlwall (2011), for example, aid assistance should be distributed on a per capita basis according to some target level of per capita income (a principle "which would operate rather like an international negative income tax" (p. 476)). At the other extreme, upholders of a strictly governance-based approach would oppose the concentration of aid on fragile countries on the grounds that taxpayer money must be efficiently used lest continuation of aid efforts should be threatened under popular pressure in donor countries. Thus, in reaction to the uncovering of massive frauds in using aid money in some countries, some donors have professed a strong belief in "zero

tolerance for corruption”.¹

It is evident that to justify aid concentration on poor and badly governed countries, an intermediate approach based on a trade-off between needs and governance is required. The problem is that even such an approach, which is increasingly accepted, does not guarantee that fragile countries will be included in aid programmes: the acuteness of their needs may not be sufficient to counterbalance the appalling governance situation that prevails in these countries. The inherent limitation of conventional need-governance approaches of aid allocation is that governance is not considered as a characteristic that donors themselves can influence through their own disciplining efforts. We depart from such conventional approaches in the present paper: governance is determined not only by domestic efforts in the recipient countries but also by external efforts made by donors. This implies that when they decide about aid allocation, donors simultaneously choose the shares of aid accruing to each potential recipient country (allowing for zero shares) and the optimal level of their disciplining efforts.

To define our novel approach, we look at the choice problem of a donor agency which has to allocate a given amount of aid money between two countries heterogeneous in terms of needs and governance. One country is relatively poorer and worse-governed than the other. Because it is sensitive to the share of aid that effectively reaches the target group (the poor), the donor agency is confronted with a trade-off between governance and need considerations when it makes its inter-country allocation decision. Reflecting such a trade-off is the criterion of “Need-Adjusted Aid Effectiveness” (NAAE), which roughly corresponds to today’s geographical allocation of aid by important donors. Yet, this criterion may be quite misleading if the donor is able to improve the quality of governance in recipient countries, at least with respect to the projects it helps to finance, particularly in the poorer and worse-governed one. Opening up such a possibility through the use of appropriate disciplining instruments -monitoring and punishment- is

¹Thus, for example, the Global Fund against Aids, Tuberculosis and Malaria, one of the world’s biggest aid outfit which hands over all its money to national governments, has been recently confronted with the claim that up to two-thirds of some grants went astray, and that corruption using faked invoices, phoney training events and other abuses involved health ministries in some African countries on an “astonishing” scale. To the news, the executive director of the Global Fund reacted by asserting that the Fund has “zero tolerance for corruption” (The Economist, February 29th, 2022).

expected to raise the share of the poorer country, perhaps from zero to a positive number.

We are in fact able to confirm this prediction, albeit with a qualification (the share of the worse governed country increases unambiguously only if the initial disparity in governance levels is large enough) and in the framework of a two-recipient-country model.² But our analysis yields other interesting yet less intuitive results. The most salient and challenging finding is that, all other things being equal (including the characteristics of the other recipient country), an improvement in the intrinsic governance of one country may induce the donor to lower the severity of the discipline of its aid delivery to such an extent that the NAAE of the country may eventually decline. This should apparently lead the donor to decrease the share of aid going to that initially better-governed country. However, this is forgetting about a second effect corresponding to the fall in the cost of aid delivery to that country. When the two effects are taken into account, we show that the aid share obtained by the country that has improved its level of domestic governance is always raised by the donor. In other words, because of the dominant role of the cost effect, there is no perverse mechanism at work that would lead the donor to sanction the country that, thanks to its own effort, has become more effective in its use of aid. On the other hand, the endogeneity of the external discipline and therefore of the NAAE also explains that the aid share of the poorer and worse-governed country does not necessarily fall (increase) when the cost of external discipline increases (falls), and reacts in an ambiguous way to changes in aid availability.

To elucidate the logic behind these and other results, we need to have a thorough understanding of the way a model of endogenous aid delivery may work when only one recipient is considered. Since this represents a significant research endeavour in itself, we have undertaken it in another paper (Bourguignon and Platteau, 2017), to which we shall refer whenever appropriate. As hinted at in the above summary

²This is good news given the following facts. The number of poor in fragile states where governance problems are the most serious has stayed flat at about 500 million since 1990, and is likely to remain so until 2025 according to a recent study (Sunner, 2012). Since the number of poor in 'non-fragile' states falls quickly -from almost 2 billion people in 1990 to around 500 million now- countries with weak states will weigh more and more in donors' aid allocation decisions (Kharas and Rogerson, 2012).

of results, a central feature of the one-recipient model is that internal and external disciplines (the former assumed to be exogenous and the latter under the control of the donor) are made analytically comparable so that they can be aggregated in a measure of total discipline exerted on the recipient country.

The outline of the paper is as follows. Section 2 is a short section devoted to reviewing the directly relevant literature. In Section 3, we analyze the problem of aid allocation between two countries when governance levels are exogenous and the donor does not therefore try to influence them. It introduces the NAAE concept and highlightss the key role it plays in aid allocation. It is then shown that the resulting theoretical allocation rule are not qualitatively inconsistent with the rules actually used by some multilateral development agencies when allocating the aid funds they manage among developing countries. In Section 4, we explore the more complex case where the donor is able to use the available disciplining instruments to modify the quality of governance in two recipient countries. Some key analytical results are derived and discussed, and special attention is devoted to those results which are apparently counter-intuitive. In Section 5, given the complexity of the problem at hand, we resort to numerical simulations to complement the results obtained in the previous section. Section 6 concludes and draws policy implications from the approach proposed in the paper. It shows in particular that, when donors can influence the governance of the projects they fund in recipient countries, official allocation rules in use in development agencies may be inconsistent. The normative message of the paper is therefore that in deciding how to allocate their aid geographically, donors should not limit their attention to the initial (internal) governance levels of potential recipient countries but examine how they can influence governance through their own disciplining actions.

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2 Literature review

The literature that addresses the issue of aid allocation with a focus on agency problems is surprisingly narrow. A survey of the earlier literature using a macroeconomic framework is offered in Azam and Laffont, 2003 who also provide a

simple and elegant framework for studying the aid allocation problem.³ Within a principal-agent framework the optimal contract between the donor and the recipient country specifies that the recipient government will receive an aid amount linearly and positively dependent on the level of consumption of the poor that it provides.⁴ Such a rule is considered by the authors as describing in a stylized manner the basic conditionality mechanism. Its mode of operation is summed up by saying that aid must be disbursed only after observing the consumption of the poor.

Azam and Laffont do not explicitly address the issue of the allocation of aid across different countries, possibly with different internal governance characteristics. Svensson (2000, 2003) tackles this issue upfront in a two-stage game among two recipient countries and the donor. The two recipients are identical yet subject to independent shocks, so that their ex post situation may differ. The key assumption is that the probability of good states increases monotonically with the amount of reform effort applied by the recipient country but this effort is not observed by the donor. In Svensson's model (2000), the second-best contract is a compromise between giving aid to those who most need it and providing optimal incentives for reforms. This translates into the following donor's strategy: in order to induce the recipient to exert higher effort, aid flows in bad states must be lowered and aid flows in good states (more likely to occur when reform effort has been higher) raised (p. 70). Again, aid depends negatively on the extent of (ex-post) poverty so as to preserve effort incentives.

Collier and Dollar (2002) look more explicitly at the problem of a donor's allocation of aid between several recipient countries when they differ in terms of both policy quality and poverty. In their setup and unlike in the previous approaches, the quality of policies in each recipient country is taken as given by the donor. The latter then maximizes poverty reduction under that constraint, which leads to the following conclusion: holding the level of poverty constant,

³A recent survey of that literature including the issue of country aid allocation is Bourguignon and Gunning (2017). Note that we ignore here the case of several donors and one recipient country as in Knack and Rahman (2004) and Torsvik (2005) who examine how alignment of incentives is affected by the presence of multiple donors.

⁴In an earlier theoretical model of aid conditionality by Adam and O'Connell (1999), aid was conditional on domestic policy variables which in turn were determining the welfare of the poor.

aid should increase with quality of policy and, holding policy quality constant, it should increase with poverty. Several papers have broadened or modified the framework proposed by Collier and Dollar, which appears as a key reference in the aid allocation literature.⁵

Our own contribution in this paper differs from both Azam/Laffont and Svensson because we assume that governance in the recipient country can be influenced by other channels than the mere amount of aid. It also differs from Collier/Dollar who take governance as given.

3 Allocating aid between two heterogeneous recipients with a given aid delivery system

3.1 The aid allocation rule and its properties

Let us consider the case of two beneficiary countries with initial income per capita w_1 and w_2 , and population n_1 and n_2 . The donor, for instance a bilateral or multilateral development agency, has to allocate a total exogenous amount of aid T among the two countries. In this section, we assume that disciplining or aid delivery instruments are not available: the donor is unable to influence the quality of governance. However, he can observe it and therefore knows the shares that are going to be embezzled by the two countries' elites, denoted by y_1 and y_2 , both in the $[0, 1]$ range. His problem is to allocate total aid so as to maximize social welfare as given by the weighted sum of utilities received from transfers to the poor in each country. Letting s_1 and s_2 be the shares of total aid going to countries 1 and 2, a fairly general specification of the donor's objective is:

$$\underset{s_1+s_2=1}{Max} n_1 u(w_1, s_1 T(1 - y_1)/n_1) + n_2 u(w_2, s_2 T(1 - y_2)/n_2)$$

where the utility, $u()$, of aid to country i depends on income per capita in that country, and aid per capita actually reaching the population.⁶ For the sake of

⁵See part B in Bourguignon and Gunning (2017).

⁶Note that the donor considers the share of aid going to leaders in recipient countries as pure waste.

simplicity, we shall assume in what follows that the two arguments are perfect substitutes and that the utility function is logarithmic. We thus rewrite the preceding objective function as:

$$\underset{s_1+s_2=1}{Max} W = n_1 \text{Log}[rw_1 + s_1T(1 - y_1)/n_1] + n_2 \text{Log}[rw_2 + rsT(1 - y_2)/n_2] \quad (1)$$

where r is the weight of initial income relatively to aid in the preferences of the donor or the constant marginal rate of substitution between aid and initial income. If $r = 1$, which we will assume implicitly throughout the paper until the numerical calibration in Section 5, the main argument in the donor's welfare function, $[w_i + s_iT(1 - y_i)/n_i]$, is the level of post-transfer income per capita among the grassroots in country i . In (1), the weights are proportional to the size of each country's population. In this setup the (exogenous) quality of governance in the two recipient countries matters: it operates through $(1 - y_1)$ and $(1 - y_2)$, the shares accruing to the poor. Since the donor is sensitive to poverty, as reflected in the logarithmic specification of his utility, he prefers to help poorer communities if other things are equal. However, other things are not equal precisely because the quality of governance varies between the two countries, determining different levels of aid effectiveness.

We assume that the donor's participation constraint is satisfied, implying that $W \geq n_1 \text{Log}(w_1) + n_2 \text{Log}(w_2)$. Maximization of the social welfare function leads to the following first-order condition for an interior solution:

$$\frac{(1 - y_1)}{w_1 + s_1T(1 - y_1)/n_1} = \frac{(1 - y_2)}{w_2 + s_2T(1 - y_2)/n_2} \quad (2)$$

Using the constraint $s_1 + s_2 = 1$, we get an interior solution defined by

$$\hat{s}_1 = \frac{n_1}{n_1 + n_2} + \frac{1}{T} \left(\frac{w_2}{1 - y_2} - \frac{w_1}{1 - y_1} \right) \frac{n_1 n_2}{n_1 + n_2}, \quad (3)$$

and symmetrically for \hat{s}_2 .

Comparative statics shows that the share of country 1 increases with population, but decreases with initial income and the opportunism of the leader. On the other hand, it increases with the initial income of country 2 and the opportunism of

that country's leader while it decreases with its population. All these effects are in accordance to expectation. They also match the so-called 'algorithm for the poverty-efficient allocation of aid' proposed by Collier and Dollar (2002). For a given level of poverty, a country should receive more aid if the quality of its policies is comparatively high and, analogously, for a given quality of policy, it should receive more aid if it is comparatively poor.

Leaving population size aside, the key factor featuring in the above equilibrium relationship is $\omega_i = w_i/(1 - y_i)$. This composite variable, which encapsulates the needs versus governance dilemma at the core of our analytical endeavour, is the inverse of need-adjusted aid effectiveness (NAAE): aid is ineffective when it goes to a country that barely needs it (w_i is high), or cannot properly direct it towards the needy (y_i is high). Therefore, the higher ω_i the less induced is the donor to allocate aid to country i . In the particular case where $n_1 = n_2$, relative country shares in total aid are equal to 1/2 plus an expression that is positive or negative depending on whether the country considered is comparatively aid effective in the need-adjusted sense. When the role of population size is also taken into account, an additional trade-off emerges between NAAE and the number of people involved. This is apparent from a comparison of the shares of aid money accruing to both countries:

$$s_1 > s_2 \iff \left(\frac{n_1 n_2}{n_1 + n_2} \right) (\omega_2 - \omega_1) \frac{2}{T} + \frac{n_1 - n_2}{n_1 + n_2} > 0$$

The first term of the condition reflects the comparative advantage of country 1 from the viewpoint of need-adjusted aid effectiveness and the second term its advantage from the viewpoint of population size.⁷

The corner solutions associated with the preceding interior solution to the optimal

⁷Note that, from (3), we also have that $\delta s_1 / \delta T \geq 0 \iff \omega_1 \geq \omega_2$. Thus, the share of aid money allocated to country 1 will rise with total aid available if and only if need-adjusted aid ineffectiveness is greater in that country than in country 2. The underlying logic becomes clear once we understand that, because the marginal utility of aid per capita is the same for the two countries at the optimum, both countries receive the same absolute amount per capita out of any additional aid fund. Yet, this amount is larger relative to the initial aid received for the more ineffective country, because it received less, per capita, than the other country in the initial equilibrium.

allocation rule are particularly simple:

$$\hat{s}_1 = 1; \hat{s}_2 = 0 \iff \omega_2 > \omega_1 + \frac{T}{n_1} \quad (4)$$

$$\hat{s}_1 = 0; \hat{s}_2 = 1 \iff \omega_1 > \omega_2 + \frac{T}{n_2} \quad (5)$$

In words, the donor allocates the whole aid fund to one country if the need-adjusted measure of aid ineffectiveness for the excluded country exceeds that obtaining for the favoured country by a sufficiently wide margin. This margin is equal to the amount of aid that the favoured country would then receive on a per capita basis. The total amount of aid available thus matters: the larger this amount the less likely is the donor to exclude the less aid-efficient country (when aid delivery parameters are exogenous). Also, the larger the population weight attached to one country, the more easily will the other country be excluded if it is more aid-ineffective in the need-adjusted sense.

All these results can be generalized to any number of countries, as shown in Appendix A.

3.2 Comparing theory with practice

Let us now relate our theoretical allocation rule to the practice followed by international donors who use explicit allocation formulas. This is the case of the European Union (EU), the International Development Association (IDA) (the arm of the World Bank that specializes in managing multilateral aid to low income countries), and the African Development Bank (AfDB), for example. Thus, the EU uses a formula that combines, in a geometric model with equal weights, indicators of population size, extent of needs, quality of governance, human development, and vulnerability (Markova, 2013). Below we focus on rules known generically as 'Performance Based Allocation' or PBA rules, upon which organizations such as IDA base their aid allocation decisions.⁸ Compared to that used by the EU, the formula chosen by IDA is based on fewer indicators and on an

⁸Bourguignon and Gunning (2017) survey the literature dealing with the selectivity of aid through this kind of rule.

unequal weighting of the various dimensions selected. It is given by:

$$A_i = CPR_i^5 \cdot (GNI_i/P_i)^{-.125} P_i$$

where A_i is proportional to the allocation for country i , CPR_i is the Country Performance Rating as judged by World Bank's local representatives, GNI_i/P_i is gross national income per capita (excluding aid), and P_i the population. CPR_i is a composite variable defined as:

$$CPR_i = .24.CPIA_{1i} + .68.CPIA_{2i} + .08.PPR_i$$

where $CPIA_1$ and $CPIA_2$ stand for the mean values of, respectively, the first three clusters of the Country Policy and Institutional Assessment (economic management, structural policies, policies for social inclusion) and the governance cluster of the same (public sector management and institutions). Finally, PPR_i reflects an assessment of the performances of the 'portfolio' of projects managed by IDA in country i .⁹

In terms of the model analyzed in this paper, the PBA rule obviously combines the three key characteristics of recipient countries: their level of income, w_i , their governance, $1 - y_i$, and their population, n_i . Rigorously, in the present two-country framework, this PBA formula would lead to the following shares:

$$S_1 = \frac{[v(1 - y_1)]^4 \cdot w_1^{-125} \cdot n_1}{[v(1 - y_1)]^4 \cdot w_1^{-125} \cdot n_1 + [v(1 - y_2)]^4 \cdot w_2^{-125} \cdot n_2},$$

and symmetrically for S_2 . In that expression, $v()$ is some transform of the governance variable since it is not clear in the PBA framework how CPR_i would translate into higher or lower shares of aid embezzled by country i 's leaders. If the same 'ingredients' are found in the PBA rule and in our own aid allocation formula, they are not combined in the same way. Interestingly, the PBA rule satisfies the comparative-static properties obtained earlier. In particular, the share going to country i declines with its initial level of income, and increases with both

⁹For details on that formula and adjustments made on previous specifications, see IDA (2010). Adjustments can be seen in the Annex to the recent IDA agreements -i.e. 2016 for IDA 17.

its population size and the quality of its governance. However, it does not depend on the total amount of aid available.

Part of our theoretical allocation rule and some of its properties are obviously influenced by the logarithmic functional form which has been selected. A more general formula is shown in Appendix B where the utility of the donor exhibits constant poverty aversion ϵ , with ϵ different from unity. In the special case where $\epsilon = 1$, we have the logarithmic function (1). Unsurprisingly the role of governance in the allocation of aid declines with the aversion to poverty.

Clearly, the implicit aversion to poverty behind the IDA yardstick is rather low and the PBA rule seems much more oriented towards forcing recipient countries to improve on governance in a kind of independent manner. If there were not several «sweeteners» added to obtain the final allocation of aid, in particular in favour of so-called fragile countries - see IDA (2010) as well as more updates in the subsequent replenishment waves of this agreement ¹⁰- the weight of the governance indicator would be devastating. $CPIA_2$ is an index that practically varies between 2 and 3.7, with a standard deviation of .5. Based on the PBA formula above, a one standard deviation from the middle of the CPIA range implies a 50 % drop in aid. In comparison, a drop in GNI per capita by a one standard deviation increases aid by less than 10%.

Collier and Dollar (2002) find a less extreme allocation rule when intending to maximize the rate of world poverty reduction. Their approach is based on an econometric equation that relates in a non-linear way the growth rate of a country to the amount of aid received (relative to GNI) and the quality of its policy, p^i (actually an average of $CPIA_1$ and $CPIA_2$). World poverty reduction can be written as $\sum_i G^i \alpha^i h^i N^i$, where G^i is the rate of growth of country i , α^i is the elasticity of poverty reduction with respect to income, h^i is a measure of poverty (say, the headcount index), and N^i is the size of the population. Approximating growth rates by an estimated function of aid and policy (see above), the allocation

¹⁰Given the multiplication of these ad hoc amendments to the rule, some observers even doubt whether the PBA concept is still relevant. See Guillaumont and Wagner (2015)

of aid that maximizes world poverty reduction is given by:

$$A^i = 13.5 + 7.8p^i - \frac{\lambda}{0.04\alpha^i} \left(\frac{h^i}{Y^i} \right)^{-1},$$

where A^i is the aid received by country i , Y^i is its level of income per capita, and λ is a constant that stands for the shadow value of aid. Clearly, A^i increases with p^i , which conveys the same information as $(1 - y_i)$ in the preceding section, and with α^i , but it decreases with the ratio h^i/Y^i , which plays the same role as w_i . This is similar to the allocation formula derived from the simple model derived in Subsection in 3.1, except for the linear form which deviates from the NAAE concept present in the PBA rule.

We now turn to the task of determining the allocation of aid when, thanks to the availability of disciplining instruments, the donor has the capacity to influence the quality of governance in the two recipient countries.

4 Endogenizing the governance of recipient countries through donor discipline

As pointed out earlier, the analytics of a one donor-two recipients aid allocation model with endogenous governance is a complex affair that cannot be elucidated in the space of a single paper. We need to first go through the analytics of the one donor-one recipient model (with endogenous governance) to be able to derive results on the basis of the one donor-two recipients model. This preliminary task has been undertaken in a paper set in a sufficiently general framework to show the wide applicability of its results (Bourguignon and Platteau, 2017). In the presentation below, taking advantage of that earlier effort, we briefly explain the setup of the one donor-one recipient model - in effect a very much reduced form of it - and we summarize its central results. Readers interested in obtaining more information about the way they are derived as well as about additional results are advised to go through the aforementioned paper.

4.1 The setup of the model

Assume the leakage y is now a decreasing function of governance/discipline

$$y_i = \tilde{y}(\beta_i + \varphi_i)$$

where β_i is an exogenous parameter characterizing the governance of country i and φ_i stands for the external discipline (monitoring plus punishment) imposed by the donor to limit fraud in country i . It is convenient to interpret β_i as internal discipline, so that both internal and external discipline add up as two different ways to limit embezzlement of aid money.

Assume also that the external discipline has a unit cost given by $\Gamma(\varphi_i, y_i)$, increasing and convex in its two arguments. The first argument reflects the role of the donor's monitoring activity. Interpretation of the convexity assumption is straightforward in this case: the unit cost increases at growing pace with the intensity of monitoring. The second argument involves the expected cost of inflicting punishment.¹¹ Because punishment can be meted out only when the fraud is detected, its expected cost depends on the probability of fraud detection which is assumed to increase at rising pace with the extent of the fraud. It thus depends indirectly on $\beta_i + \varphi_i$.

The donor's objective is now made of two parts: an intrinsic utility derived from a transfer to needy populations and a cost function that summarizes the cost of the control exerted by the donor on the use of aid:¹²

$$\begin{aligned} \text{Max}_{\varphi_1, \varphi_2, s_1, s_2} \Omega = \sum_{i=1}^2 \{n_i \text{Log} \left[w_i + \frac{s_i T}{n_i} (1 - \tilde{y}(\beta_i + \varphi_i)) \right] \} & \quad (6) \\ -s_i T \Gamma[\varphi_i, \tilde{y}(\beta_i + \varphi_i)] & \quad \text{subject to } s_1 + s_2 = 1 \end{aligned}$$

To solve this problem, we proceed by successive partial optimization of the donor's

¹¹This includes the material cost of inflicting some punishment to a corrupt government, e.g. auditing commissions, as well as the moral cost arising from appearing to refuse aid to a needy country and not being able to handle corruption satisfactorily.

¹²Note that, to simplify the presentation, the constraints of the following donor maximization problem do not include the participation constraints of the governments of the recipient countries. The complete model is analyzed in Bourguignon and Platteau (2017).

objective function. We first optimize with respect to the aid delivery instruments for a given allocation of aid (s_1T and s_2T are given). This can be done separately for each country, yielding optimal values $\varphi_i = \Phi(s_iT, \beta_i)$. Because the two countries have different levels of internal discipline and needs (as measured by initial income), the external discipline exerted on them will not be identical. The donor's problem then becomes:

$$\begin{aligned} \text{Max}_{s_1, s_2} \Omega^* &= \sum_{i=1}^2 n_i \text{Log} \left\{ w_i + \frac{s_i T}{n_i} [1 - \tilde{y}[\Phi(s_i T, \beta_i) + \beta_i]] \right\} \\ &\quad - \sum_{i=1}^2 s_i T \cdot \Gamma \{ \Phi(s_i T, \beta_i), \tilde{y}[\beta_i + \Phi(s_i T, \beta_i)] \} \\ &\quad \text{s.t. } s_1 + s_2 = 1 \end{aligned}$$

Clearly, the initial maximization problem with exogenous y_i is so radically modified that the problem at hand has become analytically intractable. Fortunately, however, some key properties can be derived once some particular specifications of $y()$ and $\Gamma()$ are adopted.

4.2 Properties of optimal disciplining with simple specifications of functions $y()$ and $\Gamma(,)$

Consider the simple case where

$$\tilde{y}(\beta_i + \varphi_i) = y_i = \frac{1}{\beta_i + \varphi_i}$$

with $\varphi_i > 1 - \beta_i$,¹³ and

$$\Gamma(\varphi_i, y_i) = B \varphi_i^k y_i^p \tag{7}$$

where B, k and p are positive constants, such that $k > 2p$. Such a specification completely bypasses the behavior of the recipient countries' government, their

¹³The limit case of $\varphi_i = 1 - \beta_i$, or $y_i = 1$ is easily dismissed if the cost of the external discipline is small enough (see below).

participation constraint to the aid agreement with the donor, and the original cost functions of the disciplining instruments available to the donor - monitoring and punishment in case of fraud detection. All these missing elements are fully developed in our aforementioned paper (Bourguignon and Platteau, 2017). Substituting the first into the second expression, it comes that

$$\Gamma(\varphi_i, y_i) = \Gamma^i = B \cdot \varphi_i^k \cdot (\beta_i + \varphi_i)^{-2p} \quad (8)$$

A noticeable feature of this cost function is that, if the cost increases with the level of external discipline, φ_i , it is not necessarily convex.

With the above explicit functions for \tilde{y} and Γ , we have that the optimal external discipline $\varphi_i = \Phi(s_i T, \beta_i)$ is given by the solution of

$$\text{Max}_{\varphi_i} n_i \text{Log} \left[w_i + \frac{s_i T}{n_i} \left(1 - (\beta_i + \varphi_i)^{-1} \right) \right] - s_i T \Gamma(\varphi_i, y_i) \quad (9)$$

which leads to the following first-order condition:

$$\frac{(\beta_i + \varphi_i)^{-2}}{w_i + \frac{s_i T}{n_i} (1 - (\beta_i + \varphi_i)^{-1})} = \Gamma'_i(\varphi_i) = \eta_i \Gamma(\varphi_i, y_i) / \varphi_i \quad (10)$$

where

$$\eta_i = k - \frac{2p\varphi_i}{\beta_i + \varphi_i} \quad (11)$$

is the elasticity of the cost function with respect to φ_i . In a rather standard way, the left-hand side of the first-order condition corresponds to the marginal utility of the external discipline for the donor and the right-hand side to the marginal cost.

We have analyzed this problem in detail in Bourguignon and Platteau (2017). The properties of the solution that matter for the problem addressed here are summarized below.

RESULT 1. *An increase in internal discipline, β_i , is always compensated by a drop in external discipline, φ_i . There is under-compensation or full compensation, i.e. total discipline, $\beta_i + \varphi_i$, increases or remains constant, iff:*

$$\eta_i \geq 1 \tag{12}$$

There is over-compensation, i.e. total discipline, $\beta_i + \varphi_i$, decreases, otherwise. In this second eventuality, the optimal level of fraud increases despite the higher level of internal discipline. A necessary condition for this to be the case is that $k < 2p + 1$.

It bears emphasis that when $\eta_i < 1$ or $k < 2p + 1$, the marginal cost $\Gamma'_i(\varphi_i)$ of the external discipline is decreasing whereas it is increasing in the opposite case. It is the former property that generates the over-compensation result. It should also be noted that the condition $\eta_i < 1$ is endogenous and more intricate than it appears from (11) as φ_i is itself a function of $s_i T$ and β_i through (10). On the contrary, the necessary condition $k < 2p + 1$ bears upon purely exogenous parameters.

Is over-compensation obtained under very restrictive conditions? It can be rigorously shown that it always prevails when internal discipline, β_i , is small enough and for a sizable region in the space of the parameters of the original model (Bourguignon and Platteau, 2017). Moreover, as soon as k gets close to $2p$, $\Gamma'_i(\varphi_i)$ is decreasing in φ_i , ensuring that the odd case of over-compensation cannot be considered unlikely. The condition for it to hold can be interpreted in the light of the definition (7) of the function $\Gamma(\varphi_i, y_i)$: the cost of the external discipline must not increase too quickly with its intensity, or this cost must not increase too slowly with the size of the fraud or the probability of fraud detection.

The intuitive explanation of this surprising result is as follows. Starting from equilibrium, consider a small increase in the internal discipline and assume a simultaneous change in the external discipline that leaves the total discipline unchanged in country i : $\Delta\beta_i + \Delta\varphi_i = 0$ or $\Delta\varphi_i = -\Delta\beta_i$. The fraud is thus unchanged, as is the marginal utility in (10). This is not true of the marginal cost, though. Both η_i and $\Gamma(\varphi_i, y_i)$, as given by (8) are modified. Since η_i is the elasticity of the total cost, the marginal cost $\Gamma'_i(\varphi_i)$ is locally approximately proportional to $\eta_i \varphi_i^{\eta_i - 1}$, and the change in the marginal cost $\Delta\Gamma'_i$ to $-\eta_i(\eta_i - 1)\varphi_i^{\eta_i - 2}\Delta\beta_i$. If $\eta_i = 1$, the equilibrium has not been disrupted and there is no need for a further change in φ_i . There is perfect substitution between internal and external discipline. If $\eta_i > 1$, the marginal cost has moved down and it is thus necessary to increase φ_i .

More precisely, to restore equilibrium in (10), φ_i should fall to a smaller extent than what is needed to keep $\beta_i + \varphi_i$ constant. There is under-compensation: total discipline goes up together with internal discipline, yet it increases to a smaller extent. Finally, the marginal cost moves up if $\eta_i < 1$: if equilibrium is to be re-established, φ_i must drop beyond what allows to keep $\beta_i + \varphi_i$ constant. There is over-compensation and total discipline falls despite the fact that the internal discipline has improved.

From Result 1 and (11), it is evident that η_i , the elasticity of the marginal cost curve, varies in the same direction as β_i . Assume that, to start with, β_i is small enough to cause η_i to be smaller than one so that over-compensation is the optimal reaction of the donor. Then, as β_i continues to rise, there will be a point beyond which η_i exceeds one: over-compensation is succeeded by under-compensation. Result 2 states this finding:

RESULT 2. The relationship between internal discipline (β_i) and total discipline ($\beta_i + \varphi_i$) or the level of the fraud ($\beta_i + \varphi_i$)⁻¹ is not necessarily monotonous. If initially there is over-substitution of internal by external discipline and the optimized fraud is an increasing function of β_i , both properties are likely to revert at some stage as β_i increases. The turning point is $\eta_i = 1$.

We may now consider the comparative-static results with respect to the other parameters of the model.

RESULT 3. The external discipline is a decreasing function of the constant element of the unit cost function, B , and of the income of the recipient country, w_i . External discipline is also decreasing with the size of aid, $s_i T$.

4.3 Optimal allocation of aid with endogenous governance or disciplining

Plugging back the preceding properties into the donor's maximization problem (6) leads to the following first-order condition for the optimal allocation of aid under endogenous governance. In an interior solution¹⁴, the optimal shares s_1 and s_2 are given by:

¹⁴Corner solutions are ignored for the sake of brevity.

$$\frac{1 - [\beta_1 + \Phi(s_1 T, \beta_1)]^{-1}}{w_1 + \frac{s_1 T}{n_1} \{1 - [\beta_1 + \Phi(s_1 T, \beta_1)]^{-1}\}} - B\Phi^k(s_1 T, \beta_1)[\beta_1 + \Phi(s_1 T, \beta_1)]^{-p} = \quad (13)$$

$$\frac{1 - [\beta_2 + \Phi(s_2 T, \beta_2)]^{-1}}{w_2 + \frac{s_2 T}{n_2} \{1 - [\beta_2 + \Phi(s_2 T, \beta_2)]^{-1}\}} - B\Phi^k(s_2 T, \beta_2)[\beta_2 + \Phi(s_2 T, \beta_2)]^{-p}$$

From this complex equation it is possible to derive a few important results which are stated in Theorem 1 below (see Appendix C for the proof). The optimal value of external discipline as obtained from the first step of the donor's optimization problem is denoted by $\varphi_i^*(\beta_i) = \Phi(s_i^* T, \beta_i)$, where s_1^* and s_2^* are the solution of the preceding equation.

Theorem 1. (i) *At an interior solution, an increase in the initial income of the grassroots in country i reduces its share of total aid, s_i . The opposite is true of an increase in the size of its population.*

(ii) *An improvement in the governance of a recipient country leads to a lower level of fraud and a higher share of aid whenever the condition for under-compensation of a change in internal discipline by external discipline holds, namely:*

$$k - 2p \frac{\varphi_i^*(\beta_i)}{\varphi_i^*(\beta_i) + \beta_i} \geq 1 \quad (14)$$

In the opposite case of over-compensation, the fraud increases with the internal discipline but the share of aid keeps increasing with β_i .

(iii) *The effect of a change in the size of total aid or of the cost of its delivery is ambiguous as it depends in an analytically intractable way on the income levels, intrinsic governance of the two recipient countries, as well as on the cost parameters.*

The latter part of result (ii) is somehow remarkable and needs to be stressed. When the condition for under-compensation does not hold, which occurs for relatively low values of internal governance and under the condition that $k < 2p + 1$, a marginal improvement of that governance in country i may lead the donor to lower his own discipline so much that the extent of the fraud goes up. In

terms of the need-adjusted aid ineffectiveness parameter defined in Section 3 - i.e. $\omega_i = w_i/(1 - y_i)$ - aid becomes less effective in country i . This should normally cause a drop in the share of aid going to that country as seen in Section 3. Yet this outcome cannot be taken for granted because the cost of aid delivery simultaneously falls with the drop in external discipline. As shown in the proof of the theorem, it turns out that the lower cost of aid delivery outweighs the fall in the marginal utility of aid with the consequence that the aid share of the country goes up although it has become less aid-effective.

Paradoxically, therefore, aid shares and levels of need-adjusted aid effectiveness may move in opposite directions, when the latter is endogenous and the cost of aid discipline matters. This is clear violation of allocation rules like the PBA.

Given the indeterminacy of some of the preceding comparative static results, which follows from the analytical complexity of the model, we now resort to numerical simulations. This will also enable us to get some idea about the order of magnitude of the various effects mentioned in the above theorem. For lack of space, however, we will only discuss a few interesting cases. Other results are summarized in a table showing the elasticities of aid allocation with respect to a selection of parameters.

5 Numerical simulations

In the following, we assume that country 2 is our reference country for which we fix the parameters β_2 and w_2 and we consider how aid allocation changes with the characteristics of country 1, assuming that it is, intrinsically, less well governed than country 2: $\beta_1 \leq \beta_2$. More precisely, we arbitrarily fix $\beta_2 = 1.6; w_2 = 100; n_1 = n_2 = 1$. On the other hand, the baseline values of the parameters common to both recipient countries are: $k = 9/7; p = 3/7; B = .2$.¹⁵ Comparative static results are shown in the space (s_1, w_1) for selected values of β_1 .

Interestingly enough, the weighing parameter, r , in the original objective function

¹⁵The values for k and p may seem odd. They correspond to simple integer values for some of the parameters in the original model (Bourguignon and Platteau, 2017), namely $m = q = 3$ where m and q are the elasticities of the cost functions of respectively the monitoring of aid and of punishment in case of fraud detection.

(1), must be introduced at this stage in order to generate meaningful and smooth results. If T/n_i as a proportion of w_i were set at a level corresponding roughly to the aid/GDP ratio observed in poor countries, i.e. around 10 per cent, -actually less when counting what actually reaches the population – the solution of the optimal allocation problem would be essentially of the bang-bang type. This means that the aid allocation pattern would move from a situation where all aid accrues to one country to the other extreme situation where all aid goes to the other country. The rationale is that, as noted above, with $r = 1$, an interior solution of the optimal aid allocation problem is often close to equalizing the net income of the grassroot population in the two countries. In the real world, the amount of aid managed by a single donor would in general not allow for such an extreme result and we do not actually observe that donors concentrate only on one or two countries. One should therefore admit that either donors tend to magnify the impact of their aid on recipient countries, implying that $r < 1$ -i.e., they give more weight to aid transfers than to incomes net of such transfers when they value the standard of living of recipient countries - or they pursue other objectives than standard welfare. Note that the former effect reflected in a low value of r may well arise from aid obeying geo-strategic considerations rather than social welfare objectives, in which case the two effects can actually reinforce each other. In what follows, we thus go back to the original specification (1) where the argument of the utility obtained by the donor from aid to country i is given by:

$$n_i \text{Log}[rw_i + s_i T(1 - \tilde{y}_i)/n_i]$$

It is easily seen that this modification does not change anything to the previous analysis and, therefore, all the attendant comparative-static results continue to hold since the implied change is equivalent to scaling down w_i or magnifying T in the original objective function. The numerical simulations reported below rely on $r = 1/5$, and $T = 20$, or 10 per cent of w in case of identical countries sharing aid equally.

To draw the graphs, we vary w_1 and β_1 (the relevant domain is located below $\beta_1 = 1.6$), and look at the effects of these variations on y_1 (Fig. 1), and s_1 (Fig. 2), bearing in mind that $s_2 = 1 - s_1$.

The two figures illustrate the effect of endogeneizing the governance of aid on inter-country allocation in comparison with the case analyzed above (Section 3) where the amount of aid embezzled by the leaders of recipient countries is fully exogenous. Regarding the latter case, it would be tempting to refer to the situation where the donor is unable to influence the recipient countries' governance ($\varphi_1 = \varphi_2 = 0$). However, such a benchmark would not be satisfactory in the present instance since it is equivalent to ignoring the asymmetry between the two countries in terms of the cost of aid delivery that does exist when the donor tries to influence the governance in recipient countries - the $\Gamma(\cdot)$ terms would be zero in (6). As clear from the expression of Γ in (8), the cost of imposing a common level of external discipline, φ , differs among the two countries because it depends on the quality of their internal discipline. With a positive exogenous and identical level of external discipline in the two countries, the optimal allocation of aid, as given by (13), would thus differ from the optimal allocation analyzed in Section 3.

Having noticed this, the question remains of how to set exogenous values for the disciplining instruments to perform the comparison with the case of endogenous, optimally chosen individual instruments. Figures 1 and 2 are based on the assumption that the common exogenous disciplining instrument, φ_0 , is set at the level that would be optimal for the reference country (country 2) if it were the only recipient. In that way, the exogenous and endogenous cases coincide when the two countries are strictly identical, i.e. they have the same β and w . Dashed lines in Figures 1 and 2 correspond to the case of exogenous common discipline, φ_0 , applied to both countries whereas solid lines describe the optimal aid allocation when instruments are optimized and individualized.

Figures 1 and 2 highlight different aspects of the inter-country aid allocation problem when the governance imposed by the donor is exogenous and when it is optimized. Figure 1 represents the extent of the fraud as a function of income and intrinsic governance in country 1. In the exogenous governance case (dotted lines), the extent of the fraud is constant across income levels and decreases with the quality, β_1 , of the intrinsic governance. In the endogenous governance case, however, we first observe that the extent of the fraud is smaller, as expected, but increases with the level of income, which verifies Result 3 obtained in the one-country model (see Section 4). Other things being equal, the external discipline

imposed by the donor decreases with the level of income of the recipient country, which leads to a larger fraud. In a two-country framework, however, another effect is at work, i.e. a higher income level leads to a lower level of aid going to country 1 (see Theorem 1(i) above). According to Result 3 again, this fall in aid leads to a more severe external discipline and, therefore, to less fraud. This compensates somewhat - but not reverts - the former effect.

A still more important result is that the extent of the fraud is not any more a monotonic function of intrinsic governance. Indeed, the smallest level of fraud is observed for the lowest, rather than the highest level of internal discipline ($\beta_1 = 0.6$). It goes up when the intrinsic governance increases (from 0.6 to 1.2) and then goes down again when β_1 increases further up to 1.6. It is also quite noticeable that the endogeneity of the external discipline has the effect of dampening the effect of variations in the intrinsic governance in comparison with the exogenous disciplining case. All this is a straight illustration of the various results stated in Section 4. As a matter of fact, the condition $k < 2p + 1$ is satisfied by the numerical values chosen for that simulation, and it is the case that $\eta_1 < 1$ when β_1 is low enough - less than 1.2 - and $\eta_1 > 1$ when β_1 gets closer to 1.6. It follows that the relationship between intrinsic governance and the size of the fraud is non-monotonic as stated in Result 2.

As stated in Theorem 1, this somewhat counter-intuitive property does not modify the way the optimal aid allocation varies with the intrinsic governance of country 1. Whether the fraud does or does not increase as country 1's domestic governance improves, it can be seen in Figure 2 that the share of aid received by country 1 always goes up.

Two other features emerge from Figure 2. First, country 1 may continue to receive aid even though it is considerably more ineffective than country 2 on the counts of both income (or needs) and domestic governance. Concentrating on the case of optimal individualized discipline (solid lines), we see that $s_1 > 0$ when $w_1 = 110$, and $\beta_1 = 0.6$. Country 1 is 10 per cent richer than country 2 and, in the absence of the discipline imposed by the donor, its leaders would embezzle more than twice as much as in country 2. Yet, it still receives 10 per cent of the available aid. This is in sharp contrast with what would happen if the donor were not adapting his discipline to changes in intrinsic governance. It can indeed be seen on the dotted

lines that under the same conditions and exogenous discipline, country 1 would simply receive no aid.

Second, when β_1 is low compared to β_2 ($\beta_1 = 0.6$), endogenous discipline always causes s_1 to be higher than under exogenous discipline, even when w_1 is extremely low relatively to w_2 . With $\beta_1 = 1.2$, however, the opposite occurs: endogenous donor discipline leads to a lower share for country 1. This is even the case when country 1 has a quality of internal governance equal to that of the reference country ($\beta_1 = 1.6$) and its income is smaller than that of country 2: its share of aid is then systematically, although slightly, lower under conditions of endogenous discipline. This is because optimal discipline increases when the recipient country's income gets smaller (for given levels of governance, the donor wants to help a country more when it is poorer), thus making aid to country 1 more expensive than to country 2.

Since the cost of (endogenous) aid delivery is what distinguishes the approach to aid allocation in this section and the simpler approach pursued in Section 3, it is worth spending some time on the corresponding comparative statics, even though it is mostly ambiguous, as stated in Theorem 1.iii. First, it should be noted that the cost of aid delivery, as determined by the scale parameter B in (13), determines the relative extent to which the aid allocation depends on needs or domestic governance. An infinite cost of aid delivery would discourage the donor from exerting any external discipline so that the optimal allocation of aid would depend on both needs and governance in the way depicted in Section 3 where the NAAE concept plays a key role. At the other extreme of negligible delivery costs, aid allocation would depend only on needs, i.e. w_1 compared to w_2 .¹⁶ As the discussion of the two polar cases indicates, and in full accordance with intuition, the weight of domestic governance in the allocation of aid is an increasing function of the cost of aid delivery. The relative importance of needs and (domestic) governance in the impact of the cost of aid delivery also shows up in less extreme cases. For instance, comparative statics results gathered in Table 1 show that the effect of an increase in the cost of aid delivery on the share received

¹⁶In that case, the participation constraint of the recipient country's government, which is ignored in the present paper, would become binding. This is because the donor is presumably able to impose zero fraud and therefore no benefit from aid for the local governing elite.

by the less well governed country is always negative when that country has the same level of income as the other country. This is also true when it is poorer and the governance differential between the two countries is large, i.e. $\beta_2 = 0.6$. On the contrary, an increase in the cost of aid delivery contributes to a small increase in the share of the poorest and less well governed country when the governance differential is small.

Other simulations reported in Table 1 confirm the relative importance of needs and domestic governance in the effect of other delivery parameters on aid allocation. For instance, the trade-off between needs and governance appears very clearly when the overall size of aid is reduced: the share of the badly governed country goes up if it is relatively poor but down if it has the same level of income as the other country.

The same phenomenon is present when the external discipline is assumed to be uniformly applied in the two countries rather than individualized. If the two countries are at the same level of income and if disparity in intrinsic governance levels is sufficiently large, uniformizing discipline generally works against the badly governed country. However, if that country is much poorer than the other country, its share increases. The intuition here is straightforward: if the donor is constrained in his ability to tailor external discipline to the particular governance characteristics of recipient countries, he will give less aid to the country that cannot be disciplined as much as he would like unless that country is very poor.

In summary, the numerical illustrations of the aid allocation mechanism show that allowing donors to directly influence aid funded programs makes the allocation of aid across countries considerably more complex than the simple model analyzed earlier in the paper, which itself fits very roughly the practice observed in some big aid agencies. The main lesson of this exercise is that aid allocation issues should not be considered in isolation from the delivery of aid and the capacity of donors to influence the governance of the programs they fund. In other words, aid allocation across countries should involve two dimensions: the amount of aid itself and the discipline - or the conditionality - donors find optimal to impose on recipient countries.

6 Conclusion

Regarding the issue of allocation of development aid, perhaps the most important question to be resolved today is the following: is there an inherent contradiction between the objective of poverty alleviation, as reflected in the Millennium and then the Sustainable Development Goals (M/SDGs), for example, and that of aid effectiveness, as enshrined in the Paris Declaration and the Accra Agenda for Action? The difficulty arises from the well-documented fact that poor people tend precisely to live in badly governed countries (in particular, those where the state has failed). This paper puts forward an approach that combines needs and governance considerations in a rigorous theoretical framework, and whose spirit is close to the approach followed by big international donors such as the World Bank and the European Union. At its heart lies the concept of “Need-Adjusted Aid Effectiveness” (NAAE) which mitigates the measure of needs by the extent to which the donor is effective in getting its aid to the poor.

When an optimal aid allocation formula based on this idea is followed, the possibility that poor and badly governed countries are denied aid continues to exist, and this will happen for poor countries whose governance record is especially dismal. Yet, it is also possible that well governed countries are excluded from the aid programme if their level of per capita income is too high. This is a satisfactory approach because needs and governance jointly determine which share of the available aid fund should accrue to each potential recipient country.

Since some among the poorest countries are likely to be denied aid even under this intermediate approach, the question that springs to mind is whether that risk could be mitigated in some way or other. An interesting result obtained with the proposed allocation formula is that increasing the total aid supply is one obvious way to raise the prospect of poorer and worse governed countries being included in the poverty alleviation programme. Such a route raises nevertheless the issue of the endogeneity of aid supply, which is ignored in the present paper.

A second escape solution looks quite attractive: the donor should not consider governance in poor countries as given, and allocate aid accordingly, but, instead, he should take into account his potential influence on local governance through disciplining instruments based on monitoring and punishment. Since recourse to

external discipline involves costs, the donor now maximizes an objective function that includes an 'intrinsic utility' and a cost component. In this new setup, the concept of NAAE becomes misleading because the level of aid embezzlement or misuse in the recipient countries (the endogenous governance outcome) is influenced not only by the domestic or intrinsic discipline (assumed to be given) of these countries but also by the external discipline optimally chosen and imposed by the donor. The major lesson from this new approach is therefore that donors ought not only to allow for an explicit trade-off between needs and governance -which many of them increasingly do-, but also to simultaneously decide about the costs of delivering aid to each recipient country. In other words, they must simultaneously determine the geographical allocation of aid and the level of their external disciplining efforts.

Since the problem thus posed is complex, only some results can be derived analytically. A most novel and challenging (analytical) result, uncovered in a previous paper, is that an improvement in the quality of domestic governance of a recipient country may possibly cause an over-reaction of the donor in terms of external discipline with the effect that the level of total discipline (the sum of domestic and external disciplines) declines and, hence, the extent of fraud increases in that country. Albeit in contradiction with the simple principle of allocating aid according to NAAE, this apparently perverse effect does not prevent the share of aid accruing to the country whose domestic governance has improved from increasing. In other words, as demonstrated in the present paper, the deserving country is not sanctioned by the donor even in this odd case where the latter over-compensates the local governance-improving effort. The reason is that, as external discipline declines, so does the cost of channelling aid to that country.

Numerical simulations yield a number of additional and valuable insights. In particular, it is when disparity in initial domestic governance levels is quite large, and when the gap between incomes is narrow enough, that endogenising the donor's discipline has the effect of raising the share of the poorer and worse-governed country most significantly (or increasing the probability that it is enlisted in an aid programme). Contrariwise, it is when both the governance and the income gaps are sufficiently large that uniform discipline (external discipline is identical for all recipient countries) best works to the advantage of the poorer and worse governed

country compared to individualized discipline (external discipline is tailored to each recipient country). If total aid available is reduced, considerations of needs predominate: the share of the poorer country increases even if the initial governance gap is large. Finally, if the cost of external discipline falls (say, as a result of technical and institutional innovations in monitoring and sanctioning activities), the worse governed country will see its aid share increase but only provided that the inter-country initial governance gap is sufficiently large.

The analytical framework proposed in this paper has yielded an unintended yet quite instructive result: it is hard to reconcile the implications of the assumption that donors pursue a straight social welfare objective where initial incomes and aid transfers are perfectly substitutable in recipient countries with evidence about actual allocation of aid among recipient countries. Under the perfect substitution assumption and symmetry among recipient countries, observed allocations should concentrate on a small number of countries, which is not what we observe. One possibility is that donors do not attach the same value to the aid transfers that they themselves make and to the initial incomes in these countries. The role of geostrategic motives, hardly justifiable on normative grounds, may actually explain this asymmetry in valuation.

Our last reflection concerns the operationalization of our theoretical model. A key variable is the initial quality of domestic governance. The question as to how to measure it adequately is therefore critical. Since the outcome of governance is the combined effect of initial (domestic) and external disciplines, the measure cannot be based on ex post observations of such an outcome. It is therefore a challenging issue to determine which presumably exogenous indicator of domestic governance should be used to infer the optimal allocation of aid. Conventional measures such as the CPIA index are probably not appropriate while indicators reflecting the intensity of civil society life better meet the exogeneity requirement.

Table 1. Numerical simulations: changes in aid share and size of the fraud in country 1 due to changes in aid delivery parameters

β_1	1.6		1.2		0.6	
w1	100	50	100	50	100	50
<i>(Initial aid share of country 1 (%))</i>	50.0	83.7	39.9	76.7	19.2	62.2
<i>(Initial fraud in country 1 (%))</i>	27.9	25.8	29.5	26.0	24.2	21.4
<i>Change in aid share of country 1 (% points)</i>						
$\Delta B = +50\%$	0.0	1.3	-1.6	0.4	-10.5	-5.9
$\Delta T = -25\%$	0.0	10.6	-2.0	9.6	-4.3	8.7
Uniform vs. Individualized discipline	0.0	0.0	1.7	2.0	-19.2	8.6
<i>Change in the fraud in country 1 (% points)</i>						
$\Delta B = +50\%$	1.9	2.8	4.9	5.1	5.0	4.4
$\Delta T = -25\%$	-0.6	-1.0	-1.2	-1.5	-1.1	-1.2
Uniform vs. Individualized discipline	0.0	0.0	3.8	1.3	n.a	4.2

Figure 1: **Optimized level of fraud in country 1 as a function of its income and governance with exogenous and endogenous external discipline (country 2: $w_2 = 100, \beta_2 = 1.6$)**

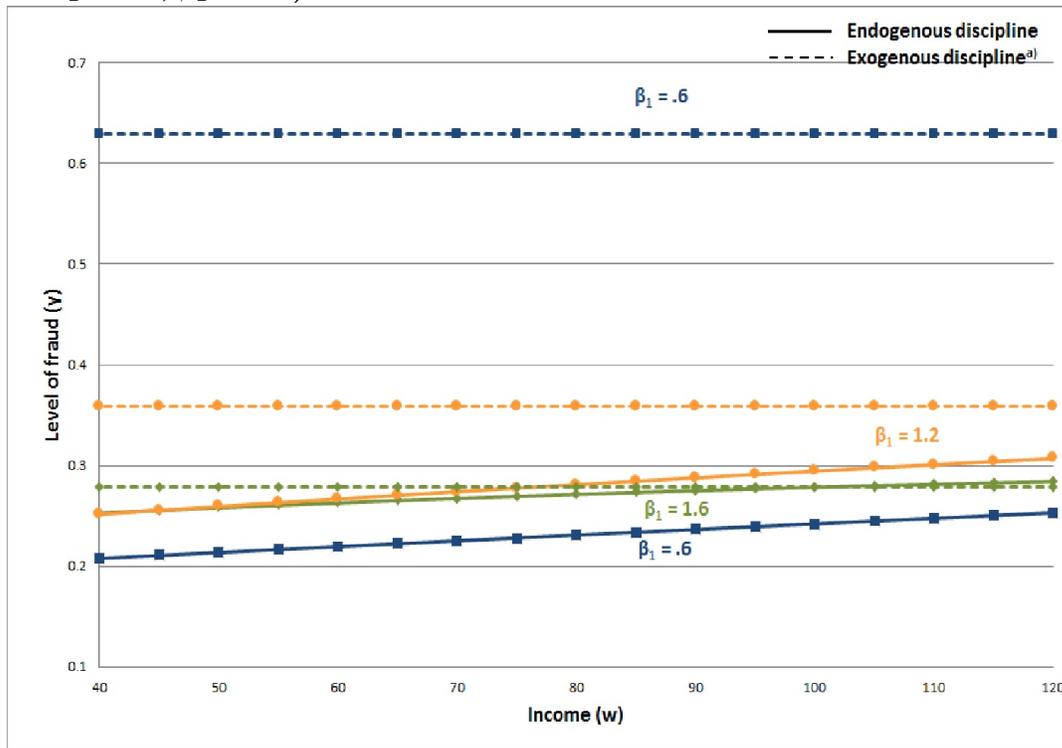
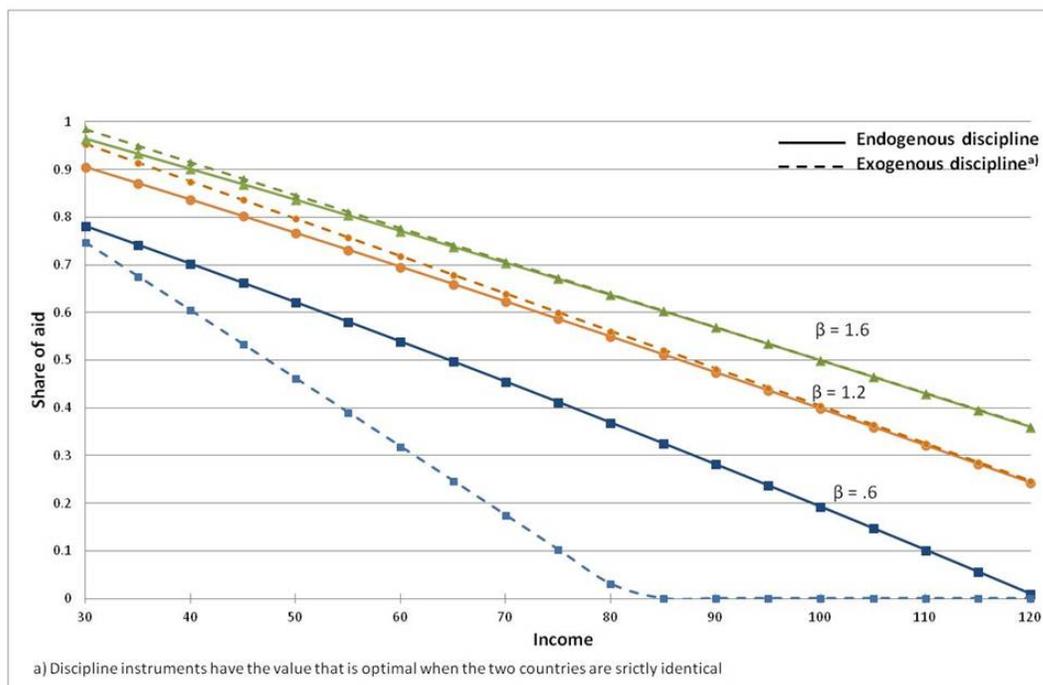


Figure 2: Aid allocation as a function of income and governance with endogenous and exogenous discipline (reference country: $w_2 = 100, \beta_2 = 1.6$)



Appendix A. The case of $m > 2$ of recipients

The objective function of the donor is:

$$\text{Max} \sum_{i=1}^m n_i \text{Log} [w_i + s_i T(1 - y_i)/n_i] \quad \text{s.t.} \quad s_i \in [0, 1] \quad \forall i, \quad \sum_{i=1}^m s_i \leq 1$$

Straight resolution of the preceding program leads to the following allocation rule. Assuming that recipient countries are ranked by ascending ω_i , the first i^* countries receive an individual share given by:

$$s_i = \frac{n_i}{T} [\bar{\omega}(i^*) - \omega_i] + \frac{n_i}{N(i^*)}$$

with $N(i^*) = \sum_{j=1}^{i^*} n_j$ and $\bar{\omega}(i^*) = \frac{\sum_{j=1}^{i^*} n_j \omega_j}{N(i^*)}$, whereas the $m - i^*$ remaining countries receive nothing. The threshold i^* is given by the following condition:

$$\omega_{i^*+1} \geq \bar{\omega}(i^*) + \frac{T}{N(i^*)}$$

In these expressions, , which appear as straight generalizations of the two country case, $\bar{\omega}(i^*)$ stands for the mean aid ineffectiveness among the i^* least aid-ineffective countries. At the same time, the critical role played by the size of total aid comes out clearly. When T increases, the number of beneficiaries (i^*) increases, whereas the share of those countries where aid is relatively ineffective in comparison with $\bar{\omega}(i^*)$ increases and the share of the relatively aid effective beneficiaries decreases. In other words, small donors should cater to fewer countries and allocate a higher share to the most aid effective countries among them. Appendix B. Making inequality and poverty aversion explicit

Consider the objective function of the donor given by:

$$\text{Max}_{s_1, s_2} \left(\frac{n_1}{1 - \varepsilon} \right) \left[w_1 + \frac{s_1 T(1 - y_1)}{n_1} \right]^{1 - \varepsilon} + \left(\frac{n_2}{1 - \varepsilon} \right) \left[w_2 + \frac{s_2 T(1 - y_2)}{n_2} \right]^{1 - \varepsilon}$$

$$\text{s.t.} \quad s_1 + s_2 = 1$$

where ε (≥ 0) is interpreted as 'aversion' towards inequality.

An interior solution is given by:

$$x_1^{-\varepsilon}(1 - y_1) = x_2^{-\varepsilon}(1 - y_2) \quad \text{with} \quad x_i = w_i + \frac{s_i T(1 - y_i)}{n_i}$$

As before in (2), the net income per capita, x , is higher in the country with the best governance. Now, however, the ratio of the net incomes of the two countries depends also on the aversion towards poverty. The more averse the donor is to poverty, the less net incomes depend on governance. At the limit, with an infinite poverty aversion, the net income per capita would be the same in the two countries, as suggested by Thirlwall (2011).

Combining now with the budget constraint $s_1 + s_2 = 1$, it can be shown that the aid allocation is given by:

$$s_1 = \frac{n_1(1-y_1)^{-\sigma}}{n_1(1-y_1)^{-\sigma} + n_2(1-y_2)^{-\sigma}} \quad (15)$$

$$+ \frac{1}{T} \frac{n_1 n_2 (1-\bar{y})^{-\sigma}}{n_1 + n_2} \left[\frac{w_2}{(1-y_2)^{1-\sigma}} - \frac{w_1}{(1-y_1)^{1-\sigma}} \right]$$

where $\sigma = (\varepsilon - 1)/\varepsilon$ and $(1-\bar{y})$ is the σ -mean of $(1-y_1)$ and $(1-y_2)$.¹⁷ It can be seen that this expression is similar to (3) - which actually corresponds to the case $\varepsilon = 1$. But governance now affects the optimal allocation directly through modifying the population share and in conjunction with income through a generalization of the need-adjusted aid ineffectiveness term, ω_i , which now writes: $w_i(1-y_i)^{\sigma-1}$.

For a low aversion towards poverty ($\varepsilon < 1$), we have that $\sigma < 0$ and it can be seen from (15) that governance plays a dominant role. The weight of the country with a better governance is enhanced. As ε falls, governance more and more dominates needs - i.e. the role of w - in the allocation of aid. At the limit when $\varepsilon \rightarrow 0$, all the aid is allocated to the country with the better governance. This priority given to governance over needs in the case of low poverty aversion is reminiscent of the IDA allocation formula discussed above.¹⁸ Conversely, for high poverty aversion ($\varepsilon > 1$), we have that $\sigma > 0$. Needs now play a larger role relatively to governance. At the limit when $\varepsilon \rightarrow \infty$, which corresponds to the Rawlsian case, only needs matter and all the aid goes to the poorest country.

¹⁷I.e. $(n_1 + n_2)(1-\bar{y})^{-\sigma} = n_1(1-y_1)^{-\sigma} + n_2(1-y_2)^{-\sigma}$

¹⁸It is surely quite paradoxical that donors sitting on the board of IDA support an allocation rule and a need/governance tradeoff that can be justified only by low - if not extremely low - poverty aversion.

Appendix C. Proof of Theorem 1

Characterizing the equilibrium

The maximization problem is:

$$\begin{aligned} \text{Max}_{\varphi_1, \varphi_2, s_1, s_2} \sum_{i=1}^2 \left\{ n_i U \left[w_i + \frac{s_i T}{n_i} [1 - \tilde{y}(\varphi_i + \beta_i)] \right] - s_i T \cdot \Gamma(\varphi_i, \tilde{y}(\varphi_i + \beta_i)) \right\} \quad (16) \\ \text{s.t. } s_1 + s_2 = 1, U(x) = \text{Log}(x) \end{aligned}$$

The optimization with respect to φ_i yields:

$$-U'_i \cdot \tilde{y}'_i = \Gamma'_{i\varphi} \quad (17)$$

where $U'_i = U' \left[w_i + \frac{s_i T}{n_i} [1 - \tilde{y}_i(\varphi_i + \beta_i)] \right]$ and $\Gamma'_{i\varphi}$ is the derivative of $\Gamma(\varphi_i, \tilde{y}_i)$ with respect to φ_i . Let $\varphi_i^*(s_i T)$ be the solution. After substituting in (16), we differentiate with respect to s_1 and s_2 to get the first-order condition:

$$\begin{aligned} TU'_1(1 - \tilde{y}_1) - s_1 TU'_1 \cdot \tilde{y}'_1 \cdot \varphi_1^{*'} - T\Gamma^1 - s_1 T \cdot \Gamma'_{1\varphi} \cdot \varphi_1^{*'} = \\ TU'_2(1 - \tilde{y}_2) - s_2 TU'_2 \cdot \tilde{y}'_2 \cdot \varphi_2^{*'} - T\Gamma^2 - s_2 T \cdot \Gamma'_{2\varphi} \cdot \varphi_2^{*'} \end{aligned}$$

where $\Gamma^i = \Gamma(\varphi_i^*, \tilde{y}(\varphi_i^* + \beta_i))$. But because of (17), this reduces to:

$$U'_1(1 - \tilde{y}_1) - \Gamma^1 = U'_2(1 - \tilde{y}_2) - \Gamma^2 \quad (18)$$

We now check that the second-order condition is satisfied. To do so, we take the derivative of both sides, each one being denoted A_i , with respect to aid shares. It comes:

$$\frac{\partial A_i}{\partial s_i} = TU''_i(1 - \tilde{y}_i)^2/n_i - s_i T^2 U''_i(1 - \tilde{y}_i) \tilde{y}'_i \varphi_i^{*'} / n_i - U'_1 \tilde{y}'_1 \varphi_i^{*'} - \Gamma'_{i\varphi} \varphi_i^{*'}$$

The last two terms cancel because of (17) and the first two terms can be combined into:

$$\frac{\partial A_i}{\partial s_i} = TU''_i(1 - \tilde{y}_i)^2 E_{i, s_i}^{sT(1-y)} / n_i \quad (19)$$

where $E_{i, s_i}^{sT(1-y)} = 1 - s_i T \tilde{y}'_i \varphi_i^{*'} / (1 - \tilde{y}_i)$ is the elasticity of the net transfer to the grassroot population - $s_i T(1 - \tilde{y}_i)$ - with respect to the aid received by country i -i.e. $s_i T$. In an interior solution of (18) this elasticity is necessarily positive since both countries receive some positive aid. If it were negative, the donor could

improve its objective function by simply reducing the aid given to country i.

Taking now into account the constraint that $s_1 + s_2 = 1$, the second-order condition corresponding to (18) writes¹⁹:

$$\frac{\partial A_1}{\partial s_1} + \frac{\partial A_2}{\partial s_2} \leq 0 \quad (20)$$

where both terms are given by (19). This condition holds since both terms are negative - the function $U()$ is concave and the elasticity of the aid reaching the population is positive.

We now can tackle the comparative statics of the optimal aid allocation given by (18). Given the second-order condition (20), the sign of the change in the share of country i caused by a change in any parameter λ of the model will be the same as the sign of:

$$\frac{\partial A_1}{\partial \lambda} + \frac{\partial A_2}{\partial \lambda}$$

An increase in w_i reduces the marginal utility term in A_i . Re-establishing equilibrium thus requires reducing s_i . The opposite results obtains with the size of the population, n_i .

Under condition (14) and for a given aid share, an increase in β_i entails a drop in φ_i but an increase in $\beta_i + \varphi_i$ and therefore a fall in the extent of the fraud. Bearing in mind that:

$$\Gamma^i = B \cdot \varphi_i^k (\beta_i + \varphi_i)^{-2p} \quad (21)$$

it follows that the cost of aid delivery goes down for country i. On the other hand, as the fraud diminishes, the marginal utility of aid to country i:

$$U'_i(1 - \tilde{y}_i) = \frac{(1 - \tilde{y}_i)}{w_i + \frac{s_i T}{n_i}(1 - \tilde{y}_i)}$$

goes up. It follows that the marginal utility net of the cost of delivery increases unambiguously with the internal discipline of a country - $\partial A_i / \partial \beta_i > 0$. As a consequence, s_i increases with β_i under condition (14).

¹⁹The condition (18) can indeed be written as $A_1 - A_2 = 0$, and this implies that the second-order condition is $(\delta A_1 / \delta s_1) \cdot ds_1 - (\delta A_2 / \delta s_2) \cdot ds_2 \leq 0$, where $ds_2 = -ds_1$.

If (14) does not hold, it is still the case that φ_i falls but this fall now outweighs the increase in β_i , so that both the marginal utility and the marginal cost of aid fall. Yet, it can be shown that in that case too, s_i increases with β_i

A general proof that covers the two cases is as follows.

Taking the derivative of (18) with respect to β_i yields:

$$\frac{\partial A_i}{\partial \beta_i} = -U_i''(1 - \tilde{y}_i)\tilde{y}_i' s_i T(1 + \frac{\partial \varphi_i^*}{\partial \beta_i})/n_i - U_i' \tilde{y}_i'(1 + \frac{\partial \varphi_i^*}{\partial \beta_i}) - \Gamma_\varphi^i \frac{\partial \varphi_i^*}{\partial \beta_i} - \Gamma_\beta^i \quad (22)$$

where Γ_φ^i and Γ_β^i are respectively the partial derivatives of Γ^i in (21) with respect to φ_i and β_i .

Consider first the case where (14) does not hold, so that $1 + \frac{\partial \varphi_i^*}{\partial \beta_i} < 0$. Using (17), the preceding expression becomes:

$$\frac{\partial A_i}{\partial \beta_i} = -U_i''(1 - \tilde{y}_i)\tilde{y}_i' s_i T(1 + \frac{\partial \varphi_i^*}{\partial \beta_i})/n_i - U_i' \tilde{y}_i' - \Gamma_\beta^i$$

from which it is evident that all the three remaining terms in the RHS are positive (since $U'' < 0$, $\tilde{y}_i' < 0$, $\Gamma_\beta^i < 0$, and $1 + \frac{\partial \varphi_i^*}{\partial \beta_i} < 0$..

Consider now the case where (14) does hold, so that $1 + \frac{\partial \varphi_i^*}{\partial \beta_i} > 0$. The logarithmic specification of the utility function $U()$ implies that²⁰:

$$U_i'' = -U_i' \frac{1}{w_i + \frac{s_i T}{n_i}(1 - \tilde{y}_i)}$$

so that, after putting together the first two terms in the RHS, (22) can be rewritten:

$$\frac{\partial A_i}{\partial \beta_i} = -U_i' \tilde{y}_i'(1 + \frac{\partial \varphi_i^*}{\partial \beta_i}) \frac{w_i}{w_i + \frac{s_i T}{n_i}(1 - \tilde{y}_i)} - \Gamma_\varphi^i \frac{\partial \varphi_i^*}{\partial \beta_i} - \Gamma_\beta^i$$

Again, it is seen that the three terms on the RHS are all positive (bear in mind that $\Gamma_\varphi^i > 0$). QED

A last source of comparative statics is the total size of aid, T . The result is essentially ambiguous. When total aid increases, the marginal utilities of aid are modified and could be modified with a change in aid shares analogous to what was

²⁰When $U = \text{Log}x$, indeed, it is straightforward that $U''/U' = -1/x$.

obtained when the fraud was taken to be exogenous. But, at the same time, the levels of external discipline are lowered in the two countries, which affects both the marginal utility of aid and its marginal cost in the two recipient countries. Which side of the FOC (18) increases most is difficult to find out analytically.

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