Strategic Multilateralism: International Development Cooperation and the World Bank

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Abstract

Multilateral development institutions ideally allow states to overcome collective action problems in the realm of international development by filling in the gaps left behind by bilateral foreign aid allocation by industrialized countries. Yet, these same organizations depend on donations to generate much of their revenue, which forces the multilateral to kowtow to the interests of its most prominent contributors. Rather than contradictory, these behaviors coexist in a delicate balance struck by multilateral development institutions. This paper begins by developing a formal model that captures this complex optimization problem. A new statistical estimator (Decision Autoregressive Model, or DAM) is then constructed on the basis of the formal model. Estimates for DAM parameters are generated using IDA and IBRD aid disbursement data from the World Bank from 2008 to 2012. Results are consistent with optimal behavior for a multilateral development institution, suggesting the World Bank simultaneously follows the development interests of donors in proportion to their contributions, while also targeting resources where donors' preferences lead them to underfund

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development.

1 Introduction

In the wake of World War II, U.S. Treasury Secretary, Henry Morgenthau, drew what he saw as an incontestable causal link between the economic tragedy, and attendant currency disorders, of the preceding decade and the outbreak of war in Europe and the Pacific. As he remarked, " '[w]e saw bewilderment and bitterness become the breeders of fascism, and, finally, of war' " (qtd. in Mallaby 2004, 14). Many of Morgenthau's contemporaries held this view as well, setting in motion events that would result in the creation of an International Bank for Reconstruction and Development (IBRD), the first of many organizational branches of what would become the World Bank. At its inception, the Bank had a simple mandate: to ensure continued peace and security post-war by promoting reconstruction and economic development. Initially, the IBRD's focus lay squarely on Europe, but its efforts would later shift toward the impoverished countries of the world, as the logic of the security-poverty nexus naturally applied to developing, not only developed, countries.

From time to time, new tragedies replenish interest in promoting development when and where its consequences pose the gravest threat to the "fortunate fifth" of the world who possess four-fifths of the global income (Mallaby 2004). Such events remind the industrialized countries of the world that "[t]here is no wall," in the words of former World Bank president, Jim Wolfensohn. The developed and developing worlds " 'are linked by trade, investment, finance, by travel and communications, by disease, by crime, by migration, by environmental degradation, by drugs, by financial crises and by terror' " (Wolfensohn qtd. in Mallaby 2004, 13). In the face of such problems, global leaders turn, near habitually, to the World Bank. But why the Bank? Scores of

industrialized countries have bilateral aid agencies of their own, allowing them to act unilaterally in addressing development when and where it impends trouble. In fact, most countries created their respective aid agencies *after* the creation of the Bank. What role does a multilateral development institution play in international politics? What does it allow industrialized states to accomplish that they cannot do on their own? How does it go about accomplishing this goal?

This paper centers on where and when a multilateral development institution offers (or would ideally provide) Pareto improvements to states facing the collective action problem of international development. I contend that an organization such as the World Bank is ideally suited to promoting development where the bilateral actions of individual industrialized countries fall short due to the pernicious and perennial problem of free-riding. At the same time, I argue that a development institution must additionally follow the interests of its largest members, as failure to do so would leave the organization short of much needed revenue required to implement its goal of promoting development where it is most underfunded.

This paper proceeds as follows. The below section identifies, on the basis of existing theory and empirical evidence, the ideal role a multilateral development institution should play. In a subsequent section, I develop a formal model that takes its cues from existing theory. This model identifies how a multilateral development agency should optimally distribute its resources across developing countries so as to assuage the collective action problem of international development while simultaneously appealing to the interests of bilateral donors to garner resources. I then create a new statistical estimator that follows directly from the theoretical model to assess whether a major multilateral aid agency, the World Bank, behaves as the theoretical model suggests it optimally should. I find that, indeed, the Bank acts in accordance with theory. While the Bank kowtows to the interests of its most prominent members, it

balances this behavior with efforts to fill in the gaps left behind by industrialized countries as they individually distribute their own resources toward development. The result is that the Bank simultaneously follows the bilateral allocations of developed countries, giving greatest weight to the largest donors, while also supplementing these countries' contributions where and when their allocations fall short.

2 Background and Motivation

This paper speaks to a long tradition in the international relations (IR) literature that seeks to understand the role of multilateral institutions in international politics. While some dismiss institutions as epiphenomenal to the ex ante interests of states (Gilpin 1981; Grieco 1988; Mearsheimer 1994–1995), others contend that institutions help states overcome collective action problems absent an international sovereign or even a powerful hegemon to cajole actors into compliance with international norms, rules, and agreements (Keohane 1984; Krasner 1991). In the latter view, international institutions serve as instruments through which self-interested states maximize their utility (Krasner 1982; Oye 1986; Fearon 1998; Clegg 2013)

What utility does (or should) a multilateral development institution like the World Bank provide? Put differently, what is the collective action problem the Bank helps to resolve? At the Bank's founding at the Bretton Woods Conference in 1944, delegates recognized a clear link between economic tragedy and political instability (Mallaby 2004). It was hoped that the Bank, along with its "twin," the International Monetary Fund (IMF), would ensure enduring peace and stability for the international community post-World War II by addressing the perceived root causes of instability, discontent, and conflict: poverty (the purview of the Bank) and currency disorders (the intended role of the IMF). Poverty and underdevelopment remain relevant, if not

more so, today.

Not long after the turn of the century, the September 11, 2001 terrorist attacks on American soil served as a grim reminder to advanced industrialized countries that problems in the developing world portend trouble beyond developing countries' borders. Leaders of major powers continue to see the value of addressing underdevelopment abroad to enhance security and well-being at home.

However, just as threats rooted in underdevelopment know no boundaries, the benefits of development promotion are not restricted to those that fund its production. The international community as a whole stands to gain from improved quality of life, economic stability, and growth in impoverished countries, making its provision a clear public good.

Since the seminal work of Olson (1965), the collective action problems associated with public goods have been well recognized. The production of a public good has properties similar to a multi-party Prisoners' Dilemma. While all actors would be mutually better off if they cooperate to produce the public good, each would be individually better off by unilaterally defecting and getting a free ride from others' efforts. At the same time, being left to solely produce the public good while others free-ride is worse than if the good was collectively produced. The result is that all actors collectively underfund the public good as this ensures that, in the best case scenario, one gets the public good without paying for it, in the worst case scenario, one avoids being the sucker who alone bears the cost of producing the public good.

In the context of international development, while industrialized countries would be mutually better off collectively funding development in poor countries, each actor could be made individually better off by letting others take the lead in footing the bill. As no country wants the sucker's payoff from being the sole (or largest) contributor of

development resources while everyone else gets a free ride, the dominant strategy is to underfund development. In anarchy, collectively agreeing to provide development funds at some pre-determined rate poses obvious challenges, and despite the iterated nature of this strategic setting (states have been distributing aid for decades and likely will continue to do so for years to come), the sheer number of countries that benefit from international development precludes easy cooperation.

One solution to the collective action problem of international development is to rely on a multilateral development institution to contribute resources to substitute for underfunded bilateral aid allocation (Bermeo 2018a; Bermeo 2018b). Such an institution would be able to lock-in resource contributions, ensuring that development is produced at a Pareto optimal rate. However, before going into more detail about the optimal design and behavior of such an institution, it is important to highlight the heterogeneous benefits that accrue to industrialized countries as a function of when and where development is produced.

Development is not a homogeneous public good in the sense that development produced in country x offers the same benefit as that produced in country y. One industrialized country may value development between x and y differently than another industrialized country. One dollar of development in Mexico is valued more by the United States than by Japan, while France values one dollar of development in its former colony, Morocco, to a greater extent than does Canada. This implies that the free-rider problem is especially nuanced in the context of development.

The question of what to make of heterogeneity in donor preferences has served as a source of disagreement among development scholars as to the ideal role a development institution like the Bank might play in facilitating Pareto optimal outcomes. Early work contends that industrialized countries turn to multilateral aid agencies such

as the Bank to capitalize on these organizations' high quality of information and expertise (Rodrik 1995). Additionally, some argue that multilateral agencies have less politicized relationships with recipients (Milner 2006), while others suggest that multilateral agencies have greater concern for rule of law and quality of governance in recipients (Dollar and Levin 2006; Girod 2008), factors that may determine the efficiency of development output per input of development resources.

More recent arguments center on the Bank as a commitment device in the face of free-riding incentives among bilateral donors, particularly when and where they have *overlapping* development preferences. Bermeo (2018a) contends that where and when wealthy states have heterogeneous preferences, free-riding poses little challenge since industrialized countries will simply specialize in promoting development where they most value its production. Most advanced countries have aid agencies of their own, allowing them to distribute development resources directly to developing countries in accordance with their interests. If industrialized states have divergent preferences over where to prioritize development, they will prefer to rely on their own bilateral aid agencies than on a multilateral agency. Working through a multilateral institution would only incite conflict among industrialized states who disagree over where the multilateral agency should spend its development resources. If industrialized country i prefers development in x, while j prefers development in y, i and j will face a bargaining problem if they work through a multilateral institution to divvy development resources between x and y. In this view, little overlap in preferences makes *bilateral* action in development promotion the more attractive and efficient option relative to a multilateral solution.

The value of an organization such as the Bank, therefore, is not simply that it allows industrialized countries to overcome collective action problems in promoting international development in general. More specifically, the Bank offers states a

commitment device to overcome free-riding when and where wealthy states have *overlapping preferences for development*. If i and j care equally about development in x and y, neither industrialized country will specialize in promoting development in one or the other developing country, and both wealthy states may underfund development as both would prefer to rely on the other's resources as a substitute for their own. In this context, a multilateral aid agency could fill in the gaps produced by free-riding, allowing for Pareto improvements in i and j's utilities.

Additionally, a multilateral development institution provides benefits, even when donors have quasi-heterogeneous preferences. Say i and j have divergent preferences between x and y, while both gain little out of promoting development in a third developing country z. A multilateral institution could still provide Pareto improvements by specializing in promoting development in z while i promotes development in x and j promotes development in y.

In a more general sense, then, a multilateral aid agency's primary purpose should be to specialize in cases that go most underfunded by the bilateral aid agencies of industrialized countries. A basic maxim such as this leads to obvious improvements in utility for international actors as greater development will only enhance the welfare of industrialized countries. However, this design feature alone is insufficient.

Annen and Knack (2018) highlight that a multilateral aid agency must abide by the average preferences of its donors, as doing so makes delegation to the multilateral agency most useful to contributing members. Empirical evidence provided by Schneider and Tobin (2016) corroborates this view. The authors show that bilateral donors allocate greater resources to multilateral aid agencies that distribute aid in a manner most consistent with their own bilateral allocations. In seeming contradiction to the ideal role of a multilateral aid agency suggested above, a multilateral interested in

garnering maximal resources from bilateral donors must, to a certain extent, kowtow to their preferences, which suggests a pattern of giving nearly opposite to that proposed above.

Though contradictory on the surface, these views—*gap-filling*, on the one hand, and *kowtowing*, on the other—of optimal behavior for a multilateral agency need not be mutually exclusive. In fact, a multilateral organization that both specializes in contributing resources where a recipient is underfunded due to free-riding, and that tries to align its giving with the preferences of bilateral donors, is ideal. In the following section I consider a formalized model of a multilateral aid agency that spells out more explicitly how these seemingly contradictory strategies can coexist as a multilateral development institution optimizes its allocation of resources.

3 The Model

Consider a multilateral development institution, denoted ML, that must optimize the distribution of its budget, R. Let ML's budget be a function of the weight ML attaches to development, δ, in poor country i. $R = f\left[\delta_i - v\left(\cdot\right)\right]$ where $f(\cdot)$ is maximized when ML prioritizes development in i in accordance with the preferences of bilateral donors. The function $v(\cdot)$ is an aggregation function for the preferences of donors that is assumed to give greatest weight to bilateral donors that make the most sizable contributions to ML. This follows the logic discussed in the previous section that bilateral donors contribute the greatest funds to multilateral aid agencies when these agencies' patterns of aid giving most align with their preferences. R is maximized, therefore, when $\delta_i - v(\cdot) = 0$.

With R determined, ML faces the following constrained optimization problem:

$$\underset{r_i}{\operatorname{argmax}} U_{ML} = \delta_i \lambda_i h\left(r_i + \gamma A_i\right) + h\left(R - r_i\right) : R \geq r_i. \tag{1}$$

In the above, r_i denotes development resources from ML to i. A_i is the sum of bilateral resource contributions from industrialized countries to i. The expression $h\left(r_i + \gamma A_i\right)$ denotes the level of development in i produced by the allocation of resources from ML and bilateral donors, where γ denotes the rate of spillin of bilateral donor contributions toward development. This captures the value of total bilateral aid in promoting development in i. λ_i denotes ML's unique preference for contributing resources to i. On the basis of prior research, λ_i would denote factors related to recipient development need. $h\left(R - r_i\right)$ captures ML's private utility from spending resources on a numeraire good. This may be thought of as consumption of goods such as paying staff, bureaucratic overhead, etc.

$h(\cdot)$ is presumed to be increasing in its inputs, but with diminishing returns. So, for the first expression, $\frac{\partial h}{\partial r_i} > 0$, and $\frac{\partial^2 h}{\partial r_i^2} < 0$. For the second expression, $\frac{\partial h}{\partial r_i} < 0$ and $\frac{\partial^2 h}{\partial r_i^2} > 0$. Later, when specifying the empirical model it will be necessary to explicitly define $h(\cdot)$, but for now it is sufficient to simply describe its properties.

3.1 The Multilateral's Solution to the Optimization Problem

- **Proposition 1**: *ML's constrained optimization problem is maximized when ML selects δ_i such that $\delta_i = v(\cdot)$ and sets r_i such that the marginal utility of development in i is equal to the marginal utility of the numeraire good.*

To show that ML will prioritize development in accordance with the preferences

of donors, consider the marginal utility of ML with respect to R:

$$\frac{\partial U_{ML}}{\partial R} = \frac{\partial h\left(R - r_i\right)}{\partial R}.$$

Given the properties of $h(\cdot)$, we know that $\frac{\partial h(R-r_i)}{\partial R} > 0$ and, thus, that ML's marginal utility with respect to R is monotonically increasing. As ML seeks to maximize U_{ML}, it therefore is in ML's interest to increase its total resource base, which it does by setting $\delta_i = v(\cdot)$.

With δ_i determined, ML must still set the optimal level of r_i so that ML's constrained optimization problem is maximized. This obtains when the marginal utility of contributing resources to i is in equilibrium with the marginal utility of consumption of the numeraire good. That is, when

$$\frac{\partial U_{ML}}{\partial r_i} = \frac{\partial \delta_i \lambda_i h\left(r_i + \gamma A_i\right)}{\partial r_i} - \frac{\partial h\left(R - r_i\right)}{\partial r_i} = 0,$$

which yields the following first order conditions:

$$\frac{\partial \delta_i \lambda_i h\left(r_i + \gamma A_i\right)}{\partial r_i} = \frac{\partial h\left(R - r_i\right)}{\partial r_i}.$$

- **Proposition 2**: *ML will linearly decrease r_i as A_i increases.*

From the first order conditions given above, we know that ML will set r_i such that the marginal utility of development in i is in equilibrium with the utility of consumption of the numeraire good. Let the optimal level of r_i be denoted r_i^*. Assume that for exogenous reasons, bilateral donors increase their giving to i so that the new level of giving is $A_i + g$, where g is the size of the increase in bilateral funds. Holding ML's giving constant at r_i^*, the increase in bilateral funds by g amount throws the marginal utility of development and of the numeraire out of equilibrium. Knowing

that

$$\frac{\partial \delta_i \lambda_i h\left(r_i^* + \gamma A_i\right)}{\partial r_i^*} = \frac{\partial h\left(R - r_i^*\right)}{\partial r_i^*},$$

and that $h(\cdot)$ is increasing in its inputs, but with diminishing returns, we know that it must be the case that

$$\frac{\partial \delta_i \lambda_i h\left(r_i^* + \gamma[A_i + g]\right)}{\partial r_i^*} < \frac{\partial h\left(R - r_i^*\right)}{\partial r_i^*}.$$

The marginal utility of development in i is now less than the marginal utility of the numeraire. ML therefore will pull back spending on development and contribute more resources toward consumption of private goods. As the values within $h(\cdot)$ contribute to the total input of resources linearly, ML can optimize its utility by simply subtracting γg from r_i^*. This ensures that the marginal utility of development and of the numeraire again are in equilibrium:

$$\frac{\partial \delta_i \lambda_i h\left(r_i^* - \gamma g + \gamma[A_i + g]\right)}{\partial r_i^* - \gamma g} = \frac{\partial h\left(R + \gamma g - r_i^*\right)}{\partial r_i^* - \gamma g}.$$

This result is consistent with a multilateral development agency that specializes in filling in the gaps left over by bilateral donors. When and where bilateral giving is high, ML will give less. Conversely, when and where bilateral donors contribute few resources, ML will contribute more.

In sum, the above shows that the ML maximizes its utility by

1. Weighting development in i in accordance with the preferences of bilateral donors, thereby maximizing its resource base.
2. Allocating its resources so that the marginal utility of development in i is equal to the marginal utility of private goods consumed by ML. Where bilateral donors contribute fewer resources, ML's marginal utility of promoting development will

be greater.

As I will discuss in the follow subsection, results 1 and 2 imply a unique interaction in how ML responds to the development preferences of bilateral donors and these donors' actual bilateral aid allocations.

3.2 The Tug of War between Gap-Filling and Donor-Pleasing

Various scholars have highlighted how incentives at the institutional level, on the one hand, and at the shareholder level, on the other, place cross-cutting pressures on a multilateral development institution such as the World Bank (Weaver 2008; Clegg 2013). The model considered here captures a set of competing dynamics, showing how a multilateral development agency should optimize its pattern of aid giving across developing countries in the face of (1) incentives to follow the preferences of bilateral donors to garner resources and (2) incentives to allocate resources where and when bilateral donors' preferences (a) lie elsewhere or (b) lead them to underfund a particular recipient. As the model shows, it is clearly possible for both of these incentives to coexist; however, as I demonstrate below, one incentive may have greater sway relative to the other over where a multilateral development institution targets resources in certain contexts.

- **Proposition 3**: *The rate at which A_i influences ML's optimization problem declines with δ_i*

In short, the greater bilateral donors' preferences for development in i, captured by δ_i, the less ML will be influenced by the need to prioritize underfunded developing countries. This can be shown by simply considering how δ_i influences the marginal utility of development in i to ML relative to A_i.

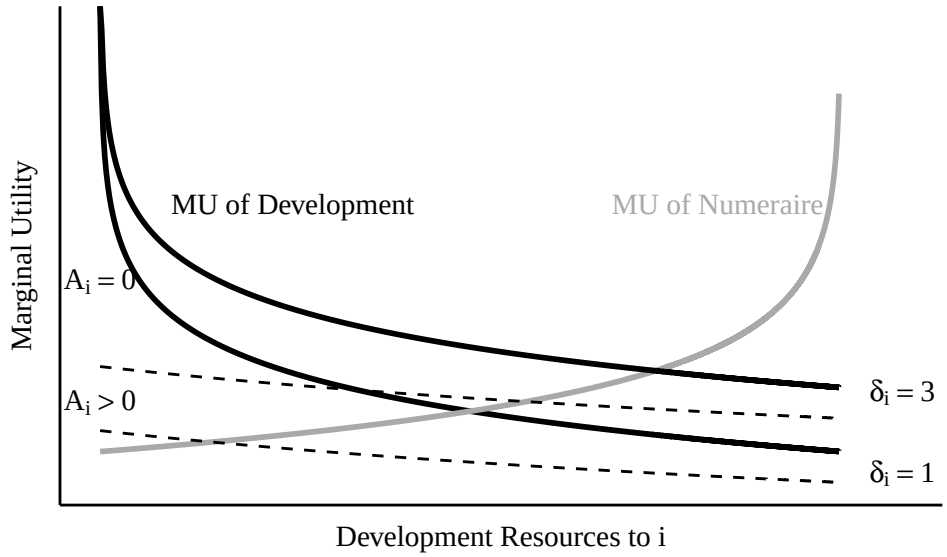

Figure 1: ML giving in equilibrium. Comparing optimal levels of resource allocation given prioritization of development and giving by bilateral donors. Solid black lines denote the marginal utility of development when bilateral allocations equal zero. Dashed black lines denote the marginal utility of development when bilateral giving is positive.

Consider the marginal utility of development in i to ML:

$$\frac{\partial \delta_i \lambda_i h(r_i + \gamma A_i)}{\partial r_i} = \delta_i \lambda_i h'(r_i + \gamma A_i).$$

ML's utility is optimized when $\delta_i \lambda_i h'(r_i + \gamma A_i) = h'(R - r_i)$. The characteristics of $h(\cdot)$ are such that $h' > 0$ while $h'' < 0$, given input of positive values. This denotes that $h(\cdot)$ is monotonically increasing with positive inputs, but is strictly concave. Given this property, we therefore know that for the expression $\delta_i \lambda_i h'(r_i + \gamma A_i)$, the value is increasing linearly with δ_i but decreasing curvilinearly with $r_i + \gamma A_i$. Further, we know that $h'(R - r_i)$ is similarly decreasing curvilinearly as ML gives fewer resources toward development and spends more on numeraire goods.

Figure 1 demonstrates how the marginal utility of each expression varies over

r_i. The grey line denotes the marginal utility of the numeraire good. The black lines denote the marginal utility of contributing resources toward development given different values for the δ_i parameter and levels of A_i. The equilibrium value of r_i lies at the intersection of the marginal utility of development and of the numeraire. Note that the difference in equilibrium levels of r_i when $A_i = 0$ versus $A_i > 0$ is greater for the case where $\delta_i = 1$ than when $\delta_i = 3$. That is, in the case where ML gives greater weight to development in i, an increase in A_i has a smaller effect on r_i relative to when development in i is given little weight.

4 Empirics

The above section laid out a straightforward decision model for a multilateral development institution that balances donor-pleasing behavior with gap-filling. Though the conclusions of the model are intuitive, the coefficients generated from a standard statistical model will not reflect quantities of theoretical relevance and, moreover, may be misleading as a standard statistical model's specification will violate the functional form of the theoretical data generating process. In this section, I describe a new statistical model, a Decision Autoregressive Model (DAM), constructed on the basis of the theoretical one considered in the preceding section. DAM estimation takes seriously the formal model in the preceding section and permits me to obtain values directly related to the this model. In the below subsections I first describe DAM. I then apply DAM to realworld data, relying on World Bank IDA and IBRD aid disbursements from 2008 to 2012 to examine whether the World Bank's allocation decisions align with optimal behavior for an ML as described above.

4.1 From Theoretical to Statistical Model:

I begin by first making explicit the functional form of $h(\cdot)$ as $\ln(\cdot)$. The natural logarithm is an ideal choice for a few reasons:

1. It abides by the properties of $h(\cdot)$: $h' > 0$ and $h'' < 0$.
2. The form of its first derivative is straightforward: $d\ln(x)/dx = 1/x$.
3. The form of its first derivative makes solving for the optimal level of r_i straightforward.

Other functional forms could also be considered, among which $h(\cdot) = (\cdot)^\alpha : 0 < \alpha < 1$ is most prominent. However, this functional form makes derivation of the best response of ML cumbersome, while affording little to no meaningful difference in substantive conclusions (Steinwand 2011).

With $h(\cdot)$ defined, I can solve for the best level of resource allocation to developing country i as follows:

$$\begin{aligned} \frac{\partial U_{ML}}{\partial r_i} &= \frac{\delta_i \lambda_i}{r_i + \gamma A_i} - \frac{1}{R - r_i} = 0 \\ \frac{\delta_i \lambda_i}{r_i + \gamma A_i} &= \frac{1}{R - r_i} \\ r_i &= \left(\frac{\delta_i \lambda_i}{\delta_i \lambda_i + 1}\right) R - \left(\frac{\gamma}{\delta_i \lambda_i + 1}\right) A_i. \end{aligned} \tag{2}$$

From equation 2, conclusions derived in the preceding section can now be easily deduced. Most notably, greater preference for i leads ML to allocate a greater total fraction of R. Conversely, the net impact of A_i clearly declines as preference for i increases.

With the demand function defined, we may now consider an empirical estimator constructed on the basis of the functional form of equation 2. But, before doing this, it is useful to consider existing methods first, so as to justify the need for a new

estimator when so many already exist.

First, consider a standard economic approach. One may estimate equation 2 with OLS by first defining the parameters $\eta_1 = \frac{\delta_i \lambda_i}{\delta_i \lambda_i + 1}$ and $\eta_2 = \frac{-\gamma}{\delta_i \lambda_i + 1}$ and then estimating the following equation:

$$r_i = \eta_1 R + \eta_2 A_i + \epsilon_i.$$

The advantage of this approach is its simplicity. However, an obvious limitation is that it does not allow the η parameters to vary with the weight ML attaches to particular developing countries. To the contrary, this method assumes ML's preferences are constant, with demand purely a function of ML's resource base (R) and the bilateral aid contributions of industrialized countries (A_i). As we know from the theoretical model, ML should have non-constant preferences across developing countries. Thus, this approach does not offer useful estimates of theoretical parameters of interest.

A second, more common, approach is to estimate a multivariate regression model that includes R and A_i as covariates, along with a suite of variables meant to capture donor interest in development. Though simple, this approach, as with the one above, suffers from similar limitations, as the functional form of the multivariate linear regression does not map onto the theoretical model. This, again, raises concerns about whether estimated coefficients reliably capture quantities of theoretical interest.

The approach that I take builds from Steinwand (2011) who models free-riding among bilateral donors using a method he developed called StratAM (Strategic Autoregressive Model), which allows the researcher to obtain estimates of the effect of covariates on free-riding on the basis of a formal model of similar form to that used here.

Following Steinwand (2011), I allow preference for development in the i^{th} developing country to be modeled as a function of a matrix of covariates $\mathbf{X}$ and a vector

of parameters to be estimated, β. I specify $\delta_i \lambda_i = e^{\mathbf{X}\beta}$, where I exponentiate $\mathbf{X}\beta$ in keeping with the restriction that preference for a particular developing country is restricted to non-negative values. Allowing for regression error (ε), analogous to error on the part of ML in allocating resources, the empirical model is specified as

$$r_i = \left[\frac{e^{\mathbf{X}\beta}}{e^{\mathbf{X}\beta}+1}\right] R - \left[\frac{\gamma}{e^{\mathbf{X}\beta}+1}\right] A_i + \varepsilon_i, \tag{3}$$

where γ is also a parameter to be estimated. Since no closed-form solution exists for estimating γ and the vector of βs, I rely on an iterative numerical optimization algorithm that searches for parameter values that minimize $\sum_{i=1}^{n} \varepsilon_i^2$.[1]

This approach is similar to StratAM, save that StratAM does not allow for a parameter similar to γ and, instead, assumes a one-to-one rate of substitution. DAM differs from StratAM in another important way as well. Steinwand (2011) proposes using researcher supplied impurity weights that capture the fraction of resources committed by actors toward the public good under study versus private goods obtainable from allocation of resources. Rather than rely on a vector of impurity weights to capture the fraction of resources used for the production of a public good versus a private good when allocated, DAM relies on total resource allocations. Though DAM's approach is potentially problematic, impurity weights are themselves subject to error as the researcher must provide these values ex ante with the expectation that they reflect the true fraction of resources contributed toward a public good. DAM makes the more parsimonious, though nonetheless still heroic, assumption that total allocations are sufficient to obtain estimates of theoretical interest.

[1] I obtain estimates with the `optim()` function in `R` using the BFGS method, a quasi-Newton algorithm commonly used in nonlinear optimization problems.

4.2 Data

With the empirical model defined, I now turn to data that I use to estimate DAM parameters of interest. Though DAM has applicability in multiple contexts, for this study I specifically focus on the World Bank. As the largest multilateral development institution, the World Bank is a natural choice for empirical analysis as studying the resource optimization decisions of the Bank will both be of interest to researchers who study the Bank and have substantive policy relevance. Moreover, focus on such a large multilateral organization such as the Bank will be of general interest to IR and IPE scholars interested in studying the role of international organizations in helping states overcome collective action problems.

I specify my response variable (r) as non-negative net IDA and IBRD aid disbursements from the World Bank from 2008 to 2012. I proxy A as total bilateral aid disbursements from DAC and non-DAC donors. To capture World Bank resource endowments (R), I rely on yearly World Bank budget reports. To normalize the distribution of these measures, I log-transform values prior to analysis.[2]

To proxy for the weight the World Bank gives to developing countries per the interests of bilateral donors, I rely on bilateral aid allocations of three groups of donors: G7 countries, non-G7 members of the DAC, and non-DAC countries. Similar to Schneider and Tobin (2016), I assume that the bilateral allocations of donors should serve as a reliable proxy for donors' development interests across developing countries. In line with the formal model, I expect the World Bank to give greatest weight to the allocations of G7 countries as these consist of prominent donors to the Bank. Following in importance should be the collective allocations of non-G7 members of the DAC, still relatively important donors, but less so than G7 countries. Last in

[2]Disbursement data is available at: stats.oecd.org. World Bank budget reports can be accessed at: documents.worldbank.org.

Table 1: Summary Statistics

Statistic	Mean	St. Dev.	Min	Max
DAC	720.907	1,186.644	3.160	9,421.980
World Bank	143.769	222.210	1.050	1,127.220
non-DAC	18.587	36.350	1.020	220.820
G7	575.005	1,028.754	3.070	8,053.040
World Bank Budget	1,735.576	65.300	1,637.100	1,823.300
GDP per capita	1,265.563	1,268.504	184.046	6,452.630

$N = 180$

importance should be non-DAC members, which are mostly new donors that give relatively little foreign aid and contribute relatively small funds toward the World Bank. Though I could rely on separate measures of bilateral giving by each donor, this would eat up degrees of freedom quickly, robbing estimates of statistical significance due to lack of statistical power and colinearity.

I further account for Bank specific interest in promoting development. I rely on recipient GDP per capita, log-transformed, as a measure of the level of development in a given country. Data are from the Penn World Table, version 8.1 (Feenstra, Inklaar, and Timmer 2015). I expect that the World Bank will prioritize development where it is most needed—e.g., underdeveloped countries.

Using this data, I estimate the following empirical model:

$$\begin{aligned} \text{WB}_{it} = \text{Budget}_t \left[\frac{e^{(\beta_1 \text{G7}_{it} + \beta_2 [\text{DAC}_{it} + \text{G7}_{it}] + \beta_3 \text{non-DAC}_{it} + \beta_4 \text{GDP}_{it})}}{e^{(\beta_1 \text{G7}_{it} + \beta_2 [\text{DAC}_{it} + \text{G7}_{it}] + \beta_3 \text{non-DAC}_{it} + \beta_4 \text{GDP}_{it})} + 1} \right] \\ - \text{Aid}_{it} \left[\frac{\gamma}{e^{(\beta_1 \text{G7}_{it} + \beta_2 [\text{DAC}_{it} - \text{G7}_{it}] + \beta_3 \text{non-DAC}_{it} + \beta_4 \text{GDP}_{it})} + 1} \right] + \varepsilon_{it}, \end{aligned} \tag{4}$$

where subscript i denotes the i^{th} developing country and t the year of allocation. To facilitate comparisons between coefficients for covariates included in $\mathbf{X}$, I rescale values so that the minimum value equals 0, and the maximum equals 1.

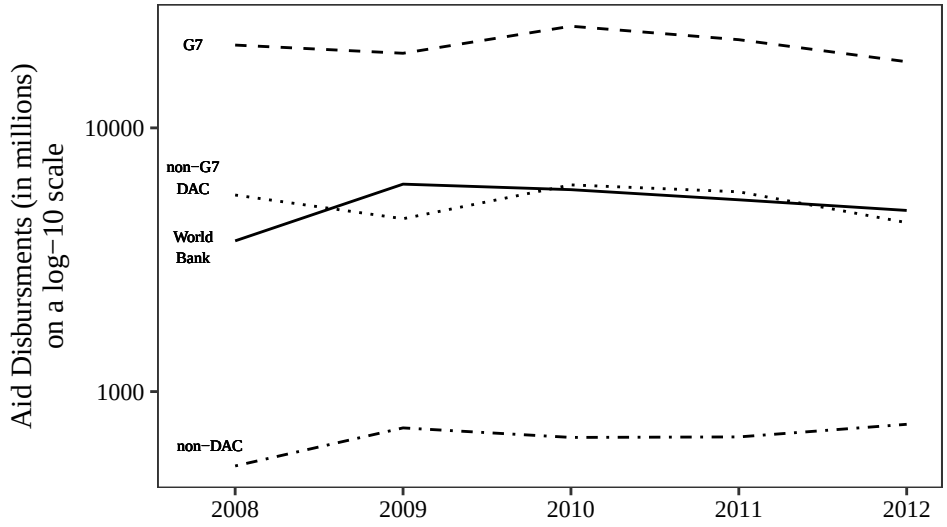

Figure 2: Aid disbursments per year, from the World Bank, G7 countries, non-G7 members of the DAC, and non-DAC countries. Values are in 2015 constant values (in millions).

Table 1 shows summary statistics for explanatory variables and the outcome variable. Values are post-listwise deletion. The number of recipients included in the analysis range from 33 to 39 per year. Figure 2 shows total aid disbursements by the World Bank, G7 countries, non-G7 DAC members, and non-DAC countries from 2008 to 2012. G7 countries clearly are the top donors collectively, accounting for more aid disbursements per year than the remaining 23 DAC countries. Non-DAC countries are the smallest donors, contributing less than one billion dollars (2015 constant) combined per year from 2008 to 2012. World Bank aid disbursements (IDA plus IBRD) nearly match those of all non-G7 DAC countries put together.

4.3 Findings

Findings from DAM analysis are shown in Figure 3. Point estimates denote model coefficients. Lines denote 95 percent confidence intervals. If these lines intersect with

zero on the x-axis, this means values fall short of conventional levels of statistical significance ($p \leq 0.05$).

DAM estimates are not directly interpreted, as values capture the impact of covariates on the World Bank's preference for the i^{th} developing country, rather than the level aid disbursements directly. Though, at face value, the direction and statistical significance estimates are in line with theoretical expectations. The coefficient for G7 aid disbursements is positive and statistically significant. Moreover, the association with World Bank preferences across recipients is greater relative to non-G7 DAC members' aid disbursements. This aligns with the prediction that a multilateral development institution should be most responsive to the interests of the largest bilateral donors. Further in support of this prediction, the aid disbursements of non-DAC countries, the smallest bilateral donors in terms of total giving, have a null association with World Bank preferences, suggesting the Bank gives little weight to the preferences of these donors as it distributes resources to developing countries.

Estimates further indicate that Bank specific interest in development is significantly determined by the level of development between different recipient countries. This is to be expected, as a multilateral development institution would naturally be inclined to promote development where it is most needed.

Finally, in support of the theoretical expectation that total bilateral aid disbursements have a negative impact on a multilateral development institution's allocations, rate of replacement (γ) is positive and statistically significant. This supports the expectation that a multilateral development institution such as the Bank should prioritize development where it is underfunded so as to facilitate Pareto improvements in industrialized countries' utility. In substantive terms, since values of total bilateral aid and World Bank aid have been log-transformed, the value of γ denotes the percent

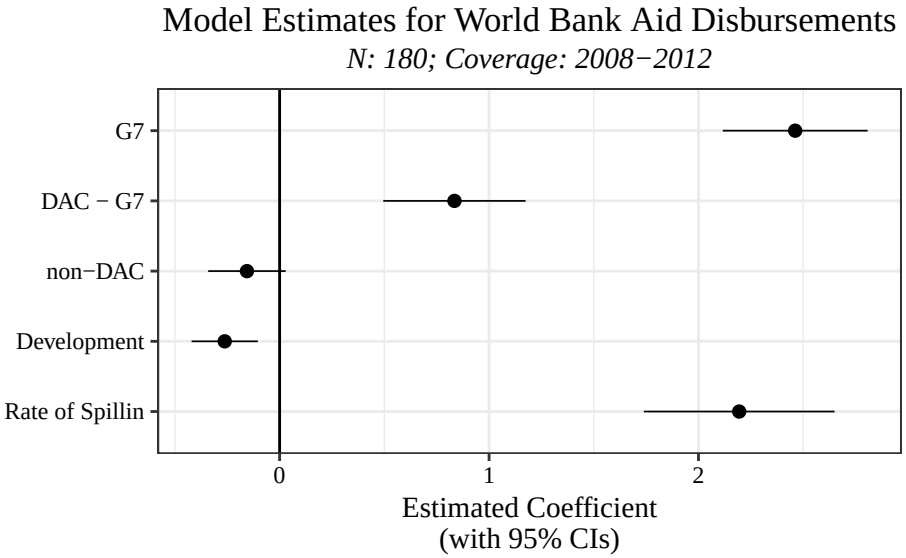

Figure 3: DAM estimates shown with 95% confidence intervals. $RSS = 129.8$. For comparison, $RSS = 160.7$ for an OLS model of the form: $\text{WB}_{it} = \eta_1 \text{Budget}_t + \eta_2 \text{Bilateral Aid}_{it} + \mu_{it}$.

substitution of bilateral aid for multilateral aid from the Bank. Estimates indicate that a one percent decline in bilateral aid is substituted by a two percent increase in aid from the World Bank, *ceteris paribus*.

An additional prediction of the theoretical model is that a multilateral development institution will deemphisize substitution as preferences for a recipient increase. The implication of this feature of the model is that the net rate of substitution for total aid will decline with G7 contributions, and to a lesser extent, non-G7 DAC member contributions. This is supported by results shown in Figure 4. Along the x-axis are values of predictor variables (each is scaled from 0 to 1). Along the y-axis is the marginal effect of total bilateral aid disbursements on net rate of replacement, or gap-filling behavior, vis-à-vis bilateral aid. Values are generated by holding all other covariates constant at their median value. 95 percent confidence intervals are shown. The net percent rate of replacement by the Bank for a one percent decline

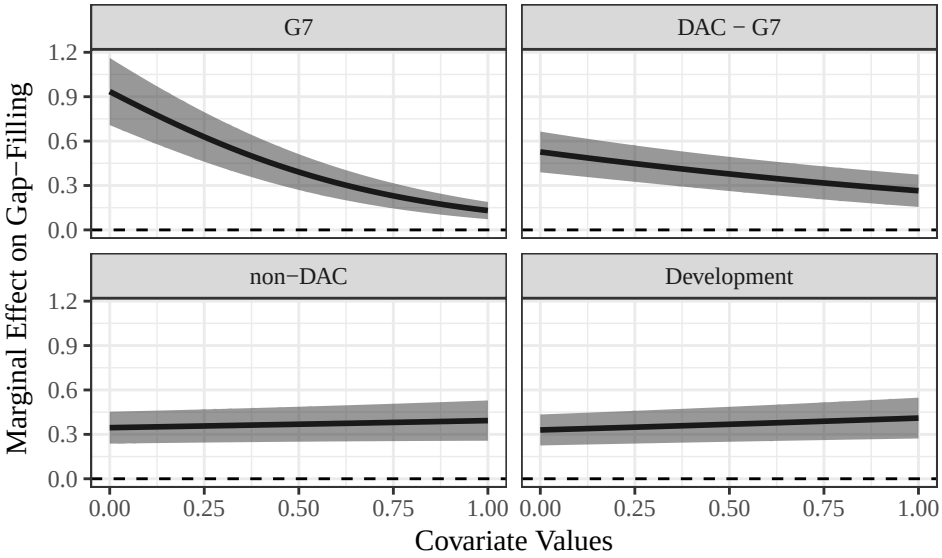

Figure 4: Marginal effects of covariates on "Gap-Filling," or the percent rate of substitution (PRS), where PRS $= \frac{\gamma}{e^{\mathbf{x}\beta}+1}$. 95% confidence intervals shown. Confidence intervals were generated via a parametric bootstrapping procedure.

in bilateral aid is nearly 0.9 when G7 contributions are at their minimum value. As G7 contributions increase, the net percent rate of replacement approaches zero, though remains statistically significant. In practical terms, this implies that gap-filling behavior diminishes when and where G7 countries contribute large sums of bilateral aid.

Variation in the Bank's responsiveness to non-G7 DAC members and to non-DAC countries is less pronounced, which is to be expected given the smaller (null for non-DAC countries) impact of these countries' preferences on Bank allocation decisions. Further, estimates indicate that the level of development has minimal influence on percent rate of substitution.

4.4 Comparison to Alternative Methods

I apply DAM in lieu of a standard econometric approach and a more commonly applied multiple regression model. To save space, I will only briefly discuss the overall model performance of DAM relative to these other approaches in terms of mean squared error (MSE), a common approach for assessing the performance of an estimator. MSE for these three approaches is measured as the residual sum of squares (RSS) divided by the number of observations (minus the number of regressors), that is

$$\text{MSE}_m = (n - r_m)^{-1} \sum_{i=1}^{n} (\text{WB}_{it} - \hat{\text{WB}}_{it,m})^2,$$

where $m = \{\text{DAM}, \text{Econ}, \text{MultReg}\}$, denoting each of the three models being compared, and r denotes the number of regressors per m.

For the standard econometric approach (Econ), I estimate a simple OLS model of the following form:

$$\text{WB}_{it} = \beta_1 \text{Budget}_t + \beta_2 \text{Aid}_{it} + \nu_{it}.$$

Note that this model, in accordance with the functional form of the theoretical model, forces the intercept through the origin ($\beta_0 = 0$). The specification for the multivariate regression (MultReg) is as follows:

$$\begin{aligned} \text{WB}_{it} = {} & \alpha_0 + \alpha_1 \text{Budget}_t + \alpha_2 \text{Aid}_{it} \\ & + \alpha_3 \text{G7}_{it} + \alpha_4 (\text{DAC}_{it} - \text{G7}_{it}) \\ & + \alpha_5 \text{non-DAC}_{it} + \alpha_6 \text{GDP}_{it} \\ & + \sigma_{it}. \end{aligned}$$

Table 2: Model performance in terms of MSE

Model	*DAM*	*Econ*	*MultReg*
MSE	0.75	0.90	0.78

After estimating each model, I calculate the MSE as specified above. Estimates are shown in Table 2. Based on this calculation, I find that DAM outperforms both the standard econometric and multiple regression approaches; though the multiple regression approach does not perform much worse than DAM. Encouragingly, DAM performs quite well, suggesting it is a reliable estimator relative to alternatives.

5 Conclusion

Bermeo (2018b) highlights two purposes for a multilateral development institution: (1) to optimize the production of a public good and (2) to act as an instrument that states leverage for private gain. On the surface, these goals stand in contradiction. However, as I show in this study, both roles can coexist in a single institution, as I find is the case with the World Bank. In the face of heterogeneous development interests among industrialized states, the World Bank must take steps to align its development priorities with those of its most prominent donors. Therefore, the Bank acts as a complement to the bilateral aid allocations of its largest contributing states. At the same time, the Bank helps to optimize the production of international development by supplementing for bilateral aid contributions where they are most lacking.

In generating this finding, this study makes theoretical and methodological contributions to the literature on international cooperation and the politics of international development. I begin by constructing a theoretical model that captures a multilateral development institution's incentives to follow the preferences of its largest contributors

while also taking steps to ameliorate the consequences of free-riding in development production. This model generates novel insights into how seemingly contradictory roles for a development organization can coexist as it optimizes the distribution of its resources.

On the basis of this theoretical model, I then develop a new statistical estimator that captures the complex decisionmaking calculus of a multilateral development institution as described above. The Decision Autoregressive Model (DAM) I develop facilitates simultaneous estimation of the influence of bilateral donor preferences on a multilateral development institution's prioritization of developing countries, while also allowing for estimation of the rate at which such an institution substitutes for development funding where bilateral donors contribute few resources. Comparison to other approaches reveals that DAM is a reliable estimator, lending credibility to the model's estimates.

The practical implications of this study's theoretical and methodological contributions are encouraging, but not overly so. While I demonstrate that the World Bank is significantly influenced by its largest donors, this influence does not prevent the Bank from generating Pareto improvements in international development, that is, to prioritize countries that go underfunded by bilateral aid allocations. At the same time, the fact that the Bank's resources are subject to the goodwill of the donor community places it at the mercy of its largest donors. This fact leaves potentially more substantial Pareto improvements on the table.

Unfortunately, few alternatives for how the Bank might generate a substantial share of its revenue exist. If the Bank showed no favoritism in prioritizing developing countries according to the preferences of major shareholders, there would be no private gain to be had by contributing resources to the Bank. If so, the same collective action

problem the Bank is meant to resolve would simply play out within the institution itself. Thus, the dual roles of *gap-filling* and *donor-pleasing* are necessary bedfellows, however much from a normative perspective one might prefer the former divorced from the latter. Pareto improvements would not accrue without resources, and generating resources requires playing to the interests of the largest shareholders in exchange for their continued contributions. The best possible multilateral development institution strikes the right balance, and the World Bank appears to do just that.

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