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Buying Influence: Aid Fungibility in a Strategic Perpective

by

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Buying Influence: Aid Fungibility in a Strategic Perspective*

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Abstract

I study equilibria of non-cooperative budgetary games between an aid donor and a recipient when there is conflict over the preferred allocation of the combined budgets of the two parties. I show that final outcomes are the same in the Nash-equilibrium of the game as well as in the equilibria of the two possible sequential games. The game-theoretic approach to aid fungibility is contrasted with the traditional non-strategic approach. I argue that in order to understand the issues involved, the former is superior to the latter as it derives final allocations instead of assuming them, and thus enables one to analyse the sources of influence over outcomes.

1 Introduction

Conflicts between the parties to aid transactions over the outcomes resulting from their joint efforts are a fact of life, current official rhetoric about "partnerships" notwithstanding. Indeed, most of the history of foreign aid relations might be read as a continual search by the donors to find ways to maximise the returns to their funds as judged by them, with recipients trying to make sure that their spending priorities - which have not always been those of the donors - prevail. Moreover, even though the World Bank now argues for "selectivity" in choosing recipients (see World Bank 1998), i.e., concentrating efforts in countries pursuing policies ajudged to be conducive to economic development, it seems unlikely that differences in spending priorities between donors and recipients will vanish overnight. Indeed, being selective would not be necessary if there was complete agreement among the parties involved about how funds should be

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allocated. Knowledge about what outcomes might be expected will therefore still be helpful in designing aid policies.

An important issue for donors is the extent to which aid is fungible, i.e., can be redirected, partially or completely, from the intended purpose by the recipient if it so wishes. If aid is fungible, the evaluation of its impact is complicated by the difficulty of assessing which activities are ultimately supported by the inflow of funds.[1] In turn, this makes the task of designing optimal aid policies harder. Judging the efficiency of development assistance also becomes more complex. Even though the diversion of funds might improve outcomes from an overall perspective, for example because donors are overly influenced by commercial or strategic interests, in order to make an informed judgment one needs to know into what activities funds leak. Although in the end this is an empirical issue, a solid theoretical understanding of the problem is an essential prerequisite for such investigations.

The results reported in this paper are derived from first-principles. That is, instead of assuming different degrees of fungibility and discussing their implications, I analyse the degree of influence that recipients and donors have over allocation patterns based on the resources available to them, their preferences, and the manner in which they interact. The game-theoretic approach adopted here differs from the contract-theoretic approach of Pedersen (1995a,b) and Azam and Laffont (2000).[2] These authors assume that donors and recipients can write binding contracts specifying what the former gets in return for the grants and subsidised loans passed on to the latter. This fits with the conditionality approach to aid adopted in the 1980s and 1990s. However, even though usually agreements between the parties are signed, particularly if the donor is a multilateral institution such as the World Bank, this is not a very fruitful approach to understanding aid impact. Aid "contracts" cannot be enforced in courts, and the generally poor record of conditionality demonstrates that such agreements have not been self-enforcing either.[3]

I prefer, therefore, to study the outcomes of equilibria of non-cooperative games between a donor and a recipient. In section 2, I investigate three different types of equilibria of a simple budgetary game by varying the order in which the players move. Section 3 contains a discussion aid fungibility in the light of the game-theoretic approach to the issue, contrasting the results with those of the traditional non-strategic approach. In section 4, I show that the pattern of equilibrium outcomes resulting when the budgets of the players are endogenous correspond to those derived in section 2 under the assumption that both donor and recipient have a fixed amount of resources to allocate. Finally, in section 5 I briefly outline the directions in which I tend to extend the analysis.

[1] For a discussion of the issues involved, see e.g. Devarajan and Swaroop (2000).

[2] Also see Svensson (2000) and Torsvik (2002).

[3] Empirical studies of conditionality include Mosley, Harrigan, and Toye (1991), Killick (1995, 1998), Devarajan, Dollar, and Holmgren (2001), and the World Bank (1998).

2 A Simple Budgetary Game

2.1 The Model

Consider the case of a donor (D) and a recipient government (R), each with their own fixed budget, interacting to determine the allocation of their combined resources between two goods, 1 and 2. The players have Cobb-Douglas preferences over the consumption vector $G = \{g_1, g_2\}$, in the recipient country:[4]

$$U^j(\mathbf{G}) = \gamma^j \ln g_1 + \left(1 - \gamma^j\right) \ln g_2, j = R, D, \gamma^j \in (0,1). \tag{1}$$

Hence, both g_1 and g_2 can be thought of as collective goods for R and D, with differential benefits if $\gamma^D \neq \gamma^R$.

The resource constraints of the donor and the recipient are

$$a_1 + a_2 \leq A, a_k \geq 0, k = 1, 2, \tag{2}$$

and

$$b_1 + b_2 \leq B, b_k \geq 0, k = 1, 2, \tag{3}$$

respectively. That is, D cannot spend more than its aid budget for the recipient in question, A. Moreover, it cannot tax the recipient, so the funds allocated to spending on each good must be non-negative.[5] Similar restrictions apply to R, which has a total budget of B.[6] I choose units so that the prices of the goods are both unity. For any combination of budgetary allocations by the two parties, the consumption of each good is then

$$g_k = a_k + b_k, k = 1, 2, \tag{4}$$

It is well-known that Cobb-Douglas preferences yield constant budget shares for each good which are equal to their weights in the objective function. The "first-best" allocation of each actor - the allocation that it would have chosen if it could dictate how the combined resources of D and R should be spent - is therefore

$$g_k^{j*} = \gamma_k^j (A + B), j = D, R, k = 1, 2. \tag{5}$$

[4] As long as prices are constant, all the results in this paper generalise straightforwardly to other kinds of homothetic preferences.

[5] Pedersen (2002) argues that negative transfers from a recipient to a donor might be interpreted as the latter insisting on repayment of debts owed it by the former. With such an intepretation, the case investigated here is an example of a "pure" aid relationship. However, even though debt forgiveness is clearly equivalent to grants in a static setting, I believe that borrowing raises additional issues that might benefit from an explicit analysis. I therefore exclude this possibility here.

[6] One way to interprete aid in this model is therefore as project aid, or, even more precisely, as aid in kind: once the donor has allocated funds for some purpose in the recipient country, these are turned into physical units of goods and services. However, one could easily extend this to program aid as long as the recipient's ability to tax or transfer resources across budget categories is limited relative to the donor's budget. In that case, the restriction would be $b_k \geq \phi$, where ϕ could be negative but greater than $-A$.

Of course, if D and R have the same preferences, their common "first-best" allocation will result; when R is a perfect agent for D, the latter need not concern itself with how to allocate its budget because in any which way it does so, the very best outcome is realised. To analyse the more realistic case of a conflict of interest, I assume that $\gamma^R < \gamma^D$. Then the donor wants more of good 1 and less of good 2 than the recipient wants. I will analyse three different orders of the timing of moves: R as the Stackelberg-leader, D as the leader, and simultaneous moves.

Much of the traditional aid literature has, at least implicitly, assumed that D is the leader. Conditionality - attaching conditions to the aid transfers - has been a strategy much used by donors in the last couple of decades. One way of viewing conditionality is thus that donors dictate the terms of the aid relationship.[7] This may be modelled as D having a first-mover advantage. Most empirical studies conclude, however, that conditionality has had at best a limited impact. Conditions are never fully implemented as specified. Furthermore, at least for altruistic donors, it would be difficult to avoid dynamic inconsistency. If unmet needs are detected in recipient countries, altrustic donors would have a hard time ignoring these even if they are due to the governments of these countries not having implemented conditions having been agreed upon. Therefore, in the literature on the Samaritan's Dilemma (see e.g. Pedersen 1997, 2001 and Svensson 2000), it is assumed that donors are followers. To highlight the differences in outcomes that result, it is common in these works to contrast the cases of donor and recipient leadership. I will do so too, even though it turns out that in the game analysed here, the order of moves does not matter. The case of simultaneous moves, where neither party has a first-mover advantage, provides a useful starting point for understanding why this is so.

2.2 Simultaneous Moves

In a simultaneous-move game, we are looking for a Nash-equilibrium in which both R and D allocate their budgets optimally given the funding strategy chosen by the other party. The donor will, if possible, choose its aid policy so that the end result is $g_1^{D*} = \gamma^D (A + B)$ and $g_2^{D*} = \left(1 - \gamma^D\right)(A + B)$. Equating this with $g_k = a_k + b_k$, we get $a_k(b_k) = \gamma_k^D (A + B) - b_k$ at an interior solution. That is, as funds from the donor and the recipient are perfect substitutes, the donor just adds on to whatever the recipient has allocated so that its optimal consumption of the two goods results. In the remainder, I will denote these functions by $\{a_1^*(b_1), a_2^*(b_2)\}$ and refer to the pair of them as the "first-best" strategy of the donor. The corresponding strategy for the recipient is $b_k^*(a_k) = \gamma_k^R (A + B) - a_k$, $k = 1, 2$. Note that by the budget constraints, it suffices to write these strategies as functions of the respective allocations to good 1. For example, we may write R's optimal allocation to good 2 as $b_2^*(a_1) = \left(1 - \gamma^R\right)(A + B) - (A - a_1)$. For the sake of brevity, I will denote these strategies by $\mathbf{a}^*(b_1)$ and $\mathbf{b}^*(a_1)$.

[7] As noted in the introduction, another is to view conditionality as reflecting a contract between donors and recipients.

It should be clear that as long as there is conflict over the allocation, it can never be the case that $\left\{\mathbf{a}^N\left(b_1\right), \mathbf{b}^N\left(a_1\right)\right\} = \left\{\mathbf{a}^*\left(b_1\right), \mathbf{b}^*\left(a_1\right)\right\}$. That is, as long as $\gamma^D \neq \gamma^R$, the first-best strategies of the players cannot constitute a Nash-equilibrium strategy profile. The first-best strategies are constructed such that if they are used by a player, the resulting allocation is the best possible partition of the combined budget $A + B$ from its perspective. When these allocations differ, it is impossible to attain them simultaneously. Hence, $\left\{\mathbf{a}^*\left(b_1\right), \mathbf{b}^*\left(a_1\right)\right\}$ cannot be a Nash-equilibrium.

The main issue is therefore under what circumstances one of the players may use its first-best strategy. Consider R first. To ask when $\mathbf{b}^*\left(a_1\right)$ is feasible is to ask for which parameter values $b_1^* \in [0, B]$. Denote the share of total resources controlled by the donor by $\alpha = \frac{A}{A+B}$. As will become apparent, there are three interesting parameter configurations, $\alpha \leq \gamma^R$, $\gamma^R < \alpha \leq \gamma^D$, and $\gamma^D < \alpha$.

When $\alpha \leq \gamma^R$, which is equivalent to $1 - \alpha \geq 1 - \gamma^R$, R controls a share of total resources that is greater than its optimal budget share for the good it has the strongest preference for in relative terms, g_2. Clearly, it is then feasible for the recipient to finance the optimum supply of this good from its perspective, g_2^{R*}: $1 - \alpha \geq 1 - \gamma^R \Leftrightarrow B \geq \left(1 - \gamma^R\right)(A + B)$. If it does, the level of g_1 cannot exceed $\gamma^R (A + B)$. Should D spend its whole budget on this good, we would have $g_1 = A + \left[B - \left(1 - \gamma^R\right)(A + B)\right] = \gamma^R (A + B)$. Spending anything less will only result in an even lower level of supply of this good. Since $g_1^{D*} > g_1^{R*}$, this is clearly not optimal for D. Or, more precisely, it is indeed optimal for the donor to choose the extreme strategy $\{A, 0\}$. Even so, R is free to choose $\mathbf{b}^*\left(a_1\right)$ and the outcome is therefore $\mathbf{G}^{R*}$.

When the parameter configuration is $\gamma^R < \alpha \leq \gamma^D$, R is less powerful. It cannot unilaterally finance the optimal level of g_2. Consider what happens if it sets $b_2 = B$. Since we now have $\left(1 - \gamma^R\right)(A + B) \geq B \geq \left(1 - \gamma^D\right)(A + B)$, D will consider such a level of supply of good 2 as excessive. The donor will therefore not find it in its interest to spend anything on this good. Consequently, it sticks to spending its whole budget on good 1. As R considers this level sub-optimal, it has no reason to move away from the strategy $\{0, B\}$. That is, each player will find it optimal to finance the good for which it has the strongest relative preference. The outcome is thus $\mathbf{G}^N = \{\alpha (A + B), (1 - \alpha)(A + B)\}$, which is an allocation intermediate to the first-best allocations of the two actors.

By now, it should not be surprising that the outcome in the third region, where $\gamma^D < \alpha$, is a mirror-image of the those of the first region, with the donor calling the shots. It can now use $\mathbf{a}^*\left(b_1\right)$, and thus ensure $\mathbf{G}^N = \mathbf{G}^{D*}$, since setting $a_1 = g_1^{D*} - b_1$ means that it becomes optimal for the recipient to choose $\{0, B\}$. In this situation, allocating any of the resources at its disposal to good 1 would, if it affected the final allocation at all, only mean that the outcome will be even more sub-optimal from its perspective.[8] So in this case R is in effect powerless. In sum, the equilibrium strategies are

[8] By choosing $b_1 = B$, R could force D to set $a_1 = 0$ if $\gamma_1^D < \frac{1}{2}$. But this would only result in g_1 being even higher than g_1^{D*}, which is clearly not optimal given the recipient's preferences.

$$\left.\begin{array}{c}\left\{a_1^N,a_2^N\right\}=\{A,0\}\\ \left\{b_1^N,b_2^N\right\}=\left\{\gamma^R(A+B)-A,\left(1-\gamma^R\right)(A+B)\right\}\end{array}\right.,\alpha\ \in\ \left(0,\gamma^R\right];\quad(6a)$$

$$\left.\begin{array}{c}\left\{a_1^N,a_2^N\right\}=\{A,0\}\\ \left\{b_1^N,b_2^N\right\}=\{0,B\}\end{array}\right.,\alpha\ \in\ \left(\gamma^R,\gamma^D\right];(6b)$$

$$\left.\begin{array}{c}\left\{a_1^N,a_2^N\right\}=\left\{\gamma^D(A+B),\left(1-\gamma^D\right)(A+B)-B\right\}\\ \left\{b_1^N,b_2^N\right\}=\{0,B\}\end{array}\right.,\alpha\ \in\ \left(\gamma^D,1\right).\quad(6c)$$

As regards the outcome, we see that the degree of influence that each player has is a weakly monotonicly increasing function of the share of resources that it commands. The donor is in full control if its share of the combined budget makes it possible for it to unilaterally finance the optimal level of the good for which it has the highest first-best budgetary share. This is the case when $\gamma^D < \alpha$. Conversely, it has no influence over the outcome when R is in the corresponding position, i.e., when $\alpha \leq \gamma^R$. In the intermediate range, the final allocation lies in between $\mathbf{G}^{D*}$ and $\mathbf{G}^{R*}$, and is closer to the former the higher α is. Each player does its best to get as close as possible to its optimum by choosing to fund only the good its opponent prefers less than itself, but is limited in the extent to which it succeeds by the fact that it does not control a share of the common budget that is large enough to achieve that goal singlehandedly. Figure 1 illustrates how the power of D over the final outcome is weakly increasing in α by depicting the equilibrium budget shares of the two goods as functions of the share of the total available resources controlled by the donor. For example, the equilibrium budget share for g_1, $\eta_1(\alpha)$, starts out at γ^R. When α exceeds the first critical value, γ^R, η_1 becomes an increasing function of α. In fact, in the intermediate region it increases one for one with the share of the combined budgets of the players controlled by D. Once $\alpha > \gamma^D$, the function is constant again, due to D being able to ensure that $\eta_1(\alpha) = \gamma^D$. Since $\gamma^D > \gamma^R$, the function $\eta_2(\alpha)$ is monotonically decreasing on the interval $\left[\gamma^R, \gamma^D\right]$: D uses the greater influence implied by higher values of α to decrease the share of $A+B$ being allocated to good 2.[9]

We shall now see that this pattern prevails even if we change the order in which the players move.

2.3 D as a Stackelberg-Leader

Now suppose that D chooses its budgetary strategy before R. In the last stage, the recipient will try to reach $\mathbf{G}^{R*}$. That is, if at all possible, it will use the strategy $\mathbf{b}^*(a_1)$. This means that if the donor is to move the final allocation away from $\mathbf{G}^{R*}$, it has to ensure that the solution to the recipient's problem is not in the interior of the choice set. In other words, it must make at least one of the non-negativity constraints on R's budgetary policy binding. It turns out

[9] As can be seen, the exact location of the two functions depend on parameter values. For example, if $\gamma_1^R > \frac{1}{2}$, then the two functions do not cross. What is important, is the properties of these functions.

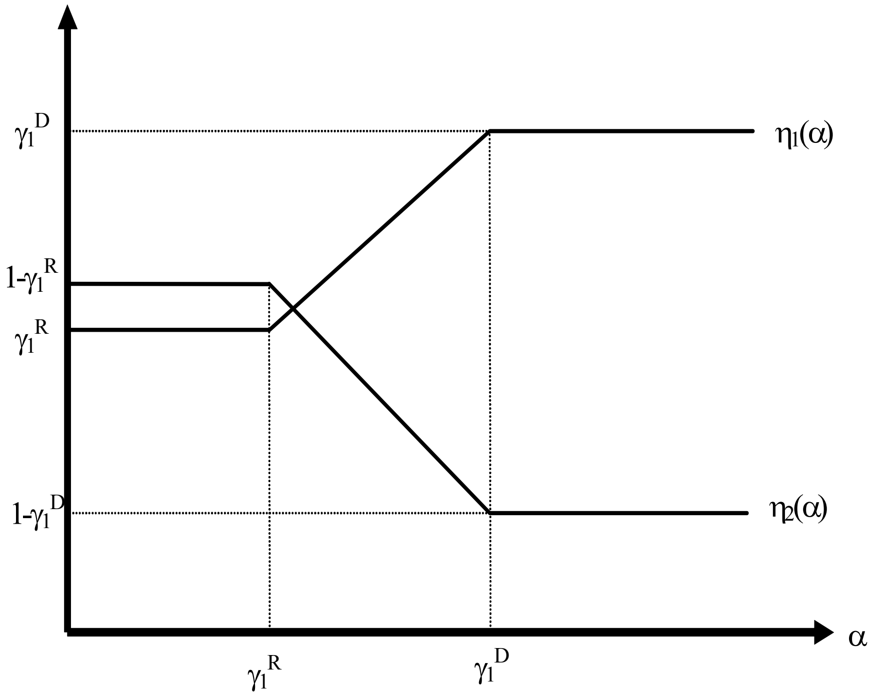

Figure 1: Equilibrium budgetary shares as functions of α

that such as strategy is not feasible if the donor's budget is too small. If the aid budget is small enough, R can make the final allocation be $\mathbf{G}^{R*}$ whatever the allocation chosen by the donor. However, for higher relative aid budgets, the donor will have some influence over the outcome. In fact, if it has enough clout in terms of relative resources, the optimal strategy of D will result in $\mathbf{G}^{D*}$. I will now demonstrate these results.

Let us start by investigating whether D can increase the share of resources going to good 1, the consumption of which it wants to be larger than R does. Exploiting its budget maximally against the first-best strategy of R will generate the response $b_1^*(A) = \gamma^R (A+B) - A$. For $\alpha = \gamma^R$, this is equal to zero. For $\alpha < \gamma^R$, it is obviously strictly positive. Furthermore, forcing the recipient into the other corner is clearly not desirable for D even if it should be feasible for aid budgets in this range. This means that when its financial muscles are weak, the donor must accept the fact that the government is in complete control over the allocation.

Moving into the region $\gamma^R < \alpha \leq \gamma^D$, D can now make the non-negativity constraint on b_1 binding. Since it wants to increase g_1 from g_1^{R*}, it will spend its entire budget on this good until $\alpha = \gamma^D$. This is optimal because doing so will increase the consumption of good 1 from $\gamma^R (A+B)$ to A while keeping the consumption of good 2 fixed at $B > \left(1-\gamma^D\right)(A+B)$, whereas any other choice would lead to lower levels of g_1 and higher levels of g_2. This means that for these parameter values $\mathbf{G}^L = \{A, B\}$.

Finally, when $\alpha > \gamma^D$, the donor has such a large budget that it can completely nullify the influence of R over the final allocation. Setting $a_1 = \gamma^D (A+B)$ is now feasible without violating the budget constraint. Since $\gamma^D > \gamma^R$, this makes $b_1 = 0$ optimal and so $g_1 = \gamma^D (A+B)$. Moreover, $g_2 = B + \left[A - \gamma^D (A+B)\right] = \left(1-\gamma^D\right)(A+B)$. Therefore, the equilibrium consumption vector is $\mathbf{G}^{D*}$. For the sake of completeness, I note the equilibrium policies (the superscript L reminds us of the fact that the donor is the leader here):

$$\begin{matrix} \left\{a_1^L, a_2^L\right\} = \left\{\left[Max\left\{0, \gamma^R A - \left(1-\gamma^R\right)B\right\}, A\right], A - a_1^L\right\} \\ \left\{b_1^L, b_2^L\right\} = \left\{\gamma^R (A+B) - a_1^L, \left(1-\gamma^R\right)(A+B) - a_2^L\right\} \end{matrix}, \alpha \in \left(0, \gamma^R\right] \tag{7a}$$

$$\begin{matrix} \left\{a_1^L, a_2^L\right\} = \{A, 0\} \\ \left\{b_1^L, b_2^L\right\} = \{0, B\} \end{matrix}, \alpha \in \left(\gamma^R, \gamma^D\right] \tag{7b}$$

$$\begin{matrix} \left\{a_1^L, a_2^L\right\} = \left\{\gamma^D (A+B), \left(1-\gamma^D\right)(A+B) - B\right\} \\ \left\{b_1^L, b_2^L\right\} = \{0, B\} \end{matrix}, \alpha \in \left(\gamma^D, 1\right) \tag{7c}$$

So outcomes follow the pattern established for the simultaneous move game. The only slight change from the last sub-section is that the strategy of the leader, D, is indeterminate when it cannot influence the end result. Any $a_1 \in \left[Max\left\{0, \gamma^R A - \left(1-\gamma^R\right)B\right\}, A\right]$ ensures that the non-negativity constraint on b_2 is not binding for $0 < \alpha \leq \gamma^R$, the region in which D cannot make the corresponding constraint for b_1 binding even if it allocates its own budget solely to g_1. As long as it does not end up in a situation where $g_2 > g_2^{R*}$, D is indifferent among all other partitions of its budget since the final outcome is $\mathbf{G}^{R*}$ regardless of its choice.

In economic policy games, it is usually an advantage to move first. Hence, I now change the order in which the players move to see if a first-mover advantage exists here as well. It turns out that the answer is no; the outcomes are isomorphic to the order of moves. This claim is demonstrated in the next sub-section.

2.4 R as a Stackelberg-Leader

In this case, the recipient chooses its budgetary strategy before the donor. We know that in the last stage, the donor will, if feasible, optimally use $\mathbf{a}^* (b_1)$ as its strategy. So in order to avoid the outcome $\mathbf{G}^{D*}$ R must try to force D into spending its whole budget on one of the goods. To see how R can best deploy its resources in this case, first note that if $a_k = 0$, $g_k = b_k$. Thus, if $\mathbf{G}^{R*}$ is to be realised, it must be the case that $b_k = \gamma_k^R (A + B)$ for at least one good. As we assume $\gamma^R < \gamma^D$, the natural candidate to consider is $b_2 = \gamma_2^R (A + B)$. b_1 is then determined residually as $B - \gamma_2^R (A + B) = \gamma^R (A + B) - A$. If this strategy is to be feasible for R, $\gamma^R (A + B) - A \geq 0$, or $\gamma^R \geq \alpha$. Hence, as already noted, the outcome is $\mathbf{G}^F = \mathbf{G}^{R*}$, where the superscript F refers to the fact that D is a follower.

Moving on to the case $\gamma^R < \alpha \leq \gamma^D$, R is no longer able to reach its optimal location on the combined budget constraint. The best it can do, given that it must respect $b_1 \geq 0$, is to set $b_1 = 0$ and $b_2 = B$. Provided that the donor's budget share is smaller than γ^D, this still allows R to influence the outcome because D will be pinned down at $\{A, 0\}$. The donor wants to reduce g_2, but is unable to do so because it cannot decrease the level of resources allocated to this good below the level set by R. Thus, it is optimal for D to allocate its entire budget to g_1 until its budget is so large it wants to have $g_2 > B$. This occurs when $\left(1 - \gamma^D\right) (A + B) > B$, or $\alpha > \gamma^D$. The outcome in this region is therefore $g_1 = A$ and $g_2 = B$. None of the players are able to ensure that their most preferred allocation is realised, as the share of the combined budget being spent on good 1 is α.

Finally, when $\alpha > \gamma^D$, the donor is in complete control; it has such large resources available relative to R that it is able to secure an outcome where the budget shares are first-best optimal from its point of view. That is, setting $a_k = \gamma_k^D (A + B) - b_k$ is feasible whatever the levels of b_k chosen by R.[10] This can be seen by noting that at $\alpha = \gamma^D \Leftrightarrow 1 - \alpha = 1 - \gamma^D$, the non-negativity constraint on a_2 is at most weakly binding. Moreover, the shares of the g_1 and g_2 in the combined budget are γ^D and $1 - \gamma^D$, respectively, even if R utilises his resources as best it can (i.e., setting $b_2 = B$). Clearly, if D has a larger share of $A + B$ than α, R cannot force it to a corner solution. This means that the recipient is powerless; its budgetary policy does not matter as it is engulfed in

[10] The qualification mentioned in footnote 8 still applies; it might be the case that R can preclude D's first-best strategy from being feasible by forcing the latter to set $a_1 = 0$, but this will never be optimal.

aid flows too large for the domestic flood controls to handle. The donor, on the other hand, simply adds on to whatever allocations R make in order to reach $\mathbf{G}^{D*}$.

In sum, equilibrium actions when the donor is a follower are

$$\begin{array}{c} \left\{a_1^F, a_2^F\right\} = \{A, 0\} \\ \left\{b_1^F, b_2^F\right\} = \left\{\gamma^R (A+B) - A, \left(1-\gamma^R\right)(A+B)\right\} \end{array}, \alpha \in \left(0, \gamma^R\right] \quad \text{(8a)}$$

$$\begin{array}{c} \left\{a_1^F, a_2^F\right\} = \{A, 0\} \\ \left\{b_1^F, b_2^F\right\} = \{0, B\} \end{array}, \alpha \in \left(\gamma^R, \gamma^D\right] \quad \text{(8b)}$$

$$\begin{array}{c} \left\{a_1^F, a_2^F\right\} = \left\{\gamma^D (A+B) - b_1^F, \left(1-\gamma^D\right)(A+B) - b_2^F\right\} \\ \left\{b_1^F, b_2^F\right\} = \left\{\left[0, Min\left\{\gamma^D (A+B), B\right\}\right], B - b_1^F\right\} \end{array}, \alpha \in \left(\gamma^D, 1\right) \quad \text{(8c)}$$

The major conclusion of this section is therefore that whatever the order of moves by the players, the outcome is the same. At first sight this may seem a surprising result. It is quite intuitive, though, upon closer inspection. For given levels of A and B, the interests of the donor and the recipient are strictly opposed: moving the final allocation closer to $\mathbf{G}^{R*}$ will be viewed an improvement by R but will worsen the outcome from D's point of view. Each player thus tries to negate the influence of the other player over the outcome. Given their preferences, the extent to which they are able to do so only depends on their relative shares of total resources $A + B$.

The results derived so far are summarised in Proposition 1:

Proposition 1:

Equilibrium outcomes of a simple two-good budgetary game between an aid donor and a recipient do not depend on the order of moves. Instead, they depend on relative budget levels. If the donor's resources are small compared to the recipient's, the outcome is controlled by the latter. For intermediate relative budget levels, the outcome is that each player funds the good for which it has stronger preferences than the other player. If the donor commands considerable resources relative to the recipient, it is able to secure an allocation of the combined budgets of the players that is "first-best" optimal according to its preferences.

From the above analyses made above, it should also be clear that the recipient is always better off playing the aid game. Figure 2 illustrates this point as well as how equilibrium outcomes map out when the comparative statics exercise is in terms of the level of the aid budget, keeping B fixed, so that higher levels of α also means higher levels of the combined budget of the two players. First note that the outcomes always lie northeast of R's optimal allocation when the donor does not transfer any funds. As R's preferences can be represented by indifference curves of the standard type, these outcomes generate a higher value of the recipient's objective function. The reason is simply that at low levels of aid, where one could suspect that the transfer could be inadequate to compensate for any "distortion" in outcomes due to donor influence, D has in fact no leverage. And when D provides resources at a level sufficient to have an impact on outcomes, R is more than compensated by the increase in the

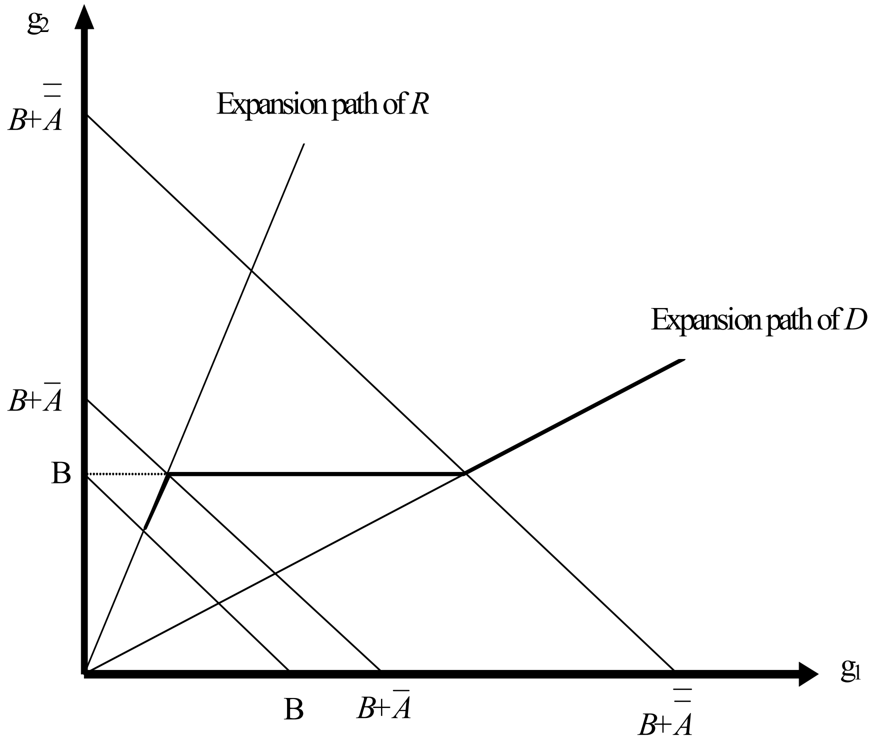

Figure 2: Equilibrium outcomes as functions of A

budget available for spending on goods 1 and 2. Secondly, because the objective functions are homothetic, optimal budget shares stay constant as $A + B$ increase. Hence, instead of studying how the equilibrium changes as α varies for fixed $A + B$, the same pattern of outcomes results when A is varied holding B constant. Note how the bold line marking equilibrium allocations first (i.e., for $A \leq \overline{A} = \left(\frac{\gamma^R}{1-\gamma^R}\right) B$) follow the expansion path of R. When D starts to have influence, outcomes begin to deviate from this path, moving closer to the donor's expansion path as A increases. When $A > \overline{\overline{A}} = \left(\frac{\gamma^D}{1-\gamma^D}\right) B$, the donor is in complete control, so outcomes move out along its expansion path as the total amount of available resources increase with A. Thus, the three regions shown in figure 2 corresponds to those depicted in figure 1.

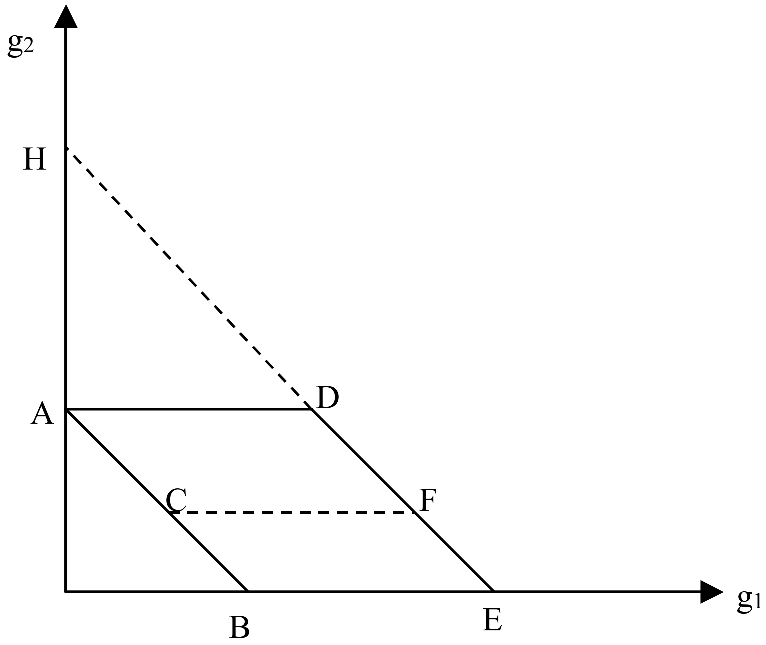

Figure 3: The non-strategic approach to fungibility

3 The Issue of Fungibility

It is difficult to define fungibility in a precise way. In the literature, the example that is ordinarily used to illustrate the concept is a situation where a donor wants to support a specific activity in the recipient country through an earmarked grant. Aid is then said to be fungible if expenditures on that activity do not rise by the full amount of the grant. Figure 3, adapted from Feyzioglu, Swaroop, and Zhu (1998), is an example of this standard approach.[11]

In Feyzioglu, Swaroop, and Zhu (1998), the donor is assumed not to care about the good or activity g_2. It only wants to support g_1. It does so by donating an amount equal to the distance between points E and B. That is, subject to a restriction to be discussed shortly, the budget line of the recipient is moved out to the extent of the aid given. The donor wants the resulting allocation to be at point F. At that point, g_1 has increased relative to the original allocation by an amount $F - C$, which is equal to $E - B$. Aid is then said to be partially fungible if the recipient can divert part of the grant for g_1 to g_2. It is said to be completely fungible if "the post-aid optimal mix of the two goods, chosen by the country, is an interior solution" (p. 31).

Even in this apparently simple setting, however, there are some loose ends.

[11] A similar illustration appears in Devarajan and Swaroop (2000).

These authors assume that the recipient must spend at least the size of the grant on the activity supported by the donor. That is, we must have $g_1 \geq E - B$, so that the new budget constraint has a kink. In figure 3 this occurs at point D, and the assumption of Feyzioglu, Swaroop, and Zhu (1998) means that points between H and D are not accessible to the recipient. This assumption is analogous to the non-negativity constraints that I impose on the recipient's funding choices.[12]

A second point to note is that, as long as the objective function of the recipient is homothetic and both goods are normal, it is easy to demonstrate that the assumption $g_1 \geq E - B$ implies that if the grant is "very large", full fungibility is not possible.[13] Moving the point D far enough to the right in figure 3, it will eventually be the case that the expansion path of the recipient lies to the northwest of D. Hence, even in this setting, there is a link between grant size and final allocations that is not explored.

A third point is that even if one accepts that the donor only cares about one good, or set of goods, while the recipient wants to spend on some goods not given priority by the donor, the latter can always adjust the level of funding. That is, if aid is to some extent fungible, this should be reflected in the size of the grant. The observation just made, namely that under the assumption $g_1 \geq E - B$ full fungibility is impossible if the grant is large enough, makes clear the need to investigate donor and recipient behaviour simultaneously.

In sum, implicit in the standard, non-strategic approach is a naive representation of the donor, particularly if fungibility is indeed an important problem. In the present model, the donor acts strategically, taking into account the possibility of diversion of resources by the recipient.[14] Therefore, it optimally adjusts its aid policy in order to achieve as much as possible. It follows that in the current context, fungibility is better defined in terms of influence over the final allocation. That is, aid is perfectly fungible if the donor has no influence on the outcome, partially fungible if it has some, and not fungible if the donor is in complete control over the outcome. Hence, the definition adopted here corresponds to that of Pedersen (1997), who characterises aid as fungible if it

[12] The motivation, however, seems to be different; the authors state that the kink indicates aid conditionality, so presumably they believe that the donor will "punish" the recipient if it spends less than this amount. But then why does not the donor punish the recipient if it diverts part of the grant to other activities? Given the problem of punishing straying recipients, as reflected in the unimpressing record of conditionality, there is an untold story here that needs elaboration. I plan to pursue this line of inquiry in future work.

[13] When the preferences of the recipient are not homothetic, it would matter which good is a luxury good. If it is the good that the donor does not care about, a smaller grant (compared to the homothetic case) is needed to preclude full fungibility. If it is g_1, it is the other way around, but of course, one could then argue that fungibility is less important. In the more general case where both donor and recipient care about both goods, matters will be slightly complicated by the fact that the optimal allocations of the donor and the recipient might converge or diverge as income increases.

[14] That there is no crowding-out of domestic spending here even when aid is perfectly fungible (c.f. $g_1 = \gamma_1^R(A + B)$, while in the absence of aid, $g_1 = \gamma_1^R B$; i.e., domestic spending is constant at $\gamma_1^R B$) is due to the homotheticity of the utility functions, which yields linear expansion paths.

is possible for the recipient to divert resources away from the activity that the donor seeks to finance. As pointed out by him, the possibility of diversion is but a necessary condition for actual diversion; in order to divert funds, the the recipient must also wish to do so. Hence, to explore the importance of diversion, we must investigate how the funding strategies of the recipient and the donor depend on their preferences, their budgets, and the nature of their strategic interaction.

An alternative view would be that foreign development assistance is not fungible at all under the conditions assumed in this paper. For example, when $\gamma^R \geq \alpha$, the donor allocates its total budget to g_1 when it is the follower. While the recipient controls the final allocation, $g_1 = \gamma^R (A + B) - A + A \geq A$ in this range. For $\gamma^R < \alpha$, the donor has some limited influence on the final allocation. It still chooses $a_1 = A$, and since $g_1 = A$, no part of the donation is spent on g_2. Finally, when the donor is in complete control, aid is clearly not fungible. But this position will not do; the donor acts in this way precisely because it realises that aid is fungible (partially or completely) for $\gamma^D > \alpha$.

Hence, I suggest that in aid games, fungibility should be defined in terms of the extent of the influence that the donor has over the final allocation. A simple though arbitrary measure of donor influence in the current model is

$$\Delta\left(\mathbf{G}^e\right) = \frac{d\left(\mathbf{G}^e, \mathbf{G}^{R*}\right)}{d\left(\mathbf{G}^{D*}, \mathbf{G}^{R*}\right)},$$

where $d(v, w)$ is the Euclidean distance between the points v and w. Thus, $\Delta\left(\mathbf{G}^e\right)$ measures the distance between the equilibrium outcome $\mathbf{G}^e$ and the government's "first-best" allocation as a proportion of the distance between the "first-best" allocations of the donor and the government. The measure therefore requires $\mathbf{G}^{D*} \neq \mathbf{G}^{R*}$, but, as noted by Devarajan, Rajkumar, and Swaroop (1999, p.1), "[T]he question of what aid ultimately finances is interesting only if the preferences of the donor are different from those of the recipient".

It is easily seen that $\Delta\left(\mathbf{G}^{R*}\right) = 0$ and $\Delta\left(\mathbf{G}^{D*}\right) = 1$. This confirms that the donor has no influence for $\gamma^R \geq \alpha$, and is in complete control once $\gamma^D < \alpha$. It is straigthforward to verify that $\Delta\left(\mathbf{G}^e\right)$ is an increasing function of α on $\left[\gamma^R, \gamma^D\right]$, with $\Delta\left(\mathbf{G}^e\right) = 0$ at γ^R and $\Delta\left(\mathbf{G}^e\right) = 1$ at γ^D. Hence, the donor has some influence when $\alpha \in \left(\gamma^R, \gamma^D\right)$, and its influence over the final allocation increases with its budget until it is in complete control, as previously shown.

4 Endogenous Budgets

Assuming fixed budgets for both the donor and the recipient is a useful benchmark. Tax systems in many developing countries are highly rudimentary and tax administration is notoriously lax, with corruption, tax avoidance, and tax evasion constituting very real constraints on the government's ability to raise revenues. Improving tax capacity takes time. Moreover, many aid recipients, particularly in Africa, lack access to alternative external sources of funds. This is not likely to change over night.

On the donor side, it is noteworthy that aid allocation patterns across countries show a relatively high degree of persistence. One reason for this, is that some donors have favourite recipients, for example due to historical or cultural ties. Even bilateral donors that tend to give aid to the poorest countries often designate some recipients as the main targets for their development assistance. One argument for building long-term relationships is of course that it facilitates the accumulation of country-specific knowledge, which potentially could lead to greater aid efficiency. Thus, over a medium-term horizon, assuming given budget levels for both players is a reasonable approximation to reality.

Still, it is obviously of interest to see whether the results derived so far hold up when budgets are endogenous, especially if the call for aid selectivity is heeded by donors. In this section I show that the same three kinds of equilibria - complete control over the outcome for either player or shared influence - arise in this case in essentially the same way. Specifically, the degree of influence now varies with the relative marginal cost of funds for D. However, the critical values now depend on the order of moves. It turns out that even though the donor controls the outcome at a higher relative cost when it is a Stackelberg-follower instead of a leader, it is always better off having the first move. In fact, for the same parameter values being a leader always yields at least as high a pay-off as in the Nash-equilibrium, with the latter in turn is everywhere at least as good as the equilibrium outcome when the donor is a follower in a sequential game. R too, ranks games in this way based on equilibrium outcomes; that is, it would always at least weakly prefer being a leader to playing a simultaneous move game, which in turn is at least weakly preferred to moving last in a sequential game. The reason is that a leader can calculate whether it would be optimal to try to impose its most preferred allocation. If the improvement in the outcome does not generate a benefit at least commensurate with the cost, the leader can always leave provision of one or both goods to the follower. The latter does not have the option of making such a calculation, and therefore cannot be better off than if it were. The simultaneous move game naturally leads to an intermediate constellation of critical parameter values.

In this section then, the preferences of the players are

$$W^D(\mathbf{G}, A) = U^D(\mathbf{G}) - \psi^D A; \quad (9a)$$

$$W^R(\mathbf{G}, B) = U^R(\mathbf{G}) - \psi^R B; \quad (9b)$$

As before, $a_1 + a_2 = A$ and $b_1 + b_2 = B$, but now A and B are determined endogenously taking into account that the marginal costs of a unit of funds are ψ^D and ψ^R for D and R, respectively. Assuming constant marginal costs allows me to derive explicit expressions for strategies and equilibrium outcomes. Moreover, at least for the donor, the assumption is not unrealistic, because most donors are not even fulfilling the UN target of giving at least 0.7% of their GNI in the aggregate.[15] Thus, the total aid budget for a particular recipient is quite

[15] Only the Scandinavian countries, the Netherlands, and Luxembourg are currently achieving this target.

small for all donors, and so is unlikely to affect the marginal cost of public funds. Admittedly, the assumption is less realistic for R given the dependence of poor countries on highly distortionary instruments such as trade taxes for a large part of their public revenues. However, the gain in terms of analytical ease seems large enough to make it defensible.

It is straightforward to derive the first-best allocations for the players in the current context. They are

$$g_1^{D**} = \frac{\gamma^D}{\psi^D}, g_2^{D**} = \frac{1-\gamma^D}{\psi^D}; \tag{10a}$$

$$g_1^{R**} = \frac{\gamma^R}{\psi^R}, g_2^{R**} = \frac{1-\gamma^R}{\psi^R}. \tag{10b}$$

Note that for $\gamma^D > \gamma^R$, it is still the case that $\frac{g_1^{D**}}{g_2^{D**}} > \frac{g_1^{R**}}{g_2^{R**}}$. From these expressions, the first-best strategies follow:

$$\mathbf{a}^{**}(\mathbf{b}) = \{a_1^{**}(b_1), a_2^{**}(b_2)\} = \left\{\frac{\gamma^D}{\psi^D} - b_1, \frac{1-\gamma^D}{\psi^D} - b_2\right\}; \tag{11a}$$

$$\mathbf{b}^{**}(\mathbf{a}) = \{b_1^{**}(a_1), b_2^{**}(a_2)\} = \left\{\frac{\gamma^R}{\psi^R} - a_1, \frac{1-\gamma^R}{\psi^R} - a_2\right\}. \tag{11b}$$

Of course, we can no longer write these strategies solely in terms of the allocation made by the other player to good 1. For the donor this implies that the following non-negativity constraints must be satisfied if its first-best strategy is to be feasible

$$a_1^{**} \geq 0 \Longleftrightarrow b_1 \leq \bar{b}_1 \equiv \frac{\gamma^D}{\psi^D};$$

$$a_2^{**} \geq 0 \Longleftrightarrow b_1 \leq \bar{b}_2 \equiv \frac{1-\gamma^D}{\psi^D}.$$

Correspondingly, for the recipient we have

$$b_1^{**} \geq 0 \Longleftrightarrow a_1 \leq \bar{a}_1 \equiv \frac{\gamma^R}{\psi^R};$$

$$b_2^{**} \geq 0 \Longleftrightarrow a_2 \leq \bar{a}_2 \equiv \frac{1-\gamma^R}{\psi^R}.$$

With these prerequisites in place, we are ready to analyse the one-shot games that the donor and the recipient might play.

4.1 Nash-Equilibria with Endogenous Budgets

Once again, let us start with the neutral alternative, the simultaneous-move game. First assume that $\psi^D = \psi^R$. Then $g_1^{D**} > g_1^{R**}$ and $g_2^{D**} < g_2^{R**}$. Hence, D is willing to add to R's spending on good 1 even if that is at its maximum: $\frac{\gamma^D}{\psi^D} - \frac{\gamma^R}{\psi^R} > 0$. The best response of the recipient to $a_1^{**}(b_1)$ is then obviously not to contribute any domestic funds. Regardless of the level of b_1 chosen, $g_1^{NB} = \frac{\gamma^D}{\psi^D}$, which, from R's perspective, is too high to warrant any spending.[16] The same logic implies that $a_2 = 0$ is an optimal choice for the donor when $b_2^{**}(a_2)$ is played. The result is that $g_2^{NB} = \frac{1-\gamma^R}{\psi^R}$.

If ψ^D is increased slightly, the equilibrium stays the same, as it will still be the case that $\frac{\gamma^D}{\psi^D} - \frac{\gamma^R}{\psi^R} > 0$. However, once the donor's marginal cost reaches $\psi^D = \frac{\gamma^D}{\gamma^R}\psi^R$, $g_1^{D**} = g_1^{R**}$. At this specific value of ψ^D, both $a_1^{**}(b_1)$ and $b_1^{**}(a_1)$ are feasible. Thus, there is an infinite number of equilibrium actions; for any $a_1 \in \left[0, \frac{\gamma^D}{\psi^D}\right]$, $b_1 = b_1^{**}(a_1)$ results in $g_1 = g_1^{D**} = g_1^{R**}$, and vice versa. With respect to good 2, though, it is still the case that $a_2^{NB} = 0$ and $b_2^{NB} = \frac{1-\gamma^R}{\psi^R}$.

For ψ^D greater than this critical value, the equilibrium changes to one in which only R contributes. This is so because now we have both $g_1^{D**} < g_1^{R**}$ and $g_2^{D**} < g_2^{R**}$. Therefore, even if the donor spends $\frac{\gamma^D}{\psi^D}$ on g_1 and $\frac{1-\gamma^D}{\psi^D}$ on g_2, R will be willing to add funds. But at $\{g_1^{R**}, g_2^{R**}\}$, both $\frac{\partial W^D}{\partial a_1}$ and $\frac{\partial W^D}{\partial a_2}$ are negative. Hence, it is not optimal for D to contribute to the provision of the two goods.

If we start out at $\psi^D = \psi^R$ and start reducing ψ^D, we eventually reach $\psi^D = \frac{1-\gamma^D}{1-\gamma^R}\psi^R$. Then $g_2^{D**} = g_2^{R**}$. This is also a parameter configuration for which there is an infinite number of equilibrium actions. More importantly, once ψ^D falls below this critical value, D wants more of both goods than R does. Then $\mathbf{a}^{**}(\mathbf{b})$ is feasible even if the recipient sets $b_1 = g_1^{R**}$ and $b_2 = g_2^{R**}$. It is obviously optimal. Accordingly, R will not spend a penny, and the donor is in complete control over the outcome.

In order to summarise these results, let us define $\overline{\psi}^N = \left(\frac{1-\gamma^D}{1-\gamma^R}\right)\psi^R$ and $\overline{\overline{\psi}}^N = \left(\frac{\gamma^D}{\gamma^R}\right)\psi^R$. Then Nash-equilibrium outcomes with endogenous budgets may be characterised as follows

$$\mathbf{G}^{NB} = \begin{cases} \left\{g_1^{D**}, g_2^{D**}\right\}, \psi^D \in \left(0, \overline{\psi}^N\right]; \\ \left\{g_1^{D**}, g_2^{R**}\right\}, \psi^D \in \left(\overline{\psi}^N, \overline{\overline{\psi}}^N\right]; \\ \left\{g_1^{R**}, g_2^{R**}\right\}, \psi^D > \overline{\overline{\psi}}^N. \end{cases}$$

[16] I will use the superscripts NB, FB, and LB to denote equilibrium strategies, actions, and outcomes in the three types of games analysed when budgets are endogenous.

It is easily confirmed that the total level of spending is higher in the intermediate case than in any of the two cases where only one of the players contrubute to the provision of the two goods. In the second region, total spending on g_1 and g_2 is $g_1^{D**} + g_2^{R**}$. The assumption $\gamma^D > \gamma^R$ ensures that this is higher than both $g_1^{D**} + g_2^{D**}$ and $g_1^{R**} + g_2^{R**}$, which is the total amount of resources made available in regions 1 and 3, respectively.

More importantly, note that this pattern is analogous to the one that we found when budgets were fixed. If D's relative marginal cost of funds is very low, it will be deciding the outcome. This corresponds to the case where the donor's share of the common budget budget was very high relative to R's. At an intermediate level of $\frac{\psi^D}{\psi^R}$, R provides g_2 and D determines g_1. Finally, when ψ^D exceeds the second critical value, the donor has no influence over the oucome. This is the equivalent of the case $\alpha < \gamma^R$ when budgets were exogenous.

As will soon become apparent, what is different when the total spending of the two players is endogenous is that the critical values for relative marginal costs depend on the type of game played (hence the superscripts). I start with D being the leader in a sequential game.

4.2 Sequential Games with Endogenous Budgets

Now let D move before R. The donor knows that the recipient aims for $\left\{g_1^{R**}, g_2^{R**}\right\}$. Hence, if $\mathbf{G}^{D**} \leq \mathbf{G}^{R**}$, $\mathbf{b}^{**}(\mathbf{a})$ is feasible regardless of what D does, and it will therefore be chosen by R. Since contributing funds will not change the outcome, it is best for D to set $a_1 = a_2 = 0$. Clearly, necessary conditions for the donor to be willing to spend are $g_1^{D**} \geq g_1^{R**}$ and $g_2^{D**} \geq g_2^{R**}$. These may be converted into the same critical relative values of the marginal costs that we have just derived. It should also be readily apparent that these are not sufficient. If $\mathbf{G}^{D**} = \mathbf{G}^{R**}$, the donor is better off leaving provision of the goods to the recipient as the outcome is in any case the best possible one and it saves the cost of contributing. So we need to compare three values of the donor's objective function, corresponding to the three possible situations where D does not contribute at all, finances one good (specifically, g_1), or pays for the provision of both g_1 and g_2: $W_0^D \equiv U^D\left(g_1^{R**}, g_2^{R**}\right)$, $W_1^D \equiv U^D\left(g_1^{D**}, g_2^{R**}\right) - \psi^D a_1^{**}(0)$, and $W_2^D \equiv U^D\left(g_1^{D**}, g_2^{D**}\right) - \psi^D\left[a_1^{**}(0) + a_2^{**}(0)\right]$. Straightforward calculations reveal that

$$
\begin{aligned}
W_2^D \quad &\gtreqless \quad W_1^D \Leftrightarrow \overline{\psi}^L = \frac{1-\gamma^D}{e\left(1-\gamma^R\right)}\psi^R \gtreqless \psi^D; \\
W_1^D \quad &\gtreqless \quad W_0^D \Leftrightarrow \overline{\overline{\psi}}^L = \frac{\gamma^D}{e\gamma^R}\psi^R \gtreqless \psi^D.
\end{aligned}
$$

The assumption $\gamma^D > \gamma^R$ implies that $\overline{\overline{\psi}}^L > \overline{\psi}^L$. We have thus found that

$$\mathbf{G}^{LB}=\begin{cases}\left\{g_1^{D**},g_2^{D**}\right\},\psi^D\in\left(0,\overline{\psi}^L\right];\\\left\{g_1^{D**},g_2^{R**}\right\},\psi^D\in\left(\overline{\psi}^L,\overline{\overline{\psi}}^L\right];\\\left\{g_1^{R**},g_2^{R**}\right\},\psi^D>\overline{\overline{\psi}}^L.\end{cases}$$

We also see that $\overline{\overline{\psi}}^L<\overline{\overline{\psi}}^N$ and $\overline{\psi}^L<\overline{\psi}^N$. This means that the outcome switches from $\left\{g_1^{D**},g_2^{D**}\right\}$ to $\left\{g_1^{D**},g_2^{R**}\right\}$ at lower levels of the donor's marginal cost of funds than was the case with simultaneous moves. Similarly, the donor pulls completely out at lower levels of costs when it has a first-mover advantage than it does when it takes the choices of R as given. The reason is that it uses its advantage to weigh the gains of an improved allocation from its perspective against the costs of providing one more good, taking the response of the follower R into account. These added degrees of freedom improve the outcomes as measured by the donor's objective function in the parameter regions where the outcomes differ. Conversely, the recipient incurs a loss when the donor has more leeway than it has.

The case where R moves before D is symmetric, with the two critical values each being higher than the corresponding cut-off rates for Nash-equilibria: $\overline{\psi}^F=e\left(\frac{1-\gamma^D}{1-\gamma^R}\right)\psi^R>\overline{\psi}^N$ and $\overline{\overline{\psi}}^F=e\frac{\gamma^D}{\gamma^R}\psi^R>\overline{\overline{\psi}}^N$. The reason is that R makes use of its first-mover advantage to calculate whether D's response is sufficient for it to refrain from contributing funds. For example, faced with no funding from R D will finance the consumption of both goods since the marginal benefit from doing so is infinite. As long as its marginal cost is relatively high, R will find a final outcome of $\left\{g_1^{D**},g_2^{D**}\right\}$ a better option than anything it could generate by spending something on the two goods. As the relative cost of funds for D goes up, that of R goes down, in the end making it optimal for the latter to fund first g_2 and then both goods. On the other hand, when playing the simultaneous move game, R takes the contributions made by D as given. The fact that it does not see a link between its own funding decisions and those of D makes it optimal for R to provide resources at higher relative marginal cost than is the case when it is the leader. For the sake of completeness, I note that in this game outcomes are

$$\mathbf{G}^{FB}=\begin{cases}\left\{g_1^{D**},g_2^{D**}\right\},\psi^D\in\left(0,\overline{\psi}^F\right];\\\left\{g_1^{D**},g_2^{R**}\right\},\psi^D\in\left(\overline{\psi}^F,\overline{\overline{\psi}}^F\right];\\\left\{g_1^{R**},g_2^{R**}\right\},\psi^D>\overline{\overline{\psi}}^F.\end{cases}$$

Consequently R does not lose and D does not gain, both compared to the simultaneous move version and to the one just analysed. For some parameter values, outcomes are the same whichever game is played, whereas for others outcomes improve from the leader's perspective because the loss in terms of the allocation being worse according to its preferences is more than outweighed by the savings in terms of the costs of contributing. The follower naturally evaluates matters differently, and sees itself as being forced into spending on the two goods at values of its marginal costs where it would rather have the leader fund one or both goods. One can thus demonstrate that each player at least weakly prefers being a leader to being a follower, with the Nash-equilibrium yielding outcomes that are intermediate in this ranking. This is proposition 2:

Proposition 2

When budgets are endogenous, the players care about the order of moves. Moving first is at least weakly preferred to the simultaneous move game, which in turn is preferred to being a follower in a sequential game. Outcomes still depend on relative resources in the sense of relative costs of making funds available. If the donor's marginal cost is sufficiently small compared to R's, it is in complete control, with its degree of influence being weakly monotonically decreasing as its relative cost advantage declines.

5 Final remarks

The current version of this paper represents a first attempt to understand the impact of aid on allocation patterns in recipient countries taking into account the fact that whenever spending priorities differ, donors and recipients play a game in which each party tries to use the resources available to it to make sure that the outcome is as good as possible from its perspective. Using a simple framework, I have analysed how the end result of the interaction between a donor and a recipient depends on the preferences and budgets of the players, as well as the order in which they move. Despite the bare-bones approach, some interesting results were derived. Specifically, outcomes do not depend on the order of moves when budgets are exogenous. Instead, each player's influence over the equilibrium allocation is weakly monotonically increasing in the share of the total available resources controlled by it. The reason is that given resource shares, the interests of the players are strictly opposed: if the outcome moves closer to the optimal one from according to the preferences of one player, it worsens in the view of the other player. This pattern extends to the case of endogenous budgets, where each player decides how much to spend on the goods that are jointly funded taking into the account the impact it can have. While the critical values are then defined in terms of relative marginal costs of funds instead of relative budgets, there are still three regions, with each player determining the allocation in one of them and the third one being one of shared influence over outcomes. However, in this case players prefer being a Stackelberg-leader to being a follower. The simultaneous move game leads to outcomes that are intermediate to those arising in these two kinds of sequential games as judged by the objective function of each player. The reason is that now there is a first-mover advantage in that the leader can evaluate whether any potential improvement in the allocation resulting from the provision of funds is large enough to warrant spending these resources. Possible extensions include generalisations to more than two goods and to more general objective functions.

Whether these changes will affect my current conclusion that donors that are able or willing to bring sufficiently large funds to the game with recipient country governments might buy considerable influence over the final allocations in these countries remains to be seen.

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