Reviewers' Appendix

Multi-bilateral Aid and Infectious Disease Control

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1 Principal-Agent Models and Payoff Asymmetries Versus Club Goods

Studies on why donors choose multilateral aid are numerous generally focusing on delegation motivations. Principal-Agent models address the tension between a country's desire to maintain control over its foreign policy and the potential benefits of delegating objectives to a multilateral organization. In the simplest models, a single principal (donor state) delegates to a single agent (multilateral organization) (Hawkins et al., 2006; Milner, 2006; Milner and Tingley, 2013). In practice, a multilateral organization acts as an agent for multiple principals. This dilutes the influence any single principal holds over the agent. But if multilateral giving dilutes influence, why then do donor states give aid through multilateral organizations? The usual answer is that the benefits outweigh the costs.

In public goods games, the payoff to players does not have to be uniform — some players may enjoy larger payoffs. The only necessity is that no player can be excluded from receiving a payoff. Player payoff may be conditioned by a variety of theoretical factors, including frequency of use and spatial distribution (Camerer, 2003). In the case of infectious disease control, the size of the benefit received by countries is conditioned by the characteristics and spatial distribution of diseases.

The payoff to players in such games does not have to be uniform — some players may enjoy larger payoffs. The only necessity is that no player can be excluded from receiving a payoff. Player payoff may be conditioned by a variety of theoretical factors, including frequency of use and spatial distribution (Camerer, 2003). In the case of infectious disease control, the size of the benefit received by countries is conditioned by the characteristics and spatial distribution of diseases. Public goods are non-rival and non-excludable — the value of the good does not diminish with use and it is impossible to prevent any individual from using the good. The classic example is the lighthouse. Infectious disease control can be thought of as a public good. For example, one individuals benefit from the eradication of smallpox does not diminish another individual's ability to benefit from it as well. Likewise, no individual can be prevented from benefiting from the eradication of smallpox. Controlling or decreasing the number of cases of any infectious disease produces an equally public benefit.

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larger payoff from the construction of a lighthouse than a company that uses the harbor less frequently. The lighthouse is still a public good, even if one of the players uses it less frequently. In the case of infectious disease control, the size of the benefit received by countries is conditioned by the spatial distribution of disease.

Payoff asymmetries do not change the nature of the public good unless the conditioning factor acts as exclusion. When spatial factors enable a player to be excluded from a benefit, the good should be thought of as a club good (Camerer, 2003; Cornes and Sandler, 1986). Club goods are non-rival but excludable — meaning that while the good is not diminished by any one individuals consumption, the good is limited to those individuals within the club.

This, of course, adds complexity to the simple model of the public good. Using the lighthouse example, at what distance away from the harbor is a company effective excluded? Attempts to deal with these complexities have led to distinctions like "national public good" and "global public good".

When applied to infectious disease control, one might argue that the spatial distribution of disease acts as an exclusionary mechanism and that the club is determined by the spatial distribution of the disease. Each disease would have its own club. For example, schistosomiasis relies on freshwater snails as an intermediary host. Because the snails require water temperatures to remain between 10 and 35C degrees year round, countries where water temperatures vary more than this are excluded from the club(Weisbrod et al., 1973; World Health Organization, 2004; Hotez, 2008). In contrast, for diseases with global distribution, the club includes all countries.

While a club goods model may be equally appropriate for infectious disease control, I choose to use the public good model with payoff asymmetries for two reasons. First, defining exclusion based on disease distribution is complicated by the variety of reasons that limit disease distribution. Club good are created when payoff asymmetries exclude players from benefiting from the good. A player that could benefit from a good but does not — for example, a country near the harbor that chooses to ships via railroad rather than via cargo ship — is not excluded.

To identify clubs based on disease distribution, one must identify when payoff asymmetries exclude players, not just if players will benefit from a good. For example, in the case of schistosomiasis, the club includes all countries where water temperatures remain between 10 and 35C degrees, regardless of whether that country has schistosomiasis of not. Yet, not all diseases enjoy such easily defined clubs. For example, malaria and yellow fever are often discussed as geographically limited diseases. The few cases of malaria in developed countries in a given year are generally imported and do not tend to spread (Jentes, 2011). Both of

these diseases rely on intermediary hosts that are present in developed countries. Indeed, both diseases were endemic in the United States — the last yellow fever epidemic occurred in 1905 and malaria was declared eliminated in 1951 due to the efforts of the National Malaria Eradication Program, which became the Center for Disease Control (CDC). Should the United States be included in the yellow fever and malaria clubs, or considered excluded? There is no clear answer.

Moreover, which distribution constraining mechanisms should define exclusion? Before the global smallpox eradication effort began, smallpox had already bee eliminated in the United States, Russia, and many developed countries. As a result, their payoff from further interventions was quite small. Does that mean that these countries were excluded from any benefit? Again, there is no clear answer.

While vector-borne illnesses might seem to provide easier cases, changes in host distribution or recruitment of new hosts adds an addition layer of complexity. For example, a recent study found that dengue — a disease transmitted by a specific species of mosquito and generally geographically limited — has become increasingly prevalent as temperatures have risen and the subspecies of mosquito has extended its range (R.A. Erickson, 2012). The range of schistosomiasis has increased due to global climate change as well (McCreesh and Booth, 2015). The geographic distribution of chikungunya — a virus also spread by two species of mosquito — has increased rapidly, spreading beyond its typically endemic region. A 2008 study warned that viral mutations have enabled the virus to be spread by up to three additional species with wide geographic distribution (de Lamballerie, 2008). Given the variety of mechanisms that affect disease distribution and the fluidity with which disease distribution changes, defining exclusion and devising a valid and reliable coding scheme for clubs is monumentally difficult.

The second reason that I forgo the use of a club goods model is because the added dimensions of the club goods model does not change the specification of behaviors or the hypotheses to be tested. In the club goods model, some countries are prevented from benefitting from controlling some diseases, while there may still be payoff asymmetries within the club. Countries that were excluded from a disease club would be less likely to contribute to control efforts for that disease. Likewise, in the public good model, some countries may not receive a benefit from controling some diseases as a result of payoff asymmetries. These countries would be less likely to contribute to disease control for these diseases. By using donor burden of disease as a proxy for the mechanism that conditions the value of the payoff, I avoid need to specify the exclusion mechanism for each disease, and the expected behaviors remain the same. Thus, I chose to use the simpler and equally valid public goods model with payoff asymmetries.

2 Additional Discussion of Principal Agent Models

In a simplified form, principal-agent models establish donor governments as principals seeking to address a transnational problem through the use of foreign aid. As principals, donor governments may choose to address problems on their own, through bilateral actions, or to delegate policy-making to agents — in this case, multilateral organizations (Hawkins et al., 2006; Milner, 2006; Milner and Tingley, 2013). In the simplest models of PA, a single principal (donor state) delegates to a single agents (multilateral organization). In these models, donors are expected to select agents that most fit their interests and, thus, agency slack should be relatively low.

In more complex models, a multilateral organization acts as agent for multiple principals. For large, complex problems, a single donor may not have the jurisdiction, resources, or expertise necessary to fully address the problem. When multiple actors are needed, a centralized and coordinated effort among the actors generally produces more efficient outcomes than each actor working independently. These gains, however, are also accompanied by the potential for greater agency losses. As principals interests diverge, agents are less likely to fit the ideal point of any given principal (Hawkins et al., 2006; Nielson and Tierney, 2003).

Although principal agent models generally treat donor states as principals and multilateral organizations as agents, democratic donor governments are, themselves agents. Constituents within donor states delegate authority to allocate foreign aid to their governments (Hawkins et al., 2006; Milner, 2006; Milner and Tingley, 2013). Because foreign aid is taxpayer money, governments are under pressure to invest according to their constituents' preferences.(Page and Shapiro, 1992; Canes-Wrone, 2006). Yet, what constituents want or expect from foreign aid remains a subject of debate.

The extended PA model is fraught with information problems. Regardless of the direction of public opinion — whether favoring delegation or not — constituents in donor countries lack necessary information to monitor and evaluate foreign aid decisions by their governments. Constituents have little information about how aid is spent, its relative quality and effectiveness, or which delivery channels best match their preferences. In addition, constituents are unable to directly observe the final outcome of the aid.

3 Research Design and Methods

3.1 Unit of Analysis

The donor-recipient-disease triad is a useful unit of analysis for several reasons. First, it allows for incorporation of recipient and donor specific variables. Aid allocation decisions reflect a variety of considerations. The literature on foreign aid suggests that most aid allocation reflect aspects of both donor interest and recipient need. Thus, a complete analysis would necessarily include both donor and recipient characteristics. Second, the distribution of both disease and aid is strongly correlated with economic development (Classens, Cassimon and van Campenhout, 2009; Jamison, 2006). Thus, it is necessary to account for recipient level characteristics in order to account for potential collinearity. Finally, the construction of the donor-recipient-disease triad produces important variation that is used to test competing theories about aid allocations and controlling for confounding explanations. For example, multi-bilateral aid is often included as a means of bypassing corrupt governments. To account for recipient-level characteristics that might affect the selection and use of aid channels, the unit of analysis must allow for donor, recipient, and disease level variables.

Beginning with allocation level data, I identified all individual foreign aid allocations using purpose codes for 'health', 'population', and 'water' between 2005 and 2011 and eliminated all other allocations. Although I am only interested in health-related aid, much of the aid directed at HIV/AIDS is allocated+ to programs listed under the purpose code of "population". Likewise, some aid for diseases such as malaria, schistosomiasis, and polio is listed under the purpose code of "water and sanitation". Using purpose codes provided by CRS and AidData.org and allocation descriptions, I identified cases that targeted specific diseases and coded these accordingly. I began with 156,301 individual allocations of health aid. Of these, 43,864 were disease control allocations. I then coded individual allocations. Just over 35,000 were specifically directed at one of the 12 diseases of interest. I then aggregated over time by donor for each recipient and disease, creating a sample of every combination of donor, recipient, and disease. Thus, the unit of analysis is donor-recipient-disease triad. With 23 donors, 12 diseases, and 140 recipients, the n for this project is 38,640.

Table 1: Diseases, Donors, and Recipients

Diseases	**Donor**	**Recipients**		
Diseases	Donor	Recipients		
Acute Respiratory Infections	Australia	Afghanistan	Gabon	Nicaragua
Dengue	Austria	Albania	Gambia	Niger
Diarrhoeal Diseases	Belgium	Algeria	Georgia	Nigeria
Filariasis	Canada	Angola	Ghana	North Korea
HIV	Denmark	Argentina	Guatemala	Oman
Malaria	Finland	Armenia	Guinea	Pakistan
Measels	France	Azerbaijan	Guinea-Bissau	Panama
Polio	Germany	Bahrain	Guyana	Papua New Guinea
Schistosamiasis	Greece	Bangladesh	Haiti	Paraguay
Tetnus	Ireland	Belarus	Honduras	Peru
Trypanosomiasis	Italy	Benin	Hungary	Philippines
Tuberculosis	Japan	Bhutan	India	Qatar
	Korea	Bolivia	Indonesia	Romania
	Luxembourg	Bosnia-Herzegovina	Iran	Rwanda
	Netherlands	Botswana	Iraq	Saudi Arabia
	New Zealand	Brazil	Israel	Senegal
	Norway	Bulgaria	Jamaica	Sierra Leone
	Portugal	Burkina Faso	Jordan	Singapore
	Spain	Burundi	Kazakhstan	Slovak Republic
	Sweden	Cambodia	Kenya	Slovenia
	Switzerland	Cameroon	Korea	Solomon Islands
	United Kingdom	Cape Verde	Kuwait	Somalia
	United States	Central African Rep.	Kyrgyz Republic	South Africa
		Chad	Laos	Sri Lanka
		Chile	Latvia	Sudan
		China	Lebanon	Suriname
		Colombia	Lesotho	Swaziland
		Comoros	Liberia	Syria
		Dem. Rep. Congo	Libya	Tajikistan
		Rep. Congo	Lithuania	Tanzania
		Costa Rica	Macedonia	Thailand
		Cote D'Ivoire	Madagascar	Timor-Leste
		Croatia	Malawi	Togo
		Cuba	Malaysia	Trinidad and Tobago
		Cyprus	Mali	Tunisia
		Czech Republic	Mauritania	Turkey
		Djibouti	Mauritius	Turkmenistan
		Dominican Republic	Mexico	Uganda
		Ecuador	Moldova	Ukraine
		Egypt	Mongolia	United Arab Emirates
		El Salvador	Montenegro	Uruguay
		Equatorial Guinea	Morocco	Uzbekistan
		Eritrea	Mozambique	Venezuela
		Estonia	Myanmar	Viet Nam
		Ethiopia	Namibia	Yemen
		Fiji	Nepal	Zambia
				Zimbabwe

4 Disease, Donors, and Recipients in Sample

4.1 Coding

I distinguished allocations directed specifically at disease control from other forms of health aid, such as basic health care and health personnel development. I then examined the descriptions of allocation purposes and identified cases that provided aid for a specific disease and coded these accordingly.

Because many diseases are linked or occur in conjunction with one another, more than 5,000 of these cases addressed more than one disease. Unfortunately, in most of these cases the information available does not include the distribution of resources across multiple diseases. To address this issue, I duplicated these cases and treated the full amount as a separate allocation for each disease. For example, if an allocation of $1,000,000 was made for HIV/AID, tuberculosis, and malaria, I created three separate cases — one for HIV/AIDS, one for tuberculosis, and one for malaria — each for $1,000,000. Among grants directed at more than one disease, 93% were directed at more than one diseases specified by the Millennium Development Goals. Thus, I use a control variable for Millennium Development Goals to help minimize the potential impact of duplicate cases. In addition, I also created a second dataset which excluded these cases and included only cases that specify a single disease. I ran all of my analyses on these data as well to identify the potential impact of duplicating cases. The results are reported in this reviewers appendix and do not vary substantially from the results reported in the manuscript.

4.2 Measures of Burden of Disease

There are many potential measures that could be used for disease burden, including infection rates and death rates. Selecting a measure requires careful consideration of how the burden of disease should be measured. The most obvious negative effects of disease are the premature loss of life and the development of disabilities. While infection rates and death rates provide information about the proportion of a population affected by a disease, they fail to account for the aggregated burden of the disease. For example, the death of a 5 year old as a result of acute respiratory infection is counted as the same level of burden as the death of an 80-year-old. Although, in terms of count, this is accurate, death rates fail to account for the added “bad” associated with premature deaths. Likewise, infection rates provide an accurate measure of the proportion of a population that is afflicted but fails to account for differing levels of harm from infection. In the manuscript, I account for these concerns by using disability-adjusted life years as the measure of disease burden.

Disability-adjusted life year is not the only possibly measure of disease burden. Each measure has

Table 2: Summary Statistics for Variables Included in Heckman Models

	Obs.	Mean	Min	Max	Std. dev
Dependent Variables					
Aid (Dichotomous)	38640	0.039	0	1	0.193
Proportion Multi-Bilateral	1499	0.188	0	1	0.348
Theoretical Independent Variables					
Global burden of disease	38640	1.841	0.001	6.273	2.22
Donor burden of disease	38640	37.466	0	757.957	94.120
Recipient burden of disease	38640	844.416	0	29581.14	2376.431
Global Disease Number Donors	38640	10.333	2	23	7.8032
Recipient Disease Number Donors	38640	0.8922	2	20	0.8923
Rec Donors x Rec Burden	38640	3157.88	0	534008.1	23951.8
Cost/DALY averted	38640	949.912	7	3929.107	1079.186
Vaccine Preventable Disease	38640	0.25	0	1	0.433
Vector-borne illness	38640	0.417	0	1	0.493
ln Trade	34188	5.764	0	14.559	2.684
ln Migration	36240	0.254	0	4.331	0.527
Control Variables					
Millennium Development Goals	38640	0.25	0	1	0.433
Governance	37536	-0.401	-2.18	2.14	0.734
ln GDP/cap	36984	1.243	0.145	4.063	0.890
HIV/AIDS	38640	0.833	0	1	0.276

strengths and weaknesses. Because there are numerous potential measures, I also test the models using a second measure of disease burden — mortality — and report the results in this reviewers' appendix. Mortality rate is the number of deaths caused by a disease divide by the population at risk. It is used here as a robustness check. The results are reported in the next section

5 Alternative Specifications of Empirical Models

5.1 Bilateral Aid Multilevel Regressions and Probits

For the most part, the paper attempts to test theory regarding the motivations for using multi-bilateral channels for foreign aid funds. Nevertheless, readers may find models predicting when bilateral channels are chosen vs. multi-bilateral and "other" channels, illuminating, despite the relative silence of the theory in this paper about when countries specifically give bilaterally. Note that since there are two omitted categories that are not bilateral channel proportion of aid given, there is no reason to expect that the bilateral and multi-bilateral regressions and probits would be perfect mirror images of one another, though in practice there are somewhat opposed patterns of coefficient signs and significance levels. Tables 3 and 4 are models with similar specifications to the multibilateral specifications presented in the text, with a hierarchical random

Table 3: Predicting Proportion of Aid Through Bilateral Channels

	Model 1		Model 2	
	Coefficient	Std Error	Coefficient	Std Error
Donor burden of disease	0.00097***	(0.00023)	0.00081***	(0.00024)
Global Burden of Disease	-0.03657***	(0.01022)	-0.03385***	(0.01093)
Recipient burden of disease	0.00000	(0.00000)	0.00000	(0.00000)
Donors in Rec.2	0.00602***	(0.00192)		
Governance	-0.00230	(0.02577)	-0.00397	(0.02579)
Cost of treatment	0.00005***	(0.00001)	0.00005***	(0.00002)
Vector	0.10057***	(0.03805)	0.09144**	(0.03929)
Vaccine	-0.11406***	(0.04300)	-0.12089**	(0.05193)
ln Trade	0.02712***	(0.00565)	0.02787***	(0.00568)
ln Migration	-0.02616	(0.02059)	-0.02770	(0.02059)
Millennium Development Goal HIV/AIDS			0.06466	(0.03950)
Donors in Rec.			-0.00467	
Rec. Burden X Donors in Rec.			-0.00000	(0.00000)
intercept	-0.04751	(0.06634)	0.02168	(0.05364)
N	1,414		1,414	

† Dependent variable is proportion of bilateral aid, conditional on receiving any bilateral aid. Donor-recipient-disease triad unit of analysis.

‡ All models are multilevel linear regressions. Models contain random intercepts for the recipient-donor dyad and recipient country. Estimates of random intercepts included as panel controls are omitted from tables.

*** p-value less than .01

** p-value less than .05

* p-value less than .10

intercept structure and similar variations in independent variables.

Table 4: Predicting Receipt of Bilateral Aid

	Model 3	
	Coefficient	Std Error
Recipient burden of disease	0.00009***	(0.00000)
Donor burden of disease	0.00216***	(0.00060)
Global Burden of Disease	-0.27556***	(0.03961)
ln GDP/capcap * -1.46314***	(0.15958)	
Governance	0.05903	(0.15497)
ln Migration	0.15019*	(0.08110)
ln Trade	0.41816***	(0.03196)
Cost of treatment	-0.00073***	(0.00016)
HIV/AIDS	3.94801***	(0.47216)
Vector	-0.91628***	(0.20190)
Vaccine	-0.75034***	(0.25429)
Millennium Development Goal	1.50920***	(0.13116)
intercept	-4.39721***	(0.39253)
N	32,064	

† Dependent variable is whether a country received any bilateral aid (1/0), at the donor-recipient-disease triad unit of analysis.
‡ Model 3 is a multilevel probit. Model contains random intercepts for recipient-donor dyad and recipient country. Estimates of random intercepts included as panel controls are omitted from tables.
*** p-value less than .01
** p-value less than .05
* p-value less than .10

5.2 Heckman Two-Step Model

Within the data set, there are many instances in which a potential recipient receives no aid for a specific disease, resulting in a 0 for both the total amount of aid and the proportion of multi-bilateral aid. However, there are also observations in which a recipient receives aid for a specific disease, but none of the aid is direct through multi-bilateral channels. These observations will also have a measure of 0 for proportion of multi-bilateral aid. These two instances reporting the same value for multi-bilateral aid should not be considered equivalent. Instead, there is a clear selection process that must be accounted for in the analysis. Thus, this study uses a Heckman two-stage model to address the selection process while also modeling the final decisions regarding how to partition aid across different channels.

The Heckman two-step model assumes that the processes at the first stage is separate from the second stage process. Although the use of maximum-likelihood estimation may create a sufficiently distinct selection stage, the use of exclusion restrictions is recommended for more robust identification (Brandt and Schenider, 2004). For this study, I use two exclusion restrictions. First, I use log of a recipient's average GDP per capita in constant 2000 US dollars as reported by the World Bank's World Development Indicators database (World Bank, 2015). The log of GDP per capita is appropriate because, while recipient need is often used as

a predictor of whether a recipient receives aid, there is no reason to expect a recipient's wealth would affect how much aid is directed through multi-bilateral channels.

Second, I also use HIV/AIDS as an exclusion restriction. Table 2 clearly illustrates that HIV/AIDS is unique among the diseases addressed in this study and receives a disproportionately large amount of aid. Although HIV/AIDS may be an outlier in the likelihood of receiving aid and the amount of aid received, there is no reason to expect HIV/AIDS to have a disproportionate impact on the proportion of aid delivered through multi-bilateral channels. Thus, I use a dichotomous variable for HIV/AIDS as an exclusion restriction in the selection stage of the statistical models. As a test of the assumption that HIV/AIDS should not have a disproportionate impact on aid delivered through multi-bilateral channels, I ran all analyses with HIV/AIDS in the second stage. The results remained unchanged.

In the following six tables, I include models predicting proportion of aid by channel and whether aid was distributed to that observation via any channel. This section includes 6 tables. The first table reports summary statistics for variables used in the paper. The other 4 tables report alternative specifications of the empirical models. Each of tables includes Heckman models of multi-bilateral, bilateral, and other bypass aid. The first table reports the findings from the paper. The second table reports the results of 3 Heckman models that are identical to the models used in the paper, but using the data set with duplicate allocations removed. The third table reports the results of 3 Heckman models that use the same data as used for the paper, but with log of GDP per capita and Recipient burden of disease included in the second stage of the Heckman model. The fourth and final table reports the results of 3 Heckman models identical to the models used in the paper, but using data with HIV/AIDS allocations removed. Thus, the data used for this last table includes on 11 diseases. Overall, the results are extremely similar to the results presented in the main text of the paper, both in direction and size of effect.

Critically, none of the multi-bilateral Heckman model ρ pass the 0.10 level of significance in a χ^2 test, indicating that all multi-bilateral proportion models are unlikely to exhibit significant sample selection bias. By contrast, some tangential models predicting bilateral selection and proportion given bilaterally are statistically significant and different from zero, but still exhibit relatively similar coefficients to their multilevel counterparts that do not model sample selection.

Table 5: Heckman Models of Proportion of Aid Through Multi-Bilateral Channels

Variable	Model 4		Model 5		Model 6	
	stage 1	stage 2	stage 1	stage 2	stage 1	stage 2
Global Burden of Disease	-0.100773***	.0410***	-0.1003***	0.037***	-0.1006***	0.032***
	(0.0179)	(.0099)	(0.0179)	(0.0103)	(0.0179)	(0.0111)
Donor Burden of Disease	0.0003	-0.00003	.00026	0.00008	.00026	0.00005
	(.0003)	(0.0002)	(.0004)	(0.0002)	(.0003)	(0.0002)
Recipient Burden of Disease	0.00007***	-0.000002	0.00007***	-0.0000004	0.00007	-0.000002
	(0.0000)	(0.000002)	(.000004)	(0.000004)	(.000004)	(0.000002)
# of Donors by Disease		-0.0103***				-0.0113***
		(0.0022)				(0.0023)
# of Donors by Rec./Disease				-0.000003		
				(0.0034)		
Rec. Burden x				0.00000002		
# of Donors by Rec./Disease				(0.0000002)		
Vaccine	-0.2437**	0.3446***	-0.2437**	0.3825***	-0.2510**	0.2038**
	(.118)	(0.0416)	(0.1180)	(0.0533)	(0.118)	(0.0892)
Vector-borne Illness	-0.5799***	-0.1147***	-0.5799***	-0.09443**	-0.5847***	-0.2138***
	(.09118)	(0.0369)	(0.0912)	(0.0381)	(0.0913)	(0.0667)
Cost/DALY Averted	-0.0004***	-0.00005***	-0.0004***	0.00004***	-0.000425***	-0.0001**
	(0.00007)	(0.00001)	(0.00007)	(0.00002)	(0.00007)	(0.00005)
Ln of Migration	0.1231***	0.0135	0.1232***	0.0185	0.9264***	0.0159
	(0.0260)	(0.013)	(0.0260)	(0.0134)	(0.0569)	(0.0131)
Ln of Total Trade	0.1823***	-0.0027	0.1823***	0.00082	0.1822***	-0.00177
	(0.0079)	(0.0044)	(0.0079)	(0.005)	(0.0079)	(0.0045)
Governance	-0.0087	-0.0682***	-0.0087	-0.0757***	-0.0088	-0.0709***
	(0.0362)	(0.0184)	(0.0362)	(0.019)	(0.0362)	(0.0185)
Millennium Development Goal	0.9291***		0.929***	-0.0744	0.9264***	
	(.05680)		(0.057)	(0.04724)	(0.0569)	
HIV	2.210***		2.2096***		2.223***	0.3008*
	(.0.2134)		(0.2133)		(0.2134)	(0.169)
Ln of Recipient GDP/capita	-0.770***		-0.770***		-0.770***	
	(.0360)		(0.036)		(0.036)	
Rho		0.003		0.1339		.05
Observations		32064		32064		32064
Uncensored Observations		1379		1379		1379
$WaldChi^2$		427.23		399.99		430.24

Table 6: Heckman Models of Proportion of Aid as Bilateral Government-to-Government Transfer

Variable	Model 7		Model 8	
	stage 1	stage 2	stage 1	stage 2
Global Burden of Disease	-0.1007***	-.0437***	-0.1020***	-0.0370***
	(0.0179)	(.0124)	(0.0179)	(0.0131)
Donor Burden of Disease	0.0003	0.0011***	.00027	0.00078***
	(.0004)	(0.0003)	(.0003)	(0.0003)
Recipient Burden of Disease	0.00007***	-0.000001	0.00007***	-0.0000009
	(0.0000)	(0.000002)	(.000004)	(0.000005)
Number of Donors by Disease		0.0008***		
		(0.0028)		
Number of Donors by Rec./Disease				-0.0109***
				(0.004)
Rec. Burden x Donors in Rec.				0.00000008
				(0.0000003)
Vaccine	-0.2634**	-0.1326**	-0.2624**	-0.208***
	(.118)	(0.0523)	(0.117)	(0.0641)
Vector-borne Illness	-0.5928***	0.1086**	-0.5930***	-0.0889**
	(.09109)	(0.0464)	(0.0910)	(0.0477)
Cost/DALY Averted	-0.0004***	0.00003*	-0.0004***	0.00003**
	(0.00007)	(0.00002)	(0.00007)	(0.00002)
Ln of Migration	0.1218***	-0.0479***	0.1208***	-0.0575***
	(0.0260)	(0.0164)	(0.0260)	(0.0167)
Ln of Total Trade	0.1829***	0.0166***	0.1833***	0.0124**
	(0.0079)	(0.0055)	(0.0079)	(0.005)
Governance	-0.0062	0.0384*	-0.0046	0.0517**
	(0.0362)	(0.0231)	(0.0362)	(0.0233)
Millennium Development Goal	0.9200***		0.927***	-0.0744
	(.05663)		(0.057)	(0.0538)
HIV	2.240***		2.247***	
	(.0.2125)		(0.2115)	
Ln of Recipient GDP/capita	-0.774***		-0.777***	
	(.0360)		(0.036)	
Rho		-0.2749		-0.411
Observations		32064		32064
Uncensored Observations		1379		1379
$WaldChi^2$		82.17		92.85

5.3 Heckman Models Using Mortality Measure

As discussed earlier, another way to measure health outcomes besides DALYs is to instead measure mortality rates. The following Heckman models in Table 7-8 use a mortality measure for relevant independent variables (average global, donor, and recipient mortality) instead of disability adjusted life years, with similar results.

Table 7: Heckman Models of Proportion of Aid Through Multi-Bilateral Channels Using Mortality

Variable	Model 9		Model 10		Model 11	
	stage 1	stage 2	stage 1	stage 2	stage 1	stage 2
Average Global Mortality	-3.221***	1.68***	-3.215***	1.097**	-3.1934***	1.546***
	(0.840)	(.473)	(0.8392)	(0.538)	(0.8398)	(0.494)
Average Donor Mortality	0.0004	-0.00014	.00031	0.00256	.00025	0.00159
	(.004)	(0.003)	(.004)	(0.0033)	(.004)	(0.0032)
Average Recipient Mortality	0.0029***	-0.00008	0.00293***	-0.000056	0.00293***	-0.000077
	(0.0002)	(0.00007)	(0.00018)	(0.00007)	(.0002)	(0.000176)
# of Donors by Disease		-0.0096***		-0.0109		
		(0.0022)		(0.0023)		
# of Donors by Rec./Disease						-0.0007
						(0.003)
Rec. Burden x						0.000004
# of Donors by Rec./Disease						(0.00001)
Vaccine	-0.217*	0.3655***	-0.2192*	0.1825**	-0.2108*	0.4088***
	(.121)	(0.0418)	(0.1210)	(0.0912)	(0.121)	(0.0528)
Vector-borne Illness	-0.5795***	-0.789**	-0.5797***	-0.211***	-0.5739***	-0.0586
	(.0933)	(0.0349)	(0.0933)	(0.0681)	(0.0932)	(0.0359)
Cost/DALY Averted	-0.0004***	-0.00005***	-0.0004***	-0.00017***	-0.00039***	-0.00004**
	(0.00007)	(0.00002)	(0.00007)	(0.00005)	(0.00007)	(0.00002)
Ln of Migration	0.12171***	0.0130	0.1215***	0.0159	0.1213***	0.0177
	(0.0260)	(0.013)	(0.0260)	(0.0131)	(0.0260)	(0.0134)
Ln of Total Trade	0.1818***	-0.003	0.1819***	-0.00184	0.1820***	0.00036
	(0.0079)	(0.004)	(0.0079)	(0.004)	(0.0079)	(0.0047)
Governance	-0.0216	-0.0679***	-0.02114	-0.0704***	-0.0211	-0.0757***
	(0.0362)	(0.0183)	(0.0362)	(0.018)	(0.0362)	(0.0190)
Millennium Development Goal	0.9068***		0.905***		0.9077***	-0.0591
	(.05434)		(0.054)		(0.0546)	(0.0461)
HIV	2.077***		2.080***	0.388**	2.063***	
	(.0.2193)		(0.2192)	(0.172)	(0.2193)	
Ln of Recipient GDP/capita	-0.778***		-0.769***		-0.770***	
	(.0361)		(0.036)		(0.036)	
Rho		0.005		0.049		.119
Observations		32064		32064		32064
Uncensored Observations		1379		1379		1379
$WaldChi^2$		424.33		429.66		399.02

Table 8: Heckman Models of Proportion of Aid Through Bilateral Channels Using Mortality

Variable	Model 12		Model 13		Model 14	
	stage 1	stage 2	stage 1	stage 2	stage 1	stage 2
Global Burden of Disease	-3.219***	-1.796***	-3.201***	-1.98***	-3.277***	-1.574**
	(0.838)	(0.595)	(0.839)	(0.678)	(0.8384)	(0.617)
Donor Burden of Disease	0.0002	0.012***	.0001	0.013***	.00044	0.0086**
	(.004)	(.004)	(.0004)	(0.004)	(.004)	(0.004)
Recipient Burden of Disease	0.0029***	-0.00008	0.0029***	-0.00007	0.0029***	0.00003
	(0.0002)	(0.0001)	(0.00018)	(0.00009)	(.0002)	(0.0002)
# of Donors by Disease		-0.0002***		-0.0006		
		(0.0027)		(0.0028)		
# of Donors by Rec./Disease						-0.011***
						(0.004)
Rec. Burden x						-0.000003
# of Donors by Rec./Disease						(0.00001)
Vaccine	-0.232*	-0.160***	-0.226**	-0.218*	-0.232*	-0.237***
	(.120)	(0.0527)	(0.121)	(0.114)	(0.120)	(0.064)
Vector-borne Illness	-0.588***	0.0665	-0.584***	0.0246	-0.589***	0.054
	(.0931)	(0.0439)	(0.0933)	(0.0854)	(0.0929)	(0.0450)
Cost/DALY Averted	-0.0004***	0.00004**	-0.0004***	0.000007	-0.0004***	0.00004**
	(0.00007)	(0.00002)	(0.00007)	(0.00007)	(0.00007)	(0.00002)
Ln of Migration	0.1199***	-0.0466***	0.120***	-0.456***	0.119***	-0.0571***
	(0.0260)	(0.0165)	(0.0260)	(0.0165)	(0.0260)	(0.0167)
Ln of Total Trade	0.1825***	0.0187***	0.1825***	0.0190***	0.1829***	0.014**
	(0.0079)	(0.0055)	(0.0079)	(0.006)	(0.0079)	(0.0055)
Governance	-0.0185	0.0354	-0.0184	0.0346***	-0.0169	0.049**
	(0.0362)	(0.0232)	(0.0362)	(0.0232)	(0.0361)	(0.0233)
Millennium Development Goal	0.898***		0.899***		0.9047***	-0.094*
	(.0542)		(0.054)		(0.0541)	(0.053)
HIV	2.097***		2.085***	0.123		
	(0.2182)		(0.219)	(0.216)		
Ln of Recipient GDP/capita	-0.774***		-0.773***		-0.777***	
	(.0360)		(0.036)		(0.036)	
Rho		-0.27		-0.258		-.414
Observations		32064		32064		32064
Uncensored Observations		1379		1379		1379
$WaldChi^2$		74.52		74.95		88.39

5.4 Duplicate Counting

As discussed earlier, there were several potential choices for counting grants which had multiple diseases targeted. In the text, I made a choice to count the grant toward both diseases. Here, to check the robustness of that decision, in Table 9-10, I present Heckman models predicting a multibilateral and bilateral aid variable which only counts those disease grants which had a single, identifiable target disease. These Heckman models do not differ significantly due to the way grants targeting multiple diseases were counted.

Table 9: Heckman Models of Proportion of Aid Through Multi-Bilateral Channels with duplicates excluded

Variable	Model 15		Model 16		Model 17	
	stage 1	stage 2	stage 1	stage 2	stage 1	stage 2
Global Burden of Disease	-0.1198***	0.0308**	-0.1198***	0.03*	-0.198***	0.035**
	(0.0238)	(.0134)	(0.024)	(0.0155)	(0.0238)	(0.0146)
Donor Burden of Disease	0.0006	0.00002	.00067	0.00002	.00067	0.00004
	(.0004)	(0.0002)	(.0004)	(0.0002)	(.0004)	(0.0002)
Recipient Burden of Disease	0.00007***	-0.000002	0.00007***	-0.000002	0.00007***	-0.0000004
	(0.0000)	(0.000002)	(.000004)	(0.000002)	(.000004)	(0.000004)
# of Donors by Disease		-0.0055**		-0.006**		
		(0.0027)		(0.003)		
# of Donors by Rec./Disease						-0.002
						(0.003)
Rec. Burden x						-0.00000005
# of Donors by Rec./Disease						(0.0000003)
Vaccine	-0.1187	0.5198***	-0.118	0.501***	-0.118	0.476***
	(.156)	(0.0545)	(0.156)	(0.129)	(0.156)	(0.074)
Vector-borne Illness	-0.539***	-0.0169	-0.539***	-0.03	-0.5389***	-0.034
	(.1262)	(0.0369)	(0.126)	(0.095)	(0.126)	(0.054)
Cost/DALY Averted	-0.0006***	-0.00003***	-0.0006***	-0.00004	-0.0006***	-0.00003
	(0.0001)	(0.00002)	(0.0001)	(0.00008)	(0.0001)	(0.00002)
Ln of Migration	0.0919***	-0.0007	0.092***	-0.0005	0.920***	-0.0006
	(0.0300)	(0.014)	(0.03)	(0.0144)	(0.030)	(0.0144)
Ln of Total Trade	0.1821***	0.001	0.1821***	0.0011	0.1820***	0.0011
	(0.009)	(0.0047)	(0.009)	(0.005)	(0.009)	(0.0048)
Governance	0.0015	-0.0653***	0.0150	-0.065***	0.0152	-0.0625***
	(0.0415)	(0.0196)	(0.0415)	(0.02)	(0.0415)	(0.0198)
Millennium Development Goal	1.040***		1.04***		1.040***	-0.117*
	(.0759)		(0.076)		(0.0759)	(0.0625)
HIV	3.017***		3.016***	0.041	3.016***	
	(0.289)		(0.29)	(0.25)	(0.289)	
Ln of Recipient GDP/capita	-0.860***		-0.806***		-0.806***	
	(.0417)		(0.042)		(0.042)	
Rho		-0.07		-0.07		-0.091
Observations		32064		32064		32064
Uncensored Observations		1094		1094		1094
$WaldChi^2$		464.14		464.10		463.99

Table 10: Heckman Models of Proportion of Aid Through Bilateral Channels with Duplicates Excluded

Variable	Model 18		Model 19		Model 20	
	stage 1	stage 2	stage 1	stage 2	stage 1	stage 2
Global Burden of Disease	-0.1210***	-0.0506***	-0.1202***	-0.064***	-0.1212***	-0.0569***
	(0.0239)	(.018)	(0.0238)	(0.021)	(0.0238)	(0.0194)
Donor Burden of Disease	0.0007	0.001***	0.0007	0.001***	0.0007	0.0008**
	(.0004)	(0.0003)	(.0004)	(0.0003)	(0.0004)	(0.0003)
Recipient Burden of Disease	0.00007***	0.0000004	0.00007***	0.000001	0.00007***	0.000003
	(0.0000)	(0.000003)	(0.000005)	(0.000003)	(.000004)	(0.000005)
# of Donors by Disease		0.008**		0.006*		
		(0.004)		(0.004)		
# of Donors by Rec./Disease						-0.014***
						(0.005)
Rec. Burden x						0.0000007
# of Donors by Rec./Disease						(0.0000004)
Vaccine	-0.125	-0.265***	-0.116	-0.470***	-0.133	-0.214**
	(.156)	(0.074)	(0.156)	(0.172)	(0.156)	(0.0997)
Vector-borne Illness	-0.5449***	0.240	-0.538***	-0.119	-0.5508***	0.0626
	(.127)	(0.066)	(0.126)	(0.127)	(0.126)	(0.0712)
Cost/DALY Averted	-0.0006***	0.00001	-0.0006***	-0.00013	-0.00058***	0.00004
	(0.0001)	(0.00003)	(0.0001)	(0.0001)	(0.0001)	(0.00003)
Ln of Migration	0.091***	-0.033*	0.091***	-0.031	0.0896***	-0.0424**
	(0.030)	(0.019)	(0.03)	(0.0194)	(0.030)	(0.019)
Ln of Total Trade	0.1821***	0.0200***	0.1822***	0.021***	0.1824***	0.0168**
	(0.009)	(0.006)	(0.009)	(0.007)	(0.009)	(0.0065)
Governance	0.013	0.0115	0.0141	-0.002	0.0142	0.0137
	(0.0415)	(0.0265)	(0.041)	(0.027)	(0.0414)	(0.027)
Millennium Development Goal	1.041***		1.042***		1.038***	0.145*
	(.076)		(0.076)		(0.0759)	(0.084)
HIV	3.034***		3.014***	0.449	3.046***	
	(.0.2899)		(0.290)	(0.341)	(0.289)	
Ln of Recipient GDP/capita	-0.803***		-0.805***		-0.806***	
	(.0417)		(0.042)		(0.0415)	
Rho		-0.193		-0.154		-0.318
Observations		32064		32064		32064
Uncensored Observations		1094		1094		1094
$WaldChi^2$		93.97		95.93		108.35

6 Models using Yearly Data (Tetrads)

A final potential option and robustness check is to test the aforementioned hypotheses, but adding a yearly dimension instead of aggregating across years as all the rest of the models in this paper have done. While I strongly warn against this approach, I, nevertheless, present the results of this approach here.

There are a number of reasons to be cautious about disaggregating time in the current analysis. On a practical level, aggregating across donor/recipient/disease triad was the result of data availability. Collecting data on burden of disease, and specifically more nuanced measures that account not only for death but other lasting costs of diseases represents significant work. The most systematic data collection efforts were sponsored by the World Health Organization every 4 years and published as the World Health Observatory's reports on disease burden and mortality, which is what I use in the main text. Because these were published every 4 years, using them requires an aggregated model.

On the other hand, it is true that the Institution for Health Metrics and Evaluation now produces yearly estimates of burden of disease through its "Global Burden of Disease" project. While these data are undoubtedly useful, and will become more so, I opt to use the WHO's disease burden and mortality data and an aggregated model for several reasons. The most significant issue, especially for this paper, is that the IHME data did not include all 12 of the diseases I included here in my data collection. Since I argue that much of the theoretically interesting variance in the data is produced by variations across disease type, the data is not really suitable to my paper as it loses the precious, theoretically interesting, variation from several diseases.

The second, practical, reason is because of the problem of non-random missing data in the IHME data when considered as a yearly project. Coding protocols for the IHME Global Burden of Disease data require teams of researchers to collect, evaluate, and record granular local level data from each country, for each disease. The available data varies systematically based on countries capacity to record and report on disease effects, compared to the WHO report which tends to be comprehensive—but not yearly. As a result, treating the data as yearly poses problems for drawing conclusions from model coefficients at the tetrad year-disease-donor-recipient unit.

Nevertheless, I do perform longitudinal models with only 10 diseases in Tables 11-15, including multilevel regressions of the type discussed in the main text, despite these issues. The sheer size of the dataset rendered multilevel probits with dyad and recipient difficult to converge; unlike the main text models, all results here, even for binary variables, are multilevel linear regressions. I collected the IHME data, created a new dataset, and ran multilevel models using donor/recipient/disease/year tetrad as my unit of analysis with fixed effects

for year in addition to random intercepts for recipient and donor-recipient dyad. The issue of missing data immediately looms large and renders any interpretation relative to the aggregated results somewhat difficult. When using a donor/recipient/disease/year tetrad as the unit of analysis, my dataset included 231,840 cases. However, when I model whether or not units received multi-bilateral aid, the model included only about 58,000 cases due to swathes of missing data, particularly in the directions of trade and migration variables. As a result of these issues, I have opted to use an aggregated model in the paper, but report the 15 models in the reviewer's appendix for curious readers.

Table 11: Predicting whether foreign aid received, tetrad dyad/disease/year

	Model 21		Model 22		Model 23	
	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error
Recipient burden of disease	0.0000***	(0.0000)	0.0000***	(0.0000)	-0.0000***	(0.0000)
Donor burden of disease	0.0005***	(0.0000)	0.0011***	(0.0000)	0.0011***	(0.0000)
Global burden of disease	-0.0000***	(0.0000)	0.0000***	(0.0000)	0.0001***	(0.0000)
Vaccine	0.0380***	(0.0022)	0.0090***	(0.0031)	0.0101***	(0.0030)
Vector	0.0299***	(0.0018)	0.0166***	(0.0023)	0.0174***	(0.0023)
Millennium Development Goal	0.0335***	(0.0014)	-0.0559***	(0.0057)	-0.0524***	(0.0057)
HIV/AIDS	0.0650***	(0.0032)	-0.0431***	(0.0049)	-0.0459***	(0.0049)
Cost of treatment	0.0000	(0.0000)	0.0000*	(0.0000)	0.0000	(0.0000)
Number of Donors			0.0124***	(0.0003)	0.0109***	(0.0003)
Rec. Burden X Number of Donors					0.0000***	(0.0000)
ln Trade	-0.0023*	(0.0012)	-0.0011	(0.0014)	-0.0011	(0.0014)
ln Migration	0.0039***	(0.0004)	0.0031***	(0.0004)	0.0029***	(0.0004)
Governance	0.0008	(0.0013)	-0.0003	(0.0011)	-0.0011	(0.0011)
ln GDP/cap	-0.0019**	(0.0008)	0.0026***	(0.0007)	0.0010	(0.0007)
intercept	-0.0223**	(0.0102)	-0.0496***	(0.0107)	-0.0371***	(0.0107)
N	65,131		53,289		53,289	

† Dependent variable is whether a country received any aid, at the dyad-disease-year tetrad unit of analysis.
‡ Models contain fixed effects for year, with the year 2011 omitted as the reference year. All models also contain random intercepts for the country dyad and recipient country. Estimates of fixed and random effects included as panel controls are omitted from tables.
*** p-value less than .01
** p-value less than .05
* p-value less than .10

Table 12: Predicting whether multi-bilateral foreign aid received, tetrad dyad/disease/year

	Model 24		Model 25		Model 26	
	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error
Recipient burden of disease	0.0000***	(0.0000)	-0.000***	(0.0000)	-0.0000***	(0.0000)
Donor burden of disease	0.0001***	(0.0000)	0.0002***	(0.0000)	0.0002***	(0.0000)
Global burden of disease	-0.0000***	(0.0000)	0.0000**	(0.0000)	0.0000**	(0.0000)
Vaccine	0.0088***	(0.0011)	0.0045***	(0.0015)	0.0046***	(0.0015)
Vector	0.0060***	(0.0009)	0.0044***	(0.0011)	0.0045***	(0.0011)
Millennium Development Goal	0.0062***	(0.0007)	-0.0086***	(0.0029)	-0.0082***	(0.0029)
HIV/AIDS	0.0167***	(0.0016)	-0.0049**	(0.0025)	-0.0053**	(0.0025)
Cost of treatment	-0.0000	(0.0000)	-0.0000	(0.0000)	-0.0000	(0.0000)
Number of Donors			0.0031***	(0.0001)	0.0029***	(0.0001)
Rec. Burden X Number of Donors					0.0000***	(0.0000)
ln Trade	-0.0001	(0.0005)	0.0002	(0.0006)	0.0002	(0.0006)
ln Migration	0.0016***	(0.0002)	0.0016***	(0.0002)	0.0015***	(0.0002)
Governance	-0.0005	(0.0005)	-0.0009*	(0.0006)	-0.0010*	(0.0006)
ln GDP/cap	-0.0003	(0.0003)	0.0010***	(0.0003)	0.0008**	(0.0003)
intercept	-0.0086***	(0.0041)	-0.0190***	(0.0050)	-0.0172***	(0.0050)
N	65,131		53,289		53,289	

† Dependent variable is whether a country received any multi-bilateral aid, at the dyad-disease-year tetrad unit of analysis.
‡ Estimates of fixed and random effects included as panel controls in all models and estimates are omitted from tables. Models contain fixed effects for year, with the year 2011 omitted as the reference year. All models also contain random intercepts for the country dyad and recipient country, random slopes for dyad logged trade and dyad logged migration, and random slopes for recipient Governance score and logged recipient gdp per capita.
*** p-value less than .01
** p-value less than .05
* p-value less than .10

Table 13: Predicting whether bilateral foreign aid received, tetrad dyad/disease/year

	Model 27		Model 28		Model 29	
	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error
Recipient burden of disease	0.0000***	(0.0000)	0.0000***	(0.0000)	-0.0000***	(0.0000)
Donor burden of disease	0.0004***	(0.0000)	0.0009***	(0.0000)	0.0009***	(0.0000)
Global burden of disease	-0.0000***	(0.0000)	0.0000***	(0.0000)	0.0000***	(0.0000)
Vaccine	0.0314***	(0.0014)	0.0096***	(0.0020)	0.0102***	(0.0020)
Vector	0.0265***	(0.0012)	0.0136***	(0.0015)	0.0140***	(0.0015)
Millennium Development Goal	0.0243***	(0.0009)	-0.0260***	(0.0038)	-0.0243***	(0.0038)
HIV/AIDS	0.0301***	(0.0021)	-0.0291***	(0.0033)	-0.0305***	(0.0033)
Cost of treatment	0.0000*	(0.0000)	0.0000*	(0.0000)	0.000*	(0.0000)
Number of Donors			0.0049***	(0.0002)	0.0041***	(0.0002)
Rec. Burden X Number of Donors					0.000***	(0.0000)
ln Trade	0.0008	(0.0008)	0.0012	(0.0009)	0.0013	(0.0009)
ln Migration	0.0024****	(0.0002)	0.0019***	(0.0003)	0.0018***	(0.0003)
Governance	0.0011	(0.0007)	0.0008*	(0.0008)	0.0004	(0.0007)
ln GDP/cap	-0.0009**	(0.0004)	0.0009**	(0.0005)	0.0002	(0.0005)
intercept	-0.0356***	(0.0060)	-0.0364***	(0.0069)	-0.0302***	(0.0069)
N	65,131		53,289		53,289	

† Dependent variable is whether a country received any bilateral aid, at the dyad-disease-year tetrad unit of analysis.
‡ Estimates of fixed and random effects included as panel controls in all models and estimates are omitted from tables. Models contain fixed effects for year, with the year 2011 omitted as the reference year. All models also contain random intercepts for the country dyad and recipient country, random slopes for dyad logged trade and dyad logged migration, and random slopes for recipient Governance score and logged recipient gdp per capita.
*** p-value less than .01
** p-value less than .05
* p-value less than .10

Table 14: Predicting proportion multi-bilateral aid of total aid for countries receiving any aid, tetrad dyad/disease/year

	Model 30		Model 31		Model 32	
	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error
Recipient burden of disease	-0.0000	(0.0000)	-0.0000	(0.0000)	-0.0000	(0.0000)
Donor burden of disease	-0.0010***	(0.0002)	-0.0010***	(0.0002)	-0.0010***	(0.0002)
Global burden of disease	-0.0003**	(0.0001)	-0.0006**	(0.0002)	-0.0006**	(0.0002)
Vaccine	0.3871	(0.3001)	0.6405*	(0.3521)	0.6384*	(0.3529)
Vector	-0.1906	(0.2038)	-0.0727	(0.2201)	-0.0744	(0.2207)
Millennium Development Goal	0.1042	(0.1557)	0.4535	(0.2981)	0.4496	(0.3001)
HIV/AIDS	0.7103	(0.4713)	0.6921	(0.4723)	0.6913	(0.4727)
Cost of treatment	-0.0002	(0.0002)	-0.0001	(0.0002)	-0.0001	(0.0002)
Number of Donors			0.0026	(0.0052)	0.0028	(0.0056)
Rec. Burden X Number of Donors					-0.0000	(0.0000)
ln Trade	-0.0176	(0.0430)	-0.0167	(0.0433)	-0.0167	(0.0434)
ln Migration	0.0213**	(0.0104)	0.0219**	(0.0104)	0.0219	(0.0104)
Governance	-0.0828**	(0.0363)	-0.0872**	(0.0369)	-0.0874**	(0.0370)
ln GDP/cap	0.0106	(0.0196)	0.0168	(0.0230)	0.0172	(0.0234)
intercept	0.4367	(0.4254)	0.1644	(0.4721)	0.1619	(0.4730)
N	627		625		625	

† Dependent variable is the proportion of multi-bilateral aid a country received given that it received any aid, at the dyad-disease-year tetrad unit of analysis.
‡ Estimates of fixed and random effects included as panel controls in all models and estimates are omitted from tables. Models contain fixed effects for year, with the year 2011 omitted as the reference year. All models also contain random intercepts for the country dyad and recipient country, random slopes for dyad logged trade and dyad logged migration, and random slopes for recipient Governance score and logged recipient gdp per capita.
*** p-value less than .01
** p-value less than .05
* p-value less than .10

Table 15: Predicting proportion bilateral aid of total aid for countries receiving any aid, tetrad dyad/disease/year

	Model 33		Model 34		Model 35	
	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error
Recipient burden of disease	0.0000	(0.0000)	0.0000**	(0.0000)	0.0000**	(0.0000)
Donor burden of disease	0.0011***	(0.0003)	0.0010***	(0.0003)	0.0010***	(0.0003)
Global burden of disease	0.0000	(0.0002)	0.0002	(0.0003)	0.0002	(0.0003)
Vaccine	0.4511	(0.3859)	0.2747	(0.4516)	0.2425	(0.4514)
Vector	0.4700*	(0.2603)	0.3853	(0.2811)	0.3582	(0.2812)
Millennium Development Goal	0.2136	(0.2003)	0.0084	(0.3818)	-0.0491	(0.3830)
HIV/AIDS	-1.1048*	(0.6007)	-1.0472*	(0.6020)	-1.0692*	(0.6012)
Cost of treatment	0.0004*	(0.0002)	0.0004*	(0.0002)	0.0004*	(0.0002)
Number of Donors			-0.0105	(0.0064)	-0.0062	(0.0070)
Rec. Burden X Number of Donors					-0.0000	(0.0000)
ln Trade	0.0968*	(0.0578)	0.0835	(0.0583)	0.0791	(0.0584)
ln Migration	0.0390***	(0.0142)	0.0378***	(0.0142)	0.0383***	(0.0142)
Governance	0.0207	(0.0441)	0.0380	(0.0453)	0.0346	(0.0453)
ln GDP/cap	-0.0090	(0.0240)	-0.0343	(0.0286)	-0.0246	(0.0292)
intercept	-1.3138**	(0.5524)	-0.8624	(0.6151)	-0.9005	(0.6150)
N	627		625		625	

† Dependent variable is the proportion of multi-bilateral aid a country received given that it received any aid, at the dyad-disease-year tetrad unit of analysis.

‡ Estimates of fixed and random effects included as panel controls in all models and estimates are omitted from tables. Models contain fixed effects for year, with the year 2011 omitted as the reference year. All models also contain random intercepts for the country dyad and recipient country, random slopes for dyad logged trade and dyad logged migration, and random slopes for recipient Governance score and logged recipient gdp per capita.

*** p-value less than .01

** p-value less than .05

* p-value less than .10

7 Dichotomous Models of Receipt of Multi-Bilateral Aid

As a robustness check, Table 16 presents multilevel probits predicting a dichotomous variable of whether an observation received any (1/0) multi-bilateral aid. Includes relevant variables from selection of aid recipient and proportion given to multi-bilateral dependent variable models because it conceptually combines both to test for a different activity. Models results are quite similar to main text probits predicting receiving any disease-specific aid, with some additional positive associations between global and recipient number of donors, and an occasionally confounding effect when atheoretically controlling for HIV/AIDS in Model 3.

Table 16: Predicting Proportion of Aid Through Multi-Bilateral Channels

	Model 36		Model 37		Model 38		Model 39	
	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error	Coefficient	Std Error
Global Burden of Disease	0.09436**	(0.03767)	0.08442**	(0.03686)	-0.03374	(0.04181)	0.08232**	(0.04065)
Donor Burden of Disease	-0.00095	(0.00069)	-0.00056	(0.00070)	0.00088	(0.00007)	-0.00138*	(0.00075)
Recipient Burden of Disease	0.00005***	(0.00000)	-0.00005***	(0.00000)	0.00006***	(0.00000)	0.00008***	(0.00002)
Cost of Treatment	0.00026***	(0.00004)	0.00023***	(0.00005)	-0.00143***	(0.00025)	-0.00006	(0.00006)
Vaccination	1.77500***	(0.15248)	1.84517***	(0.16130)	-0.59668*	(0.33932)	1.01732***	(0.14882)
Global Disease Number Donors	0.08387***	(0.00619)			0.05123***	(0.00663)		
Recipient Disease Number Donors							0.29953***	(0.02174)
Rec Donors x Rec Burden							-0.00001***	(0.00000)
Vector Borne Illness	-0.08999	(0.14491)	-0.14040	(0.13974)	-1.87626***	(0.31491)	-0.37212**	(0.14845)
Trade	0.33424***	(0.03444)	0.31750***	(0.03254)	0.33956***	(0.03522)	0.34375***	(0.04303)
Log GDP/capita	-1.13834***	(0.01562)	-1.08394***	(0.14798)	-1.16778***	(0.16017)	-0.58709***	(0.18479)
Migration	0.35234***	(0.08952)	0.33160***	(0.08475)	0.36467***	(0.09173)	0.45592***	(0.10592)
Governance	-0.25935*	(0.15217)	-0.24382*	(0.14457)	-0.26122***	(0.15578)	-0.55823***	(0.19087)
Millenium Dev Goal Disease			1.42298***	(0.12950)				
HIV/AIDS					5.18229***	(0.70259)		
Intercept	-7.2519***	(0.38338)	-6.44549***	(0.34548)	-4.45988***	(0.50602)	-7.11328***	(0.47089)
N	32,064		32,064		32,064		32,064	

† Dependent variable is whether a country received any from the multi-bilateral channel (1/0), at the donor-recipient-disease triad unit of analysis.
‡ Models are multilevel probits. Model contains random intercepts for recipient-donor dyad and recipient country. Estimates of random intercepts included as panel controls are omitted from tables.
*** p-value less than .01
** p-value less than .05
* p-value less than .10

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