

Stopping Spillovers or Seizing Strategic Advantage?

Industrialized Country Interactions in Allocating Resources to the
Developing World

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Abstract

What drives observed complementarity in the bilateral foreign aid allocations of industrialized countries to the developing world? In this formal analysis I develop three game theoretical models that capture primary motivations argued in the foreign aid literature to incentivize allocation of resources to poor countries: (1) self-interested development (targeted development), (2) aid-for-policy exchange, and (3) a mix of 1 and 2. I show that complementarity is consistent neither with 1 nor 2. Rather, complementarity arises in equilibrium in model 3, when industrialized countries have both development and non-development interests. The features of this equilibrium are suboptimal with respect to industrialized countries' payoffs and total development produced in poor countries.

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1 Introduction

As former President of the United States, Bill Clinton, once observed, “[w]e advance our interests at home by advancing the common good around the world.”¹ Former Prime Minister of the United Kingdom, David Cameron, similarly noted some sixteen years later: “If we don’t [build a more prosperous world], the problems of conflict, the problems of mass migration, the problems of uncontrolled climate change are problems that will come and visit us at home.”² These statements highlight growing awareness among the leaders of advanced industrialized powers that international development furthers their own countries’ national interest. More than cheap talk, prioritization of development is reflected in large- n analyses of the pattern of bilateral foreign aid giving by major industrialized countries (Bermeo 2017; Bermeo 2018).

However, not all evidence points in the direction of prioritization of self-interested development. Studies that focus on the spatial correlation in bilateral foreign aid giving by wealthy states find something rather anomalous: in practice wealthy states appear to respond to the purported development effort of peers as though they obtain some private, rival and excludable, benefit in exchange for allocating resources to the developing world. That is, these studies find complementarity in the aid giving of industrialized countries.

Complementarity is problematic for the argument that wealthy states have prioritized development in recent decades for the simple reason that development promotion should be subject to the problem of free-riding and underfunding. In other words, rather than observe complementarity, we should observe substitution if industrialized states primarily emphasize development production as the end of

¹US Department of State Archive: (https://1997-2001.state.gov/www/about_state/detroit.html)

²Remarks made in New York, NY at the United Nations High-Level Panel of Eminent Persons on the Post-2015 Development Agenda (25 September 2012).

foreign aid allocation. Yet, several studies uniformly find evidence of rivalry among bilateral foreign aid donors. Fuchs, Dreher, and Nunnenkamp (2014) find a positive link between the bilateral foreign aid allocation of individual states and the sum of aid effort by others. These authors contend that this correlation follows from private gains donors receive from their aid allocation. Davies and Klasen (2018) also detect complementarity, noting that this positive interaction is most pronounced with respect to aid “darlings”—recipients that receive more foreign aid from donors than would be expected given their needs. Others, such as Barthel et al. (2017) find evidence to suggest that bilateral donors use foreign aid to obtain rival access to export markets in recipient countries, which is manifestly a non-development goal. Further, recent work by Steinwand (2015) suggests that competitive impulses among donor countries have impeded recent efforts among OECD members to coordinate their bilateral aid allocations in agreements such as the 2005 Paris Declaration and the 2008 Accra Agenda for Action. Is crowding-in in the aid allocations of industrialized countries evidence against development interests among donors?

Damning as the above findings may be for the claim that donors have prioritized development goals vis-à-vis private non-development benefits, they do not on their own do irreparable harm to the theory that states follow a strategy of “targeted development,” as contended by Bermeo (2018). In fact, rival non-development benefits could not, on their own, account for complementarity as well. I argue that complementarity is, rather, a function of both development and non-development goals being at work *simultaneously*.

That donors may have an interest in mitigating security and economic threats rooted in underdevelopment while also pursuing non-development goals is certainly not an extreme view. Indeed, it seems quite plausible that industrialized states would utilize a foreign policy tool such as aid both to prevent or mitigate spillovers

of developing country problems while also using these resources to gain diplomatic influence and conduct aid-for-policy exchange (a la Bueno de Mesquita and Smith 2007; Bueno de Mesquita and Smith 2009; Bueno de Mesquita and Smith 2015). The novelty of my claim, therefore, is not that states may pursue both goals with the same policy instrument. Rather, my contribution lies in identifying the unique implication simultaneous pursuit of these goals has for how industrialized countries interact and respond to each other as they allocate resources to the developing world.

Using a relatively straightforward set of models that capture the public and private goods aspects of resource allocation to developing countries, I generate predictions for when and where substitution vis-à-vis complementarity will emerge in the aid allocations of wealthy states. I begin with two simple scenarios where I assume donors follow a “pure” policy—either targeted development or aid-for-policy exchange. I then consider how donors’ best responses will vary when they pursue “mixed” policy—some combination of development and policy exchange. Most surprisingly, I find that complementarity emerges neither in a world where states care only about development nor in a world where states pursue rival concessions. In the former, underprovision of resources and free-riding are likely equilibrium outcomes. In the latter, the semblance of substitutionality emerges as wealthier or more interested actors outbid rivals in obtaining a policy concession, thus crowding out their peers. Only when states care *both* about development *and* exchange does crowding-in occur.

This crowding-in equilibrium possesses a number of unique properties, all of which are suboptimal from the perspective of industrialized countries. Payoffs in equilibrium are Pareto deficient, and the overall level development production is lower despite more resources flowing into a developing country. This finding offers a unique account for why various empirical studies identify complementarity in donors’ aid allocations and suboptimality in the production of development in the face of aid fragmentation.

2 Modeling Resource Allocation to the Developing World: The Setup

In this section, I describe a series of cases that capture two distinct motivations argued to underlie bilateral resource allocations to the developing world. The first centers on targeted development interests of industrialized states. The second emphasizes non-development policy concessions given in exchange for aid. The third and final model combines 1 and 2. As it will be shown in the analysis that follows, cases 1 and 2 do not, on their own, lead to complementarity in equilibrium. Only in the third model, when development and non-development goals are combined, does complementarity arise in equilibrium. The models developed here are based loosely on those set up by Bermeo (2018), Bueno de Mesquita and Smith (2009), and Steinwand (2011). The interested reader is encouraged to explore these sources for further details.

2.1 Case 1: International Development

Assume a world with $i = (1, \dots, I)$ industrialized countries and $d = (1, \dots, D)$ developing countries. Each of these actors has an exogenously determined resource endowment, where R_i denotes resources endowed to industrialized states and R_d of developing states. Industrialized states choose a vector of resource allocations $a_i = (a_{id}, \dots, a_{iD})$ to be distributed across D developing countries. I characterize the i^{th} industrialized country's payoff as a Cobb-Douglas utility function, specified as

$$\begin{aligned}
 u_i &= \ln(R_i - A_i) + \sum_{d=1}^D \beta_{id} \ln(a_{id} + A_{jd}), \\
 \text{s.t. } R_i &\geq A_i = \sum_{d=1}^D a_{id}.
 \end{aligned} \tag{1}$$

i optimizes its utility subject to the constraint that total resource allocations, A_i , do not exceed i 's total resource endowment. In solving its constrained optimization problem, i will consider the following, captured in equation 1:

- β_{id} : i 's preference for promoting development in d , where $\beta \in [0, 1]$ captures the proportion of development in d that enhances i 's utility. If $\beta < 1$, then each 1 dollar increase in d 's development yields diminishing returns to scale.
- A_{jd} : The sum of giving by all actors other than i (where subscript j denotes the set of all industrialized countries other than i) to d , where the contributions of other industrialized countries add to the overall level of development produced in d . The additive nature of other-country contributions captures the public nature of development promotion, which is to say, development is a public good, nonrival and nonexcludable.
- R_i : i 's total resource endowment will determine the overall provision of resources to developing countries.
- $\ln(R_i - A_i)$: i obtains utility from consumption of a private numeraire good, which it purchases with $R_i - A_i$ remaining resources. The less i allocates toward development, the more i consumes of this private good.

2.2 Case 2: Aid-for-Policy Exchange

With the model of targeted development defined, I now turn toward a markedly different model that characterizes a world where industrialized countries receive a privately enjoyed and excludable non-development concession in exchange for allocating resources to a developing country. As before, assume a world with $i = (1, \dots, I)$ industrialized countries and $d = (1, \dots, D)$ developing countries. Each, again, is endowed with resources, R_i and R_d . i chooses a vector of $f_i = (f_{id}, \dots, f_{iD})$ resources to be given to

a developing country in exchange for some private policy concession. Let utility for the i^{th} industrialized state be given as

$$\begin{aligned} h_i &= \ln(R_i - F_i) + \sum_{d=1}^D \gamma_{id} M_{id}, \\ \text{s.t. } R_i &\geq F_i = \sum_{d=1}^D f_{id}. \end{aligned} \tag{2}$$

In the above, M_{id} denotes the value of some policy concession to i from d , where $M > 0$. M is assumed to vary between industrialized countries so that where one highly values the concession, another may obtain little utility from receiving it.

In the case of development, I made the implicit assumption that d was a passive actor (essentially a development production machine that requires only input of resources to facilitate consumption of the desired good). In the current setting, as aid-for-policy exchange entails an *exchange*, I introduce a utility optimization problem for the d^{th} developing country. d , in the below, chooses which among the I industrialized countries receives the desired concession M . Utility for d is given as

$$\begin{aligned} h_d &= \ln \left(R_d + \sum_{i=1}^I \gamma_{id} f_{id} \right) - C_d \sum_{i=1}^I \gamma_{id}, \\ \text{s.t. } \gamma &\in \{0, 1\} : \sum_{i=1}^I \gamma_{id} \in \{0, 1\}. \end{aligned} \tag{3}$$

The expression $\ln \left(R_d + \sum_{i=1}^I \gamma_{id} f_{id} \right)$ denotes d 's consumption of some private good, where consumption is a function of both d 's initial resource endowment and the addition of resources from at most one industrialized country. The value $\sum_{i=1}^I \gamma_{id} f_{id}$ denotes resources from at most one industrialized country to whom d grants a concession. The idea that only one industrialized country may receive a concession captures the excludability and rival nature of aid-for-policy exchange.

If a concession is provided, d incurs a cost C_d . d 's choice to provide a concession, and to whom this concession is given, is determined by the vector $\gamma_d = (\gamma_{id}, \dots, \gamma_{Id})$, where if $\gamma_{id} = 1$, d gives the concession to i , or else $\gamma_{id} = 0$ if d gives the concession to some other industrialized country or to no industrialized country.

In this strategic setting, the i^{th} industrialized country must consider:

- Its utility with M_{id} in hand relative to the value of keeping its resources so as to consume more of some private numeraire good.
- The value of this concession to its peers and its peers' resource endowments.
- The cost of providing this concession incurred by d .

The d^{th} developing country must consider:

- Its utility with additional resources in hand relative to the cost of providing a concession.
- Variability in offers made from industrialized countries.

2.3 Case 3: Development and Exchange Simultaneously

I turn now to the third and final case where industrialized countries care both about development production and aid-for-policy exchange. All actors are defined as before. Let utility for the i^{th} industrialized country be given as

$$\begin{aligned}
 v_i &= \ln(R_i - S_i) + \sum_{d=1}^D \beta_{id} \ln(a_{id} + A_{jd}) + \sum_{d=1}^D \gamma_{id} M_{id}, \\
 \text{s.t. } R_i &\geq S_i = \sum_{d=1}^D a_{id} + \sum_{d=1}^D \gamma_{id} f_{id}.
 \end{aligned} \tag{4}$$

Further, let the d^{th} developing country's utility be given as

$$\begin{aligned}
 v_d &= \ln \left(R_d + \sum_{i=1}^I \gamma_{id} f_{id} \right) + \beta_d \ln(A_d) - C_d \sum_{i=1}^I \gamma_{id}, \\
 \text{s.t. } \gamma &\in \{0, 1\} : \sum_{i=1}^I \gamma_{id} \in \{0, 1\}.
 \end{aligned} \tag{5}$$

In this blended game, i now benefits both from the public good of development production in d and also from the private benefit of obtaining a non-development policy concession from d . d , in turn, not only benefits from additional resources allocated toward private consumption (though with opportunity cost C_d), but also the production of development within its borders per input of development aid from the community of industrialized countries. This unique setting constitutes a dynamic issue space where industrialized countries simultaneously pursue rival policy exchange and nonrival development production.

3 Analysis

The preceding section laid out three cases that capture incentives of industrialized countries as they allocate resources to developing countries and incentives of developing countries in accepting these resources. In this section, I set out to solve for a set of equilibria of these games, with an emphasis on finding equilibria under particular contexts so as to generate findings that may shed light on outcomes of significance in light of observed behavior among real world industrialized countries. As the form of models 2 and 3 imply that these are extensive form games, the equilibria I identify for these are pure strategy subgame Nash equilibria.

Models 1, 2, and 3 allow for a variety of equilibria to emerge. Therefore I do not exhaustively pursue all equilibria of the games, but rather equilibria that I think offer

useful lessons in the current landscape of international development. I begin with case 1 and proceed in order to 2 and then to 3. To simplify the analysis, I solve for cases where there are two industrialized countries and a single developing country. Though unrealistic, the results from the analysis are provided without loss of generality and still have something to teach us about the broader multi-actor environment of international development.

3.1 Case 1: Development Production in Equilibrium

For a world with $i = (1, 2)$ industrialized countries and $d = 1$ developing country, let the i^{th} actor's utility be given as

$$u_i = \ln(R_i - a_{id}) + \beta_{id} \ln(a_{id} + a_{jd}), \quad (6)$$

where, recall, utility maximization is subject to $R_i \geq a_{id}$. i 's solution to its constrained optimization problem is found by finding the level of a_{id} such that the marginal utility of development in d is equal to the marginal utility of the numeraire good. That is, when

$$\begin{aligned} \frac{\partial u_i}{\partial a_{id}} &= 0 \\ \frac{\beta_{id}}{a_{id} + a_{jd}} - \frac{1}{R_i - a_{id}} &= 0 \end{aligned}$$

which produces the following first order conditions:

$$\frac{\beta_{id}}{a_{id} + a_{jd}} = \frac{1}{R_i - a_{id}}.$$

Solving for a_{id} from the above yields the following best response function for i :

$$a_{id} = \frac{\beta_{id}}{1 + \beta_{id}} R_i - \frac{1}{1 + \beta_{id}} a_{jd}. \quad (7)$$

As resource allocations are such that $a \in \mathbb{R}_{\geq 0}$, if the right-hand side of equation 7 is negative, $a_{id} = 0$.

From equation 7, some basic observations can be made:

1. i 's best response is to increase its allocation of development resources as its resource endowment grows.
2. i 's optimal resource allocation increases with the value it attaches to development in d (β_{id}).
3. i 's optimal response to an increase in resources from j is to reduce its own resources.
4. The rate at which i reduces its resource allocation in the face of j 's contribution declines as a function of its own development preference.

Observations 3 and 4 capture the unique interaction of, on the one hand, what are called “spillins” from the resource provision of other actors and, on the other hand, the influence of heterogeneous benefits across actors from the production of a public good. If i values development little, it is more apt to allow j 's resources to substitute for its own in promoting development in d . Conversely, if i highly values development in d , the rate at which j 's resources will substitute for its own diminishes. As I show below, this feature of the actors' best responses leads to equilibrium outcomes where the actor with lower preference for development will exploit the more interested actor's interest in promoting development by letting it take the lead in footing the bill. The less interested actor, in other words, may get a free ride from the other actor's efforts.

We may derive the equilibrium response for each of the industrialized countries by substituting j 's (the other of the two industrialized states) best response for a_{jd} in equation 7:

$$a_{id} = \frac{\beta_{id}}{1 + \beta_{id}} R_i - \frac{1}{1 + \beta_{id}} \left[\frac{\beta_{jd}}{1 + \beta_{jd}} R_j - \frac{1}{1 + \beta_{jd}} a_{id} \right].$$

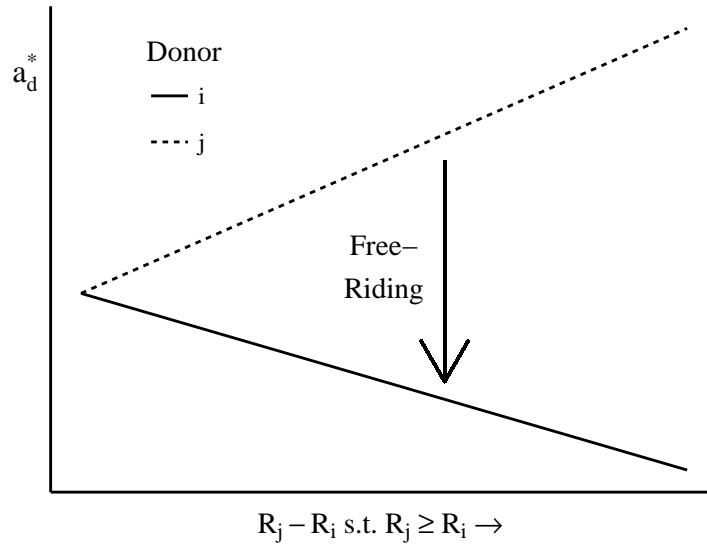


Figure 1: Free-riding in equilibrium as a function of total resource endowments.

Rearranging, we have the following equilibrium best response for i (and by symmetry, j):

$$a_{id}^* = \frac{\beta_{id}R_i(\beta_{jd} + 1) - \beta_{jd}R_j}{\beta_{id}\beta_{jd} + \beta_{jd} + \beta_{id}}. \quad (8)$$

Figure 1 shows variation in equilibrium levels of giving, holding equal i and j 's development preference with respect to d . Though it was noted above that variability in preferences between industrialized countries may result in free-riding, so too does free-riding emerge when one actor has more resources than another. The x-axis shows the size of the difference between j 's resource endowment and i 's, where j 's resources are made to be increasingly larger than i 's. As shown, when $R_j = R_i$, both actors contribute equally to the production of development in d ; though, both nevertheless give less than they would have absent giving by the other.

The equilibrium outcome changes, however, as j 's resource base increasingly exceed i 's. As R_j grows, j takes the lead in promoting development while i free-rides on j 's efforts. If R_j were allowed to increase beyond the range shown in Figure 1, we

would eventually observe a corner solution, that is, an equilibrium where j pays for all the development in d , while i contributes nothing.

As argued earlier, free-riding similarly occurs in equilibrium when one actor prefers development in d more so than another. This is shown in Figure 2. Holding $R_j = R_i$, Figure 2 depicts variation in equilibrium resource allocations of i and j over variation in the magnitude of development preference each industrialized country has with respect to d . The x-axis depicts variation in the difference between β_{jd} and β_{id} , ranging from values where $\beta_{jd} = \beta_{id}$ on to values where $\beta_{jd} > \beta_{id}$ with increasing magnitude. As with variability in resource endowments, when industrialized countries have equal preference for development in d , both contribute equally to development production. However, as the value of development to j grows relative to the value of development to i , in equilibrium j pays for a larger share of development while i gets away with allocating a smaller share. Assuming i valued development little, we would observe a corner solution where j alone pays for development in d and i receives a an entirely free ride.

To summarize the results from case 1:

- In a world where industrialized states care only about development, underprovision of resources and, potentially, free-riding constitute the Nash equilibria of the game.
- Whether, and the extent to which, free-riding occurs depends upon
 - (a) variation in resource endowments between industrialized countries, and
 - (b) variation in development preferences between industrialized countries.
- Actors with fewer total resources and/or actors that value development production little will free-ride on their more endowed and development-oriented peers.

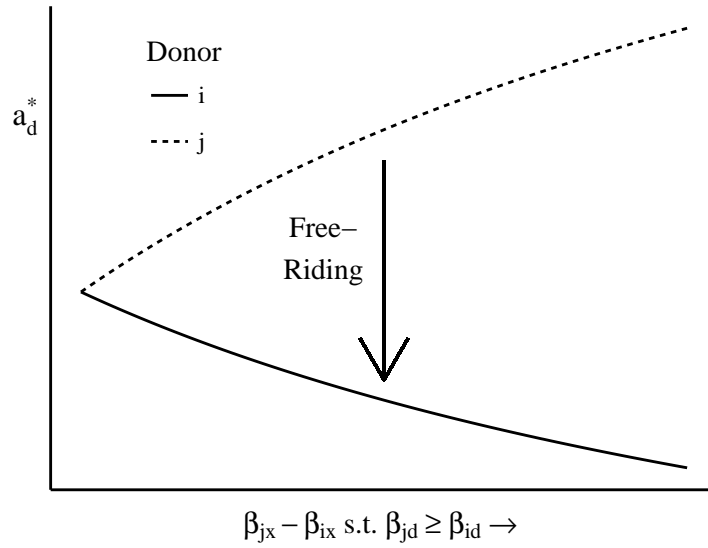


Figure 2: Free-riding in equilibrium as a function of asymmetrical development preferences.

3.2 Case 2: Aid-for-Policy Exchange in Equilibrium

In the preceding section I considered Nash equilibria that emerge as industrialized states pursue development in poor countries. Here, I consider pure strategy subgame Nash equilibria that emerge as industrialized states vie for rival policy concessions from a developing country.

As before, let the set of industrialized countries be $i = (1, 2)$ (denoted also as i and j for simplicity's sake) and let there be $d = 1$ developing country. Utility for i is given as

$$h_i = \ln(R_i - \gamma_{id}f_{id}) + \gamma_{id}M_{id}, \quad (9)$$

where $R_i \geq \gamma_{id}f_{id}$. Utility for d is given as

$$h_d = \ln(R_d + \gamma_{id}f_{id} + \gamma_{jd}f_{jd}) - C_d(\gamma_{id} + \gamma_{jd}), \quad (10)$$

where, recall, d chooses $\gamma \in \{0, 1\}$ such that $\gamma_{id} + \gamma_{jd} \in \{0, 1\}$.

For an exchange to be incentive compatible between an industrialized country and d , it must be the case that M_{id} exceeds the loss in consumption of the numeraire good. That is, the following condition must hold:

$$M_{id} > \ln(R_i) - \ln(R_i - \gamma_{id}f_{id}) \quad (11)$$

This inequality captures i 's opportunity cost for pursuing aid-for-policy exchange with d . i will not make d an offer f_{id} that violates the inequality in 11.

Aid-for-policy exchange is incentive compatible for d if i makes an offer such that the cost of providing a policy concession is less than the gain in utility from additional resources. This cost is characterized by Bueno de Mesquita and Smith (2009) as the cost of some leader providing a concession that violates the preferences of his/her selectorate and/or winning coalition. For d to be willing to accept i 's offer in exchange for providing a concession, the following condition must be met:

$$C_d < \ln(R_d + \gamma_{id}f_{id} + \gamma_{jd}f_{jd}) - \ln(R_d). \quad (12)$$

This inequality captures d 's opportunity cost for making an aid-for-policy exchange with an industrialized country.

The order of the game is simple, i and j make the first move as they simultaneously choose the size of the offer f each will make to d . d then chooses whether it will accept i 's offer, j 's offer, or neither. As the players move, I assume perfect information on the part of all actors. i and j are aware of the resource endowments of each other and of d , and i and j know the values of M_{id} , M_{jd} , and C_d . As each actor moves, it does so with full knowledge about the incentives and possible choices of the other actors.

We may imagine a variety of subgame equilibria that emerge from this game. Most obviously, one possible equilibrium outcome is that aid-for-policy exchange is not incentive compatible for any of the actors, that is, inequalities 11 and 12 cannot be met. In this case, neither i nor j makes d an offer, and d does not accept any offer. Such an equilibrium may arise because d 's cost for providing a particular concession is extremely high, or else it may arise because i and j value the concession little, or are equally matched in incentives and ability to obtain a concession but competition drives the price of receiving the concession beyond the bounds of affordable options.

A more interesting case is to consider equilibria that emerge when d is willing to conduct an exchange, and i and j neither are equally matched in terms of resources, nor do they weight the concession equally. In such a scenario, there exists a pure strategy subgame Nash equilibrium where an offer is made by either i or j and d provides the concession to the state that makes it the offer.

Consider, first, the case where $R_i > R_j$ but $M_{id} = M_{jd}$. Here, i has more available resources than j , but both equally value a rival policy concession from d . Figure 3 shows how utilities for i , j , and d vary with the size of the offers the industrialized countries make to d . Solid lines denote utility without exchange, dashed lines with exchange. Blue is utility for i , red for j , and black for d . Consider, first, utilities for d . At lower values of f offered to d in exchange for a policy concession, d 's utility is less than it would be if it refused the offer. Thus, for all values of f below this threshold, d will reject all offers made. Beyond this threshold, d will accept an offer from whichever industrialized country can make it better off. As d 's utility is monotonically increasing with f , it will always prefer to accept the offer greater than all other offers.

The question of whether i or j will win the contest for the rival concession from d is answered by considering each actor's payoffs with a deal relative to no deal over possible

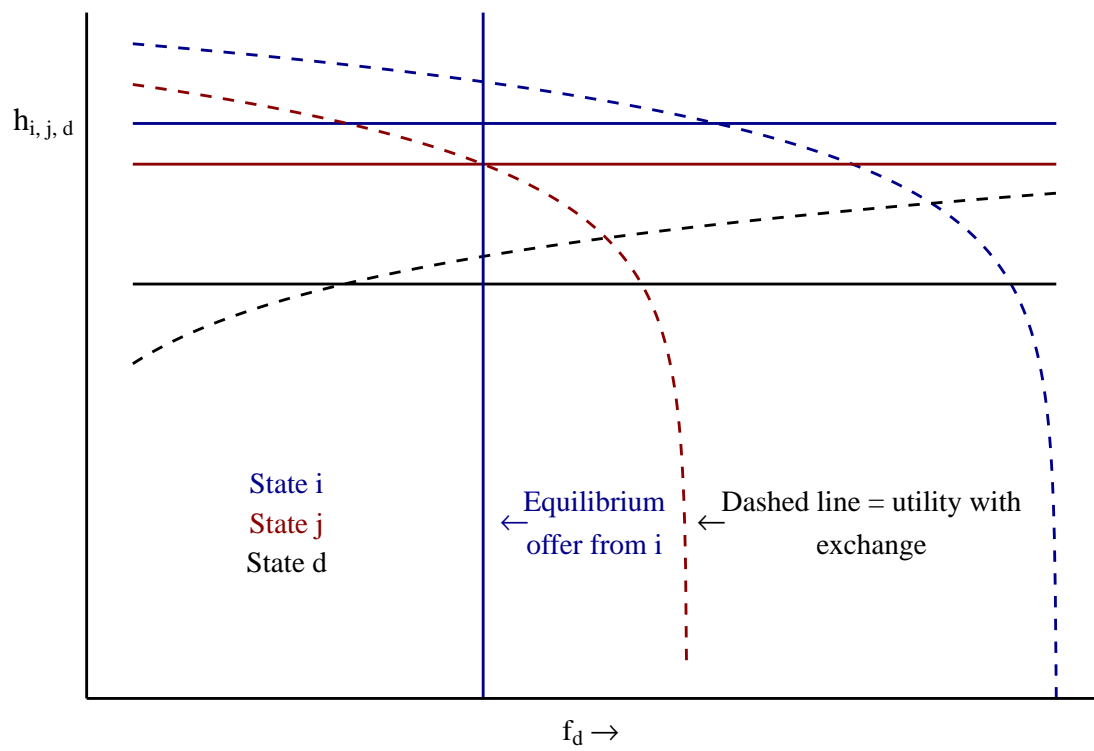


Figure 3: Competition for aid-for-policy exchange between industrialized countries.

resource allocations, f_d . For lower values of f_d , i and j 's incentive compatibility is met. However, as utility is decreasing with f_d , eventually each industrialized state faces a threshold beyond which making an offer and receiving a concession leaves it worse off than if it did not make an offer. As shown in Figure 3, j reaches this threshold before i . This occurs because of the disparity in resource endowments between industrialized countries. i can make an offer of f_d that is still incentive compatible beyond what j can offer.

In equilibrium, i makes an offer f_{id} such that if j were to match this offer, inequality 11 would not obtain, that is, an offer such that

$$M_{jd} = \ln(R_j) - \ln(R_j - \gamma_{jd}f_{jd}).$$

This is the Nash equilibrium that arises, as any lower value of f_{id} might be countered by a better offer from j .

The unique feature of this equilibrium is that the actor that is able to secure a concession from d pays more for this concession than would otherwise be required. Competition among multiple actors for the same rival and excludable concession raises the minimum price for obtaining the concession. In a version of the game where only a single industrialized country and developing country interact, the former would be able to obtain the concession at lower cost by just satisfying the latter's compatibility constraint. Therefore, from the perspective of the developing country, the game where multiple states vie for a concession is utility enhancing as it increases the equilibrium offer made in exchange for a concession.

Consider, now, a scenario where $R_i = R_j$, but $M_{id} > M_{jd}$. Figure 4 shows how utilities for i , j , and d vary with the size of the offers the industrialized countries make to d . As with Figure 3, solid lines denote utility without exchange, dashed lines with

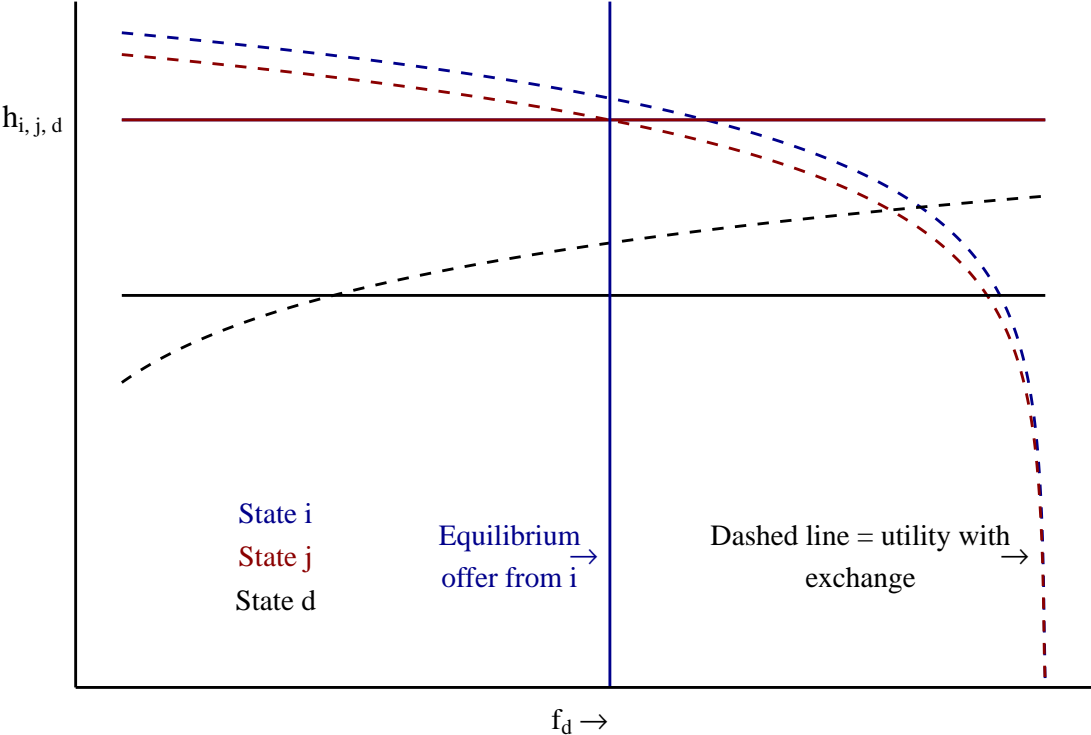


Figure 4: Competition for aid-for-policy exchange between industrialized countries.

exchange. Blue is utility for i , red for j , and black for d .

In this alternative scenario, i again receives the concession in equilibrium; though, as before, i pays more for the concession than it would have absent interest in the concession on the part of j . i can do no better than to make an offer such that if j matched it, $M_{jd} = \ln(R_j) - \ln(R_j - \gamma_{jd}f_{jd})$. Like the previous scenario, then, i is worse off than if it did not have to compete with j , while d is made better off by the presence of competition among industrialized countries as this raises the equilibrium offer made in exchange for a policy concession.

To summarize, in a scenario where there is competition for a rival policy concession among industrialized countries:

- There exists a pure strategy subgame Nash equilibrium where the wealthiest industrialized country is able to obtain the desired concession.
- There is also a pure strategy subgame Nash equilibrium where the industrialized country most interested in receiving a given concession obtains this concession.
- However, in both cases, the winner in the contest for this concession pays more in equilibrium than it would otherwise need to pay.

3.3 Case 3: Development and Exchange in Equilibrium

The games in the preceding sections offer many lessons, but perhaps the most valuable is that in neither game is there a scenario that aligns with complementarity in the bilateral foreign aid allocations of industrialized countries. Whether states pursue development, as contended by Bermeo (2018) and others, or aid-for-policy exchange as contended by Bueno de Mesquita and Smith (2009), states do not crowd-in resources in equilibrium. In the former case, free-riding and underprovision of development resources is a likely outcome. In the latter, competition drives up the price for

an incentive compatible exchange, but this exchange is only made between the industrialized country that is able to outbid its peers and the developing country with which it interacts. One state obtains the good, and only this state pays for it while all others pay nothing as they are crowded out either by the superior endowment or stronger preference for the concession possessed by the winner. As I demonstrate in this section, things change when development and non-development interests are blended in a single model. In this version, there exists a set of pure strategy subgame Nash equilibria where both industrialized countries give more total resources than they would otherwise. Unfortunately, as I further will show, this equilibrium has the undesirable property of Pareto deficiency.

Let utility for $i = (1, 2)$ industrialized countries be given as

$$v_i = \ln(R_i - \gamma_{id}f_{id} - a_{id}) + \beta_{id} \ln(a_{id} + a_{jd}) + \gamma_{id}M_{id}. \quad (13)$$

Let utility for $d = 1$ developing country be given as

$$v_d = \ln(R_d + \gamma_{id}f_{id} + \gamma_{jd}f_{jd}) + \beta_d \ln(a_{id} + a_{jd}) - C_d(\gamma_{id} + \gamma_{jd}). \quad (14)$$

In this game, i must compare its utility with a concession, but with reduced resources left over for promoting development against the utility of obtaining no concession. d similarly compares its utility with and without making an exchange with i .

An aid-for-policy deal is incentive compatible to i if

$$\begin{aligned} M_{id} &> \{\ln(R_i - a_{id}^*) - \ln(R_i - a'_{id} - \gamma_{id}f_{id})\} \\ &+ \left\{ \beta_{id} [\ln(a_{id}^* + a'_{jd}) - \ln(a'_{id} + a_{jd}^*)] \right\}. \end{aligned} \quad (15)$$

In the above, a_{id}^* denotes i 's equilibrium allocation of development resources in the

face of j 's equilibrium offer a'_{jd} if j makes a policy exchange with d . a'_{id} denotes i 's equilibrium allocation of development resources if it makes a policy exchange with d and j therefore allocates a^*_{jd} in equilibrium. The first bracketed expression in 15 captures the change in i 's consumption of the numeraire as it offers a larger payment to d in exchange for M_{id} . The second bracketed expression captures the change in development production given the new equilibrium development provision of i and j if i obtains the desired concession.

Aid-for-policy exchange is incentive compatible to d under the condition that

$$C_d < \{\ln(R_d + \gamma_{id}f_{id} + \gamma_{jd}f_{jd}) - \ln(R_d)\} + \left\{ \beta_d [\ln(\gamma_{jd}(a^*_{id} + a'_{jd}) + \gamma_{id}(a^*_{jd} + a'_{jd})) - \ln(a''_{id} + a''_{jd})] \right\}. \quad (16)$$

a''_{id} and a''_{jd} in the above denote equilibrium giving if d is unwilling to make an aid-for-policy exchange with either i or j .

This new game allows for a variety of equilibria to emerge. Depending upon the interests of actors, outcomes similar to those that obtain in cases 1 and 2 are certainly possible. Rather than consider all outcomes, I narrow the scope of my analysis to a subset of equilibria that, for the purpose of illuminating the phenomenon of crowding-in of resources by industrialized countries, are most insightful. In particular, consider a scenario where $R_i > R_j$ and $\beta_{id} = \beta_{jd} > \beta_d$. Figure 5 shows utilities for i , j , and d over possible values of f given to d in exchange for a policy concession. I assume that $M_{id} = M_{jd}$. Dashed lines denote utility if no deal is made for a given actor, solid lines if a deal is made. Utilities are color coded by actor, where d is given three shades denoting whether d strikes a deal with i , with j , or neither. Given these conditions, an equilibrium exists such that d makes an aid-for-policy exchange with i . The equilibrium offer made by i is denoted in the figure.

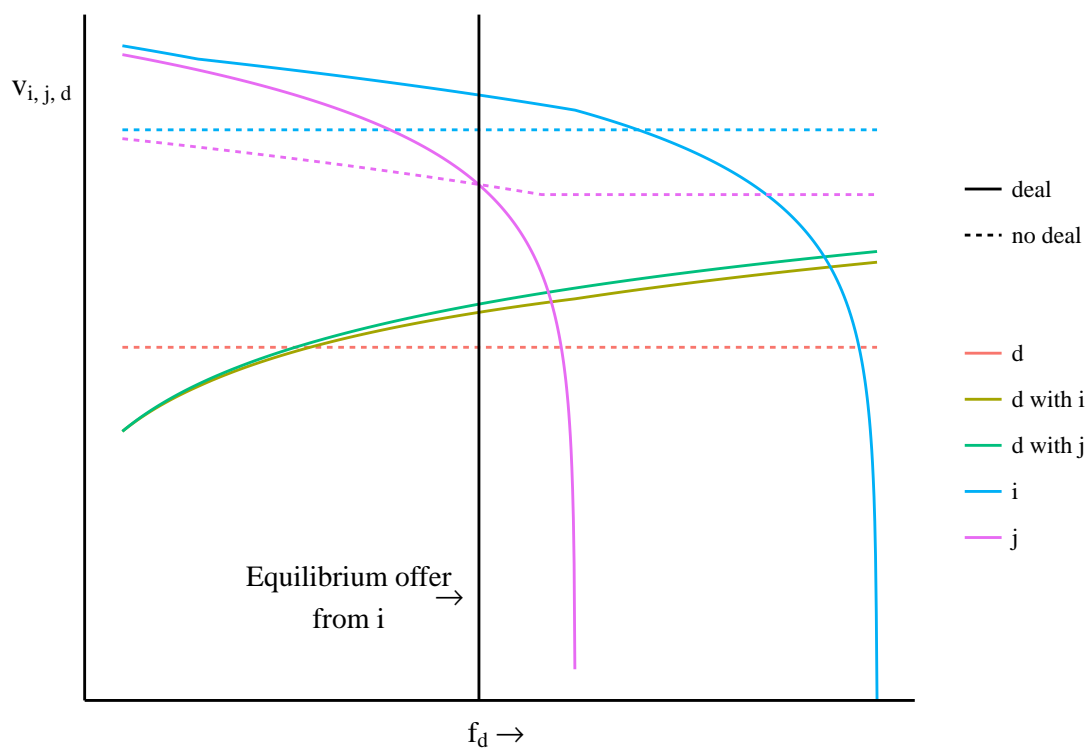


Figure 5: Aid-for-policy exchange in the face of development interests among actors.

This equilibrium, on the surface, appears quite similar to the one discussed in case 2. However, in this new game where states care both about development and aid-for-policy deals, the features of this equilibrium are quite different. Among the more interesting characteristics is that, for any given value of f such that $f_{id} = f_{jd}$, d would do marginally better by accepting j 's offer over i 's. Yet, despite this, accepting an offer from j only occurs off the equilibrium path as i is able to outbid j such that aid-for-policy exchange is no longer incentive compatible for j .

What would drive d 's mild preference for exchange with j ? As development now is allowed to contribute to d 's utility, d has more to gain if a wealthier donor takes responsibility for contributing development funds in lieu of allocating resources toward d 's consumption of private (non-development) goods. However, in the equilibrium discussed here, i , as the wealthier of the two industrialized countries, is able to outbid j and thereby obtain the desired concession from d . In doing so, i 's redirection of resources leaves it fewer available resources for development. i therefore contributes less to development production than it would otherwise. This leaves j to make up for the difference, which it willingly does as i 's reduced development funding leaves j worse off relative to its payoff for increasing funding. However, as j has a smaller resource base relative to i , it cannot fully compensate for the loss of development revenue. The result is that development production in d is less in equilibrium than it would be absent aid-for-policy exchange with i or if such an exchange could be made with j . Unfortunately, i 's greater resources allow it to make d an offer vis-à-vis j that d would be foolish to refuse.

The reason d would do marginally better if it made a deal with j rather than i highlights another unique (unfortunate) feature of the equilibrium described above. That is, that competition for aid-for-policy exchange leads to reduced levels of development in d . And, the downsides of this equilibrium do not end here.

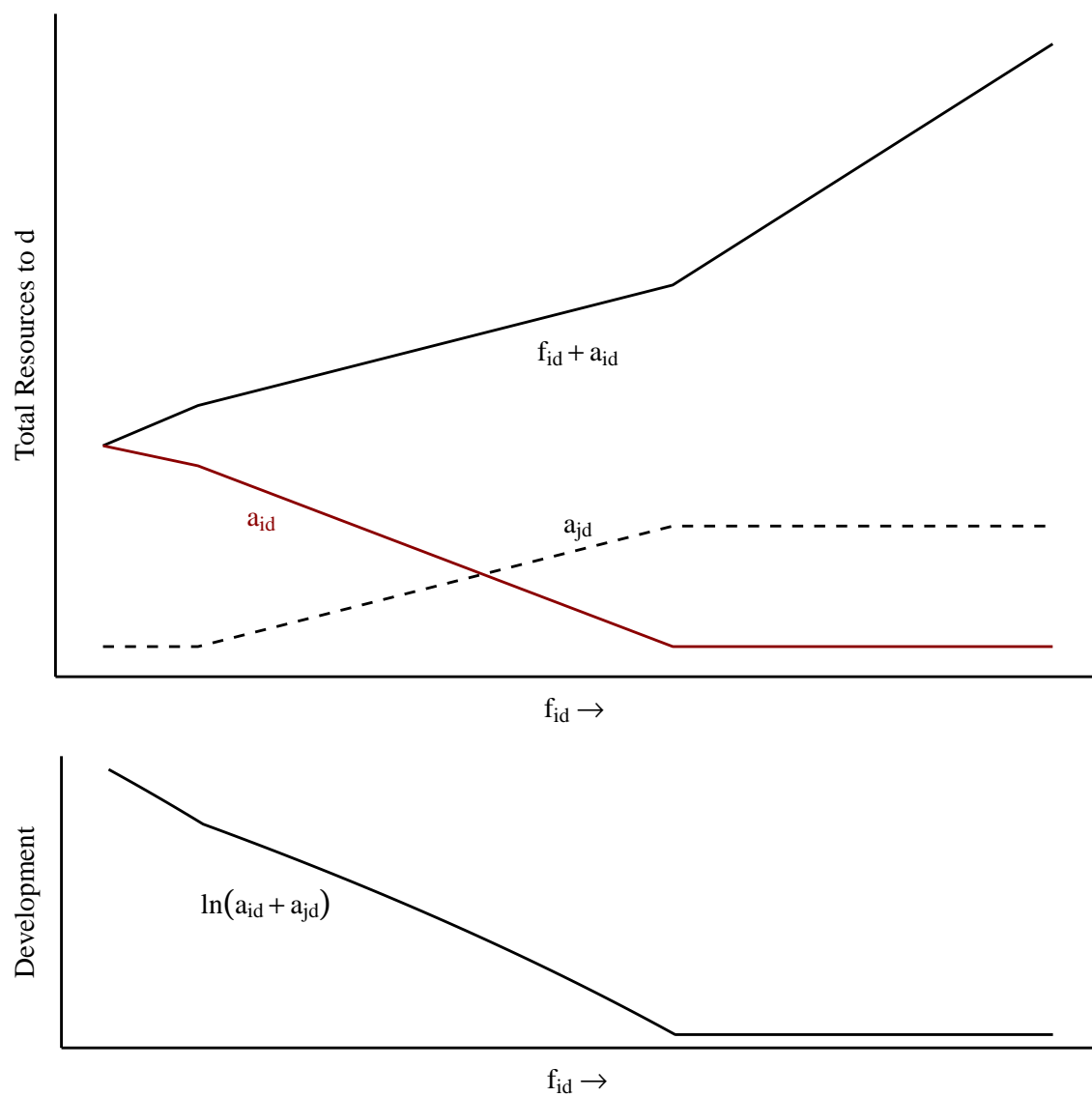


Figure 6: Competition for policy concessions comes at a high price, and results in lower total development.

Consider Figure 6. Along the x-axis is possible offers of f_{id} that i may offer d in exchange for a non-development concession. In the top panel of Figure 6, equilibrium giving by i and j is shown. In the bottom panel, development production in equilibrium is given. What immediately strikes the eye in Figure 6 is that as the offer i makes to d in exchange for M_{id} increases, i 's total resource allocation to d also increases, despite its development resource contribution declining as a share of total "aid" committed to d .

Further, at the same time that i gives more total resources to d (with an declining share of these resources in the form of a_{id}), j increases its provision of development resources to compensate for the reduction of a_{id} . However, as j has fewer resources than i , total development produced declines as j is forced to pay for a larger share of development in d .

The suboptimality of this equilibrium is manifold! Both i and j give more resources in equilibrium than they would otherwise, yet development is produced at a lower rate. Pareto improvements, at least from the perspective of i and j are possible, however. Most notably, both i and j could be made mutually better off if j would agree to forgo its interest in obtaining a policy concession from d . Doing so would allow i , who would win the contest for a rival concession from d in equilibrium anyway, to obtain the concession at lower cost. This would allow i to retain more resources which it then would be able to contribute toward development in d . The result would be utility enhancing for both i and j and would additionally lead to more total development produced in d . Such a deal, however, would be hard to strike as j would still face the temptation to defect and make an offer to d in exchange for a concession. Knowing that j would face this temptation, i would have difficulty in willingly making d an offer that j could counter.

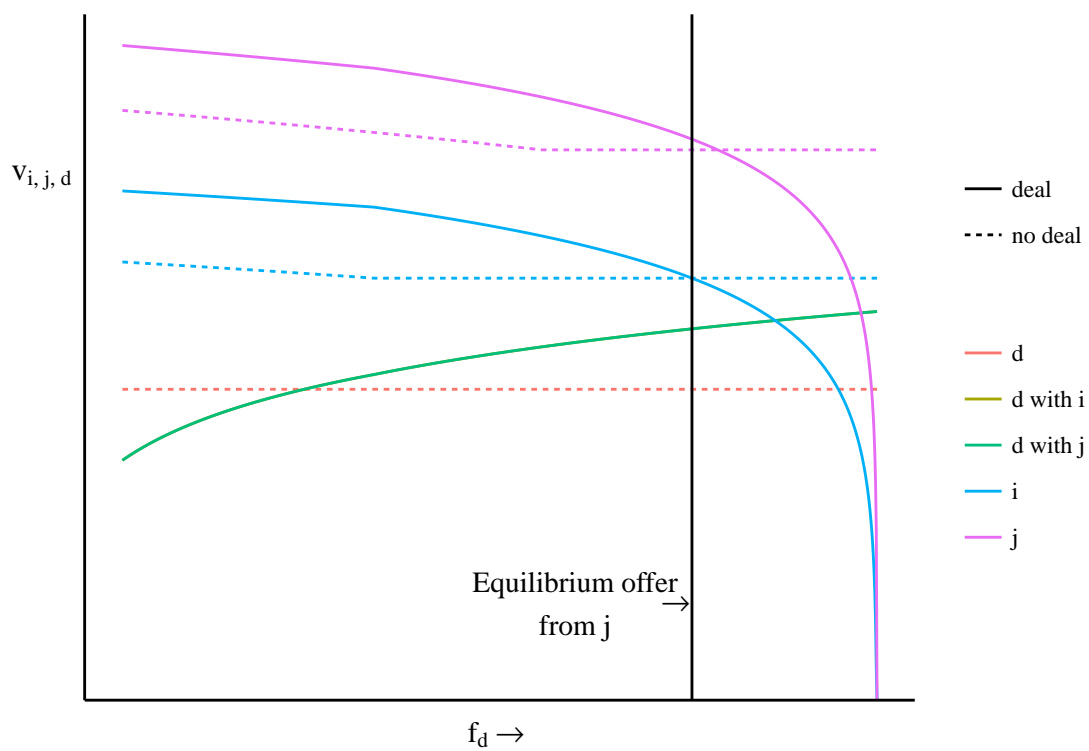


Figure 7: Aid-for-policy exchange in the face of heterogeneous development interests among actors.

Equilibria with similar characteristics emerge in two other cases as well: (1) when $\beta_{id} \neq \beta_{jd}$ and (2) when $M_{id} \neq M_{jd}$. Consider the first scenario. Holding all else equal, let j have a stronger preference than i for development in d ($\beta_{jd} > \beta_{id}$). Absent interest in aid-for-policy exchange, we would expect both industrialized countries to each give fewer resources, while j will nevertheless bear a larger proportion of the responsibility for funding development in d . i , as the less interested party, would free-ride on j . However, in a world where i and j compete for a concession from d in addition to promoting development, j , counterintuitively, is at an advantage in leveraging a deal with d . And, in fact, j will leverage this deal to the detriment of i and to total development produced in d .

Figure 7, similar to Figure 5, shows utilities for i , j , and d over possible payments to d in exchange for M . In the setting where j 's development preference is stronger than i 's, j is able to outbid i . In equilibrium, j makes the offer denoted by the vertical line in Figure 7, and d gives j the concession. As this outcome obtains, i , the party *less* interested in promoting development, now foots the *majority* of the bill in producing it.

Figure 8 shows variation in total resource expenditures by i and j given the size of the payment made from j to d in exchange for a policy concession. As f_{jd} increases, total expenditures by both i and j increase. As in the previous example, this crowding-in effect occurs because, even while j gives more total resources to d , the amount of resources j contributes to development declines as j funnels more funds toward making an incentive compatible exchange with d . As i gets no benefit from the exchange made between j and d , its main source of utility with respect to d entirely derives from d 's level of development. Since j now funds development at a lower rate, i must now take the lead in promoting it. However, because i 's development preference is lower than j 's, the total rate at which i funds development in equilibrium is lower

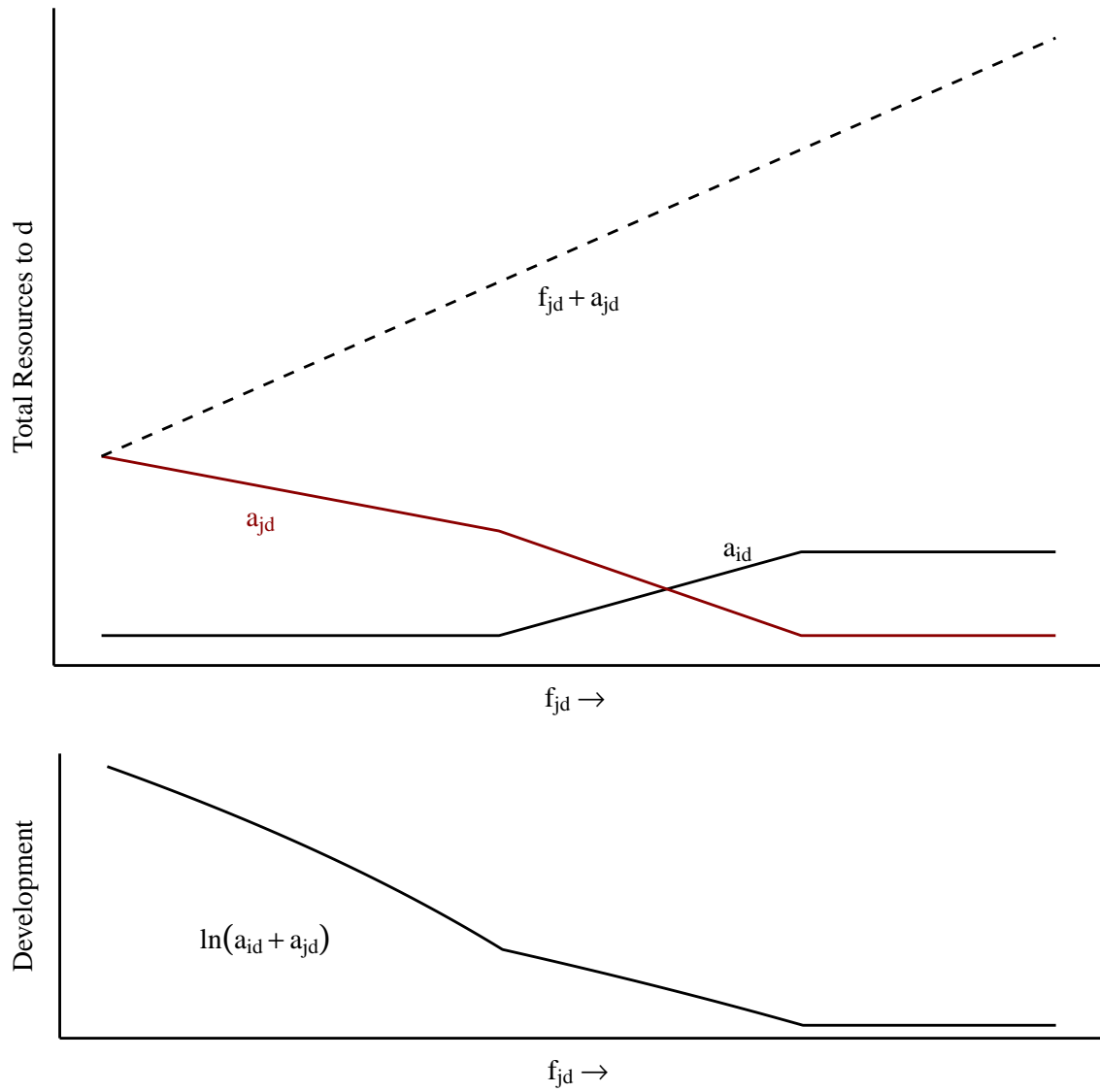


Figure 8: Consequences of competition. The donor with higher development preference gets the concession, but at the cost of total development production.

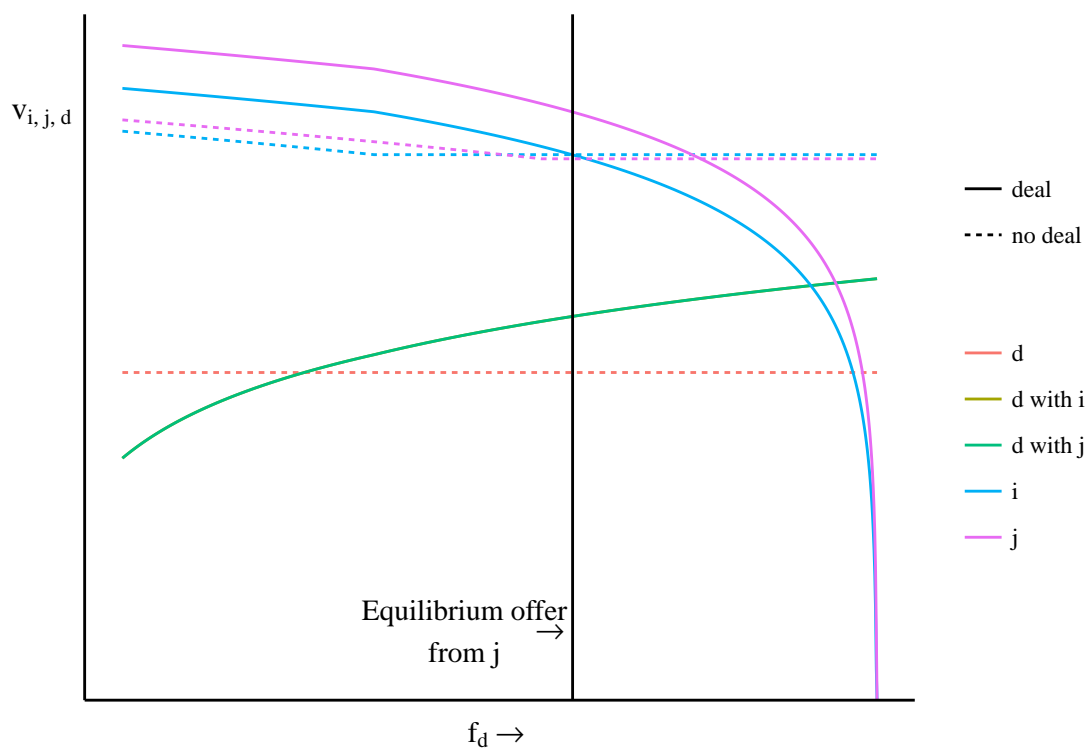


Figure 9: Aid-for-policy exchange in the face of heterogeneous preferences for a non-development policy concession.

than j 's would have been had it not made an exchange with d . Again, competition drives up the value of the equilibrium offer made to d , which comes at the cost of total development produced.

Figures 9 and 10 demonstrate the results from a final example where $M_{jd} > M_{id}$. In this world, j again is able to win the concession, but, as before, the rival and excludable nature of this concession drives up j 's equilibrium offer for this concession as it is driven to outbid any potential offers made by i . Further, as j makes the offer, it funds development in d at a lower rate. i now takes the lead in promoting development, but total development produced declines.

In sum:

- Simultaneous interest in development and exchange leads to a crowding-in effect in resource allocation to developing countries.
- Though more resources flow into the developing country, development is produced at a suboptimal rate.
- Moreover, the crowding-in equilibrium is Pareto inefficient for i and j . Both could be made better off if the industrialized country that would lose in a contest for a concession would concede the concession to the one that would win. In such a scenario, the winner could pay for the concession at lower cost giving it more available resources to contribute toward development. This would leave the remaining industrialized country better off as it would be able to pay less for development.
- Cooperation, in addition to leading to Pareto improvements, would also yield greater total development in d .
- Unfortunately, cooperation is difficult as unilateral defection offers a better payoff than mutual cooperation for the actor that concedes the policy concession.

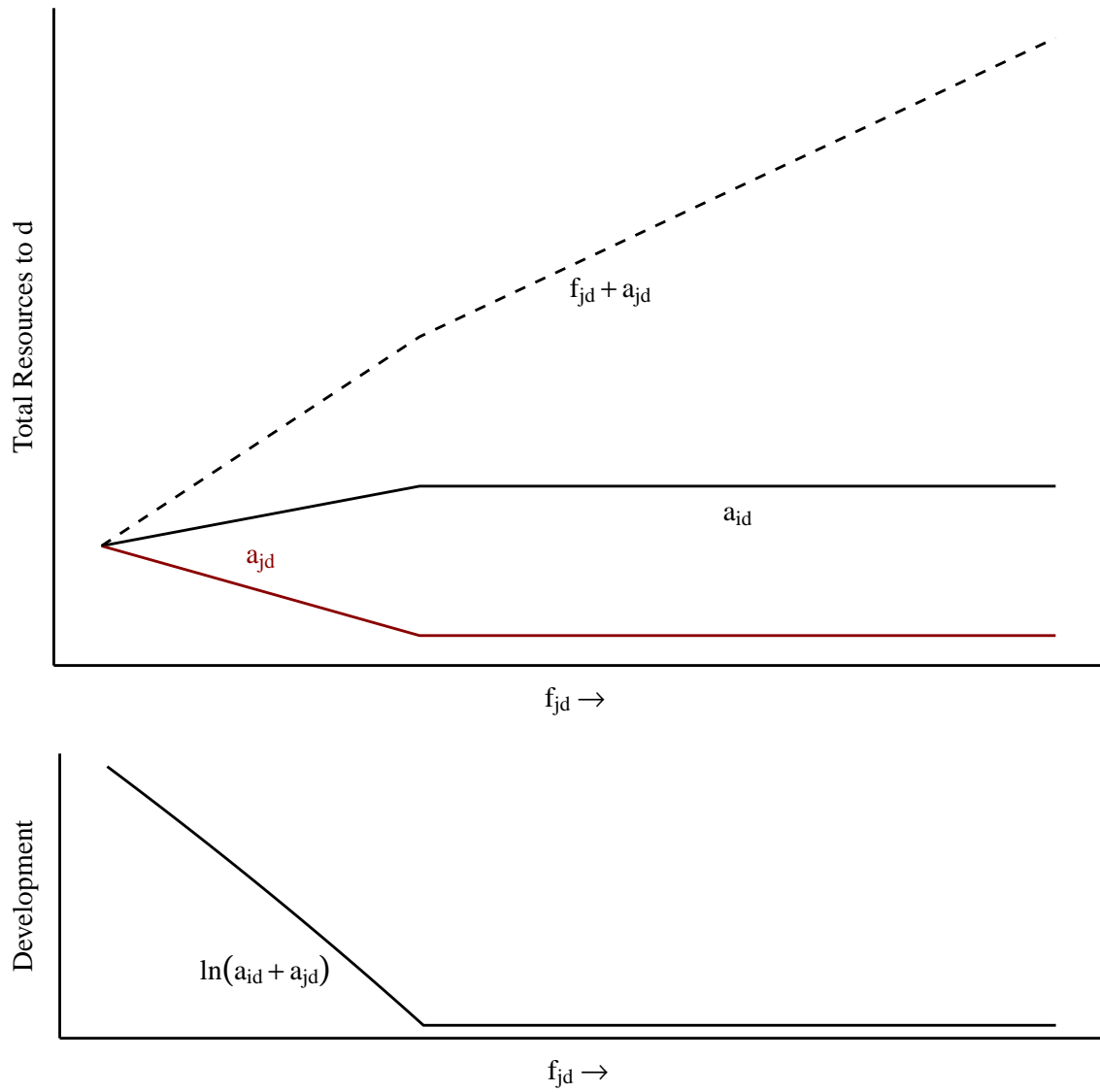


Figure 10: Consequences of competition. The donor with higher development preference gets the concession, but at the cost of total development production.

4 Discussion and Conclusion

Despite the public goods qualities of international development, numerous studies find complementarity in the bilateral foreign aid contributions of wealthy countries. This finding runs counter expected behavior if states pursue a policy of targeted development, as Bermeo (2018) contends industrialized countries increasingly do. Contrary to this view, accounts of crowding-in center on the existence of private, rival goals among foreign aid donors (Fuchs, Dreher, and Nunnenkamp 2014; Barthel et al. 2017; Steinwand 2015). Rather than care about development, it is argued that industrialized countries care primarily about political and economic goals when allocating resources to developing countries (e.g., Bueno de Mesquita and Smith 2007; Bueno de Mesquita and Smith 2009; Bueno de Mesquita and Smith 2015). The rival and excludable nature of these goals, it is suggested, drive crowding-in effects. Contrary to this view, I demonstrate that, while the presence of crowding-in rightly runs counter to development prioritization by industrialized countries, pure interest in generating rival goods in exchange for foreign aid also fails to explain crowding-in.

I show that complementarity arises only in the presence of *simultaneous* public and private gains from contributing resources to developing countries. In a world where industrialized states only care about development, free-riding and underprovision of development funds arises as a Nash equilibrium. And, though qualitatively different than free-riding, substitution also occurs in a world where industrialized states care only about obtaining rival aid-for-policy deals. This occurs due to the rival and excludable nature of such deals. Where one actor pays for and receives the concession, others will neither pay for, nor obtain, this benefit as the actor that wins the concession does so by outbidding its peers. It is only in the world where industrialized states receive both the public benefit of development and the private benefit of rival concessions that

complementarity obtains. Where one actor outbids peers to obtain a rival concession, the remaining actors are left to fund development at a higher rate due to reduced development provision from the actor paying for and receiving a non-development concession. This occurs due to redirection of funds toward making a side payment in exchange for the concession that would have otherwise gone toward promoting development.

The features of this complementarity are not good news if one considers the normative implications for international development. I find that the wealthiest industrialized states, the ones most interested in promoting development, and those most interested in obtaining concessions essentially free-ride on the development efforts of their less endowed and less interested peers. By allowing others to pay for a larger share of development, the state that is able to obtain the desired policy concession contributes a larger share of its resources toward the exchange than toward development. This results in the perverse outcome that while more total resources flow into developing countries, less overall development is produced as those left to fund development are either less equipped or less interested in promoting it.

In highlighting the suboptimality of resource provision to developing countries, these findings, in part, offer an answer to why phenomena such as aid fragmentation (the presence of multiple donors in a single recipient with no clear leader) is associated with inefficient development outcomes. It is not that multiple sources of aid is inefficient per se; it is that multiple sources of aid where some is given for political reasons and only some for development is inefficient.

The implications of this analysis are not all bad, however. Industrialized countries could cooperate to achieve Pareto improvements. The actor best positioned to win a bidding war among foreign aid donors could be allowed to obtain a concession from a

developing country at lower cost. For this to happen, those who would not otherwise be able to win such a contest could agree to abstain from making offers. This would allow the actor receiving the concession to pay less for it, allowing it to contribute more resources toward development, thus mitigating suboptimal development production. Such an outcome, though, requires credible commitments on the part of all actors. We may imagine that large number of bilateral foreign aid donors, unfortunately, precludes easy cooperation.

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