Public Goods and Donor Priorities: The Political Economy of Development Aid for Infectious Disease Control

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Abstract

Over the last two decades, development assistance for health (DAH) has reached record levels. Yet, many developing states continue to struggle with diseases easily prevented and treated in industrialized states. Within the aid literature, DAH has historically been viewed as technical rather than political and has been largely disregarded. I argue that, like other forms of foreign aid, DAH may be subject to political influences; and that identifying those interests requires moving beyond dyad-level conceptualizations of political interests. I apply a public good model to bilateral aid allocations for infectious disease control, using disease characteristics to specify recipients' need and donors' interests. I use an original data set to model disease-specific aid allocations. The results suggest that, within the public goods setting of global disease control, bilateral donors allocate aid to maximize their own payoff. In addition, this analysis provides a theory-driven explanation for poor health outcomes in many developing countries where aid allocations fail to match need.

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1 Introduction

In January 2010, Haiti was struck by a devastating earthquake that left the more than 100,000 dead and much of the capital, Port-au-Prince, in ruins. Many Haitians lost their homes and began living in displacement camps with no water or sewage system. The response, the international community provided a variety of assistance, including humanitarian aid and support personnel, to assist with recovery efforts. In October, the Haitian Ministry of Health reported a serious cholera outbreak approximately 60 miles from the capital. Within a month, cholera had spread throughout the country, causing 60,240 reported cases and 1,415 deaths. Investigations into the source of the outbreak revealed that the strain of bacteria responsible for the epidemic originated in South Asia, was likely introduced by individuals who arrived in Haiti as part of the relief effort, and was facilitated by lack of sanitation in displacement camps(Chin and Waldor, 2011; Cravioto and Nair, 2011). Five years after the earthquake, many displaced Haitian continue to live in camps and the cholera outbreak continues. The Pan American Health Organization (PAHO) estimates that more than 732,000 Haitians have been infected, resulting in nearly 9,000 deaths (Pan American Health Organization, 2015). In addition, cholera cases have spread from Haiti to the Dominican Republic, Cuba, Mexico, Venezuela, and the United States. Haiti has received approximately $90 million dollars of aid for cholera control from October 2010 and June 2015 (*Financial Tracking Services*, 2015).

In December 2013, three years after the start of Haiti's cholera epidemic, a boy in a remote village in Guinea died from an unidentified disease. Within a month, most of the boy's immediate family, as well as several midwives, traditional healers, and hospital staff members had died from the same illness. In March, the World Health Organization identified the illness as Ebola hemorrhagic fever (EHF) and announced a public health emergency of international concern as the disease spread across Guinea's borders into Sierra Leone and Liberia. As of June 2015, the epidemic has resulted more than 27,000 cases in 10 countries, and more than 11,000 deaths. In response to the epidemic, government and non-government donors have provided a total of nearly $3.5 billion in aid (World Health Organization, N.d.*a*). In addition to emergency aid, numerous government and non-government donors have pledged to increase funding for health and disease control in the future. The difference in aid volume in these two cases raises questions about where, when, and why aid for disease control is allocated.

International aid flows for health increased between 1990 and 2012(for Health Metrics and Evaluation, 2014)[1]. These funds make up a substantial portion of spending in the health sector — from 2000 to 2013, DAH comprised an average 13.7% of total health expenditures in non-OECD countries and as much as 92%

[1]More recent analysis indicate a drop in health aid beginning in 2013

in some least developed countries(World Health Organization, N.d.*b*). As a result, allocation decisions have a substantial impact on disease control and general health in developing countries.

Although development aid has drawn considerable attention from political science scholars, little has been directed at development aid for health, and virtually none has addressed disease control. As a development objective, disease control is relatively novel. High infection rates in one country can have tangible effects on other countries through international spread. Likewise, the benefits of disease control and diminished threats of international spread can be enjoyed globally. Using variation in and across diseases, this study examines how the distribution of benefits affects bilateral aid allocations. The results extend the existing literature on donor motivations and aid decisions to disease control and provide new insight to donors' use of aid for the production of public goods.

2 Disease Control and Development Aid for Health

DAH has previously been viewed as a technical or humanitarian endeavor and relatively free of political distortions (Fidler, 2003; Kickbusch, 2003; Lee and Zwi, 2003). Unlike other development objectives, disease control enjoys an unusually high degree of consensus. Disease-specific DAH is directed at clearly identified problems, with known causes, and collectively agreed upon objectives. Money to prevent and treat measles is spent on specific activities such as vaccines and immunization clinics — activities that directly and effectively control the spread of measles. These activities produce measurable improvements. In contrast, other forms of development aid are highly contested. For example, governance aid is subject to ethical and political questions about whether democracy should be promoted, as well as practical questions regarding if and how governance aid may affect democratization.

Although DAH is often viewed as supporting human development, Williamson (2008) indicates that health sector aid does not improve human welfare Williamson (2008). Likewise, despite general consensus regarding the ethical and practical aspects of disease control, some studies suggest that aggregate aid flows do not accurately reflect aggregate and/or regional need, particularly in relation to disease burdens (Global Burden of Disease Project, 2003; Millennium Development Goals Commission on Macroeconomics and Health, 2001; MacKellar, 2005; Shiffman, 2006, 2008; Suhrcke and Michaud, 2005). These findings indicate that aid is not being directed at diseases that affect the most people or cause the most suffering, and suggest that assumptions about the apolitical or technical nature of development aid for health are incorrect. However, these studies do not explain how political factors produce these outcomes.

The competing influences of recipient need and donor interests have been central in foreign aid scholars' attempts to explain distortions in aid allocations (Hook, 1995; Lancaster, 1999). Several studies find that recipient need — generally measured by GDP per capita — is a major motivator for bilateral foreign aid allocations(Schraeder, Hook and Taylor, 1998; Neumayer, 2003*b*; Alesina and Dollar, 2000). This assumes that donors can and do accurately identify the most pressing problems and allocate attention and funding accordingly. In contrast, some argue that donors use bilateral aid to "buy influence" within politically and economically important countries. These studies indicate that measures of a recipient country's strategic value to a donor are an equally, if not more, powerful predictor of bilateral foreign aid allocations (Frey and Schneider, 1986; Schraeder, Hook and Taylor, 1998; Alesina and Dollar, 2000; Neumayer, 2003*a*; Anderson, Hansen and Markussen, 2006; Easterly and Pfutze, 2008).

Applied to DAH, these two models provide a framework that may help explain distortions in aid across diseases. If recipient need is the major motivator for aid, one would expect donors to target the poorest countries — where lack of resources inhibits disease control activities. Many studies examining disease-specific aid flows measure disease burden at the global or regional level, not accounting for recipient-level variation. If the diseases that cause the most harm in the poorest countries are different than those that cause the most harm in the rest of the world, then the supposed distortion may simply be a result of differing levels of aggregation.

In contrast, if donor interest is the major motivator for bilateral aid, donors should seek to satisfy strategic political concerns when allocating DAH. Donor interest is generally conceptualized at the dyad-level — the political and economic importance of the recipient to the donor. Thus, one would expect donors to allocate DAH to strategically important recipients such as trade partners and former colonies, which may explain the previously noted distortions.

Although these models are set up as a dichotomy, the mixed results in the aid literature lead one to reasonably conclude that bilateral aid decisions are the result of a complex set of objectives. Donor's objectives may include both humanitarianism and self-interest, and may vary across development issues or problems. Likewise, a recipient's strategic importance may change according to the donors' objectives. Thus, it is essential to account for more than just recipient level characteristics.

In addition, donors' objectives may affect aid decisions at different stages in the allocation process. The foreign aid decision-making process is composed of two stages — a gatekeeping stage and a decision stage (Schoultz, 1981; Cingranelli and Pasquarello, 1985; McGillivray, 2003; Drury, 2005). In the gatekeeping stage, policymakers winnow the list of potential recipients, systematically excluding some countries. In the

second stage, policymakers decide the level or amount of aid to be provided. Decision-makers may apply different criteria at each stage. For example, donors may use recipient need to limit the pool of recipients, but make decisions about levels of aid based on self-interest. Thus, any theory attempting to examine donor motivations must specify expected behaviors at both stages. The next section uses a public goods model of infectious disease control to flesh out expectations about disease-specific aid allocations. Using expectations from the public goods literature, I establish clear criteria for both self-interest and need-based allocation behaviors.

3 Development aid and Infectious Disease Control

Infectious disease can be thought of as an externality. One country's inability to stop the spread of disease may impose costs on other countries. These costs are not limited to increased morbidity and mortality. In addition to human costs, the spread of disease hampers economic growth and development and is increasingly regarded as a source of instability and a threat to peace (United Nations Security Council, 2000; World Health Organization, 2003, 2007; Garret, 2005; Kirton, 2004). Illness and death undermine economic productivity including reduction in GDP, decreased worker productivity, labor shortages, decreased foreign direct investment, increased financial burdens on households, reduction in per capita income, reduced savings, and increased income inequalities within and across societies (Millennium Development Goals Commission on Macroeconomics and Health, 2001; Sachs and Malaney, 2002; United Nations Security Council, 2000; World Bank, 2004; World Health Organization, 2003, 2007). These effects are evident in Guinea, Liberia, and Sierra Leone, the three countries most affected by the Ebola crisis. All three countries have experienced job losses, smaller harvests, food insecurity and a decline in public services. World Bank estimates suggest that the epidemic will cause a loss of at least $1.6 billion in economic growth in these countries in 2015 (World Bank Group, 2015). In addition, mechanisms used to control the spread of disease, such as quarantines and embargoes, inflict additional costs. For example, embargoes established in response to a reported outbreak of plague in Surat, India in 1994 resulted in India's loss of US$2 billion in trade and tourism (Deodhar and Banerjee, 1998).

Just as the spread of disease can be conceptualized as an externality, the control of infectious disease can be conceptualized as a public good. No single country can control disease entirely by itself. In addition, infectious disease control is both non-rival and non-excludable. One's benefit from low disease spread does not diminish others' benefit. Likewise, individuals and countries cannot be prevented from benefiting from

improved control of disease, regardless of their contribution. For example, the eradication of smallpox that is enjoyed globally and across generations, regardless of contribution to the eradication effort.

In public goods games, each country can invest resources for the production of a public good that is shared by all participants. The size of the public good is determined by the total contributions — the payoff is greatest if every country makes the maximum contribution. In the case of infectious disease control, countries may contribute in three ways. First, countries may invest resources in domestic-level disease control efforts, such as monitoring and reporting, building agency capacity, and treatment programs. Second, countries may invest resources in multilateral efforts, generally through international organizations. For example, the World Health Organization directs a variety of surveillance, reporting, and response efforts, including Flu-net — a global influenza surveillance and reporting system — and the Global Outbreak Alert and Response Network (GORAN) — a network of organizations that provide rapid technical response to outbreaks. Finally, countries may invest resources through foreign aid, to improve disease control capabilities in other countries.

It is beyond the scope of this paper to explain why countries choose one form of contribution over or in addition to another, although it is an interesting question for future research. Instead, this project is limited to explaining how countries that engage in aid for disease control allocate their contributions. When applied to disease-specific DAH, the public goods model can be used to better specify both public good/humanitarian behaviors and donor interest behaviors.

In the basic public goods model, the size of the public good is determined by the amount of resources invested by participants. However, the impact of development aid is conditioned by factors other than quantity (Burnside and Dollar, 2000; Dollar and Levin, 2006; Isham and Kaufmann, 1999). Aid has the greatest impact when directed toward countries with the greatest economic need (United Nations, 2002; Dollar and Levin, 2006). Domestic health systems are the front line of defense against infectious disease, and health system effectiveness is tied to economic development. For developing countries with few resources and weak health systems, controlling infectious disease is a daunting task. Disease-specific DAH is used to strengthen weak health systems and improve disease control capabilities. **Donors seeking to minimize disease spread and maximize the public good would be expected to invest resources in the poorer countries.**

In addition to economic need, the size of the payoff may be conditioned by medical need. Diseases vary in their distribution and severity. Just as the impact of development aid is greatest where economic need is greatest, the impact of disease control interventions should be greatest when targeted at diseases that infect, cripple and kill the most people. **Thus, if donors seek to minimize infectious disease and maximize**

the public good, aid allocations should target diseases causing the greatest global burden.

Although donors may seek to maximize public goods by targeting disease based on global burden, aid allocations based on global burden may be incongruous with the structure of bilateral aid, which is allocated to individuals countries. The most burdensome disease globally may differ from that of a given recipient. In such cases, **donors may seek to maximize the public good by targeting diseases that infect, cripple, and kill the most people in the recipient country.** For example, if a donor is choosing whether to target cholera or measles, and there is currently a severe cholera outbreak affecting a given recipient, investing resources in cholera containment and control will have the greater impact, despite the *global* burden of measles being greater than that of cholera. These differences in disease burden at the global and country levels may explain findings that suggest a distortion between global aggregations of disease burden and aid.

Thus, the theoretical model suggests to the following hypotheses regarding bilateral aid allocations if donors seek to maximize the public good:

Hypothesis 1: Donor governments will provide more disease control aid to the poorest countries.

Hypothesis 2: Donor governments will provide more disease control aid for diseases that cause greater global burden.

Hypothesis 3: Donor governments will provide more disease control aid for diseases that cause greater burden in the recipient state.

In contrast to public good maximization behaviors, disease-specific DAH allocations may reflect donors' attempts to maximize their own benefit rather than the public good. Like other public goods, infectious disease control is subject to collective action problems — namely free-riding. Because no country can be prevented from enjoying decreased infection rates, some countries may choose not to contribute through development aid while still partaking of the benefits produced by other donors' contributions. However, while free-riding may explain why some countries choose to give aid and others do not, it fails to explain distortions in DAH allocations across diseases. One must also incorporate pay-off asymmetries across countries and across diseases. These payoff asymmetries allow for a more refined specification donor interest.

Although no country can be excluded from the benefits of global disease control, the distribution of benefits is not uniform. Countries that are targeted for interventions receive the greatest direct benefit — improvement in domestic health. All other countries enjoy a smaller benefit — decreased threat of international spread of disease from the targeted countries. The relative size of this smaller benefit for

each country is conditioned by the likelihood of a disease spreading to that country from a target country. Because disease spread is facilitated by the movement of people and goods, trade and migration a key modes of disease transmission. For countries that have few trade and migration ties to the target country, the marginal benefit is relatively small. In contrast, the marginal benefit is relatively large for countries that have many interactions with the target country. **Thus, if donors attempt to maximize their individual payoff, aid allocations should target countries with which they engage in more trade, as well as the countries from which more of their immigrants originate.**[2]

Variation in the distribution and severity of diseases also creates payoff asymmetries. For example, HIV/AIDS occurs in every country, with approximately 33 million individuals infected globally (World Health Organization, 2003; Global Burden of Disease Project, 2003; Joint United Nations Programme on HIV/AIDS, 2008). Because symptoms may not appear for 8-10 years after infection and individuals may be unaware of infection, it moves across borders with relative ease. Interventions that decrease HIV/AIDS infections also decrease the risk of spread across borders. As a result, all countries enjoy the marginal benefits of HIV/AIDS control. In contrast, schistosomiasis — which can cause chronic illness, increased risks of cancer, nervous system lesions, damage to internal organs and is the second most socioeconomically damaging parasitic disease in the world — is caused by a blood fluke and cannot be transmitted directly from one person to another. The fluke requires a freshwater snail as an intermediate host (Weisbrod et al., 1973). Thus, schistosomiasis is geographically limited to areas hospitable to these snails — specifically, areas where water temperatures remain between 10C and 35C year round(Weisbrod et al., 1973; World Health Organization, 2004; Hotez, 2008). The benefits of controlling schistosomiasis are distributed only among the subset of countries within the geographic range of the disease; there are no marginal benefits to be enjoyed by countries outside of this range. **If donors seek to maximize their own benefit through disease control DAH, aid allocations should target diseases that most affect populations in the donor state.**

Examining disease-specific DAH adds a useful refinement to donor-interest and provides a more complete explanation of potential aid distortions across disease. Many vector-borne diseases, like schistosomiasis and trypanosomiasis, are limited by the geographic range of their intermediary host. Likewise, many developing countries continue to struggle with diseases that are easily prevented and/or treated in industrialized countries. Millions of people in developing countries die each year from measles, acute respiratory infections,

[2]Alternatively, disease control could be conceptualized as a club good — non-rival but excludable. The distinction between spatial asymmetries and exclusion is ambiguous and does not change the theory-based expectations of donor behavior. See reviewer's appendix for further discussion.

malaria, and diarrheal diseases, while economic and medical advancements and public health programs have minimized their impact in developed countries.[3] If allocation decisions are intended to maximize the donor's payoff, one would expect these diseases to receive less aid, regardless of global and recipient need.

Thus, the theoretical model suggests to the following hypotheses regarding bilateral aid allocations if donors seek to maximize their own benefits:

Hypothesis 4: Donor governments will provide more aid to countries with which they do more trade

Hypothesis 5: Donor governments will provide more aid to countries from which more of their migrants originate

Hypothesis 6: Donor governments will provide more aid for diseases that cause greater burden in the donor state

I test these hypotheses using an original data set and a series of Heckman selection models.

4 Data and Research Design

The two models described in the previous section use variation in disease impact in both the donor and recipient countries to differentiate aid allocation behaviors. I use donor-recipient-disease triad as the unit of analysis to account for recipient and disease factors that may influence donors' decisions. To construct the data set, I began with donor-recipient dyads comprised of the 23 members of the OECDs Development Assistance Committee[4] and 139 potential recipients. I then identified 14 infectious diseases that account for large numbers of disability and death within developing states and for which burden of disease is calculated by the Global Burden of Disease Project and the World Health Organization. Thus, my population is comprised of all combinations of potential donors, recipients, and diseases totaling 44,758 observations.[5]

4.1 Dependent Variable

The dependent variable for this study is disease-specific development aid. As previously discussed, aid allocation decisions include two stages — gatekeeping and allocation. Donors first select units to receive aid from a broader pool. After this winnowing process, donors then decide upon the amount of aid to be allocated. Donors may engage in either public good maximization (recipient need) or individual benefit maximization (donor interest) at each stage. Thus, one must account for both the selection and the allocation

[3]For discussion of causes of geographically limitations on disease and the distribution of benefits, see the discussion of club goods in the Reviewer's Appendix.

[4]I exclude members that ascended in 2013, as well as the European Union, which is not a bilateral donor.

[5]See reviewer's appendix for complete list of donors and recipients

processes. Failing to do so may bias results.

Using data from the AidData.org database (Tierney and Hicks, 2011), I examined more than 60,000 ODA grants and loans from 2005 to 2012. From these I identified 26,410 grants that specifically targeted one or more of the specified diseases. I coded these for donor, recipient, and disease and calculated the aggregate funding allocated by each donor, to each recipient, for each disease between 2005 and 2012 in 2009 US dollars.[6]

For the gate-keeping stage, I model the process by which a donor selects which recipient/disease pairings will receive aid. I create a dichotomous variable where 1 indicates that aid was given and 0 indicates that no aid was given. As expected, there is an abundance of zeros — cases where no aid was given. Indeed, more than 90% of the observations result in no aid given by the specified donor to the specified recipient for the specified disease. This supports the need to model the selection process.

After modeling the selection process, I then examine the allocation stage. I model total allocation amount for the sub-set of the cases that received aid. I use the log of aggregate aid given by a donor, to a specific recipient for a specific disease.

4.2 Key Independent Variables

The two models of donor behavior articulated in the theory section rely on four key factors — economic need, disease burden, trade, and migration. In order to test these models, I develop operational measures for each relevant factor.

Economic Need Low income countries generally have poorer infrastructure and weaker health systems. As a result, donors may be inclined to provide more funding to less developed states. I use the recipient's average GDP per captia in thousands of constant US dollars (2000). These data were collected from the World Bank (2015).

Disease Burden: Disease distribution and severity is measured using disease-specific mortality per 1000 people. Cause-specific mortality data are reported by the World Health Organization every four years. The most recent release was 2012. I collected mortality data for both 2004 — the year before my sample begins — and 2012 — the year that my sample ends.

To differentiate between donor interest and public good maximizing behaviors, I create three separate

[6]Some grants targeted more than one disease, without providing a breakdown of how much aid was allocated to each disease. This is most often the case with HIV/AIDS and Tuberculosis, immunizable diseases (measles, tetanus and diptheria), and tropical cluster diseases (schistsomiasis, trypanosomiasis and dengue). Where this was the case, I included the full grant amount in the total for each disease. As a robustness check I also constructed the data excluding grants that identified more than one disease. The results were unchanged and are presented in the reviewer's appendix.

mortality variables. The first is recipient mortality in 2004 and measures the number of deaths caused by a specific disease within a given country that is or could receive aid, per 1,000 people in that country, in 2004. The second is global mortality and measures the global total number of deaths caused by a specific disease per 1,000 people in the global population in 2004. The third is donor mortality and measures the number of deaths caused by a specific disease within the donor country, per 1,000 people in the donor country, in 2004.

These variables provide a measure of the distribution and burden of each disease the year before my sample begins. Because I aggregate across time, changes in disease burden may affect aid allocations. Thus, I also include a variable for change in recipient mortality. I subtract mortality estimates from 2004 from estimates for 2012 each recipient.[7]

Trade International trade acts as a conduit for contagion through the of goods, livestock, and pests. A country's likelihood of importing an infection increases as the level of trade with countries experiencing high levels of infection increase. Likewise, the benefit a country receives from improvements to disease control increase if the intervention is directed at one of its trade partners. Trade data are available through the International Monetary Fund (IMF) (2015). The trade variable used here measures that average trade between donor and recipient from 2005 to 2011 in billions of constant US dollar (2000).

A donor's benefit will be conditioned by both the volume of trade with the target country, as well as the impact of the disease in the target country. A disease that is more prevalent in one country has a higher likelihood of traveling to one of its trade partners. A donor's payoff is largest when the intervention is directed to high volume trade partner *and* targets a high burden disease within the partner country. Thus, I also include an interaction variable that is the product of trade and recipient burden of disease.

Migration Movement of people across borders is another key mechanism for disease spread. The likelihood of disease spread increases as the number of people from countries with high infection rates increases. The benefit a country receives from improvements to disease control increases if the intervention targets populations that are likely to travel to that country. Migration data are available from the Organization for Economic Cooperation and Development (OECD) (2015). The migration variable used here measures the average number of new migrants that move from a potential recipient to a given donor country from 2005 to 2011 in millions of migrants.

As with trade, a donor's benefit will be conditioned by both the number of migrants from the target country and the impact of the disease in the target country. Migrants from countries where a particular

[7]I ran additional tests using average donor, global, and recipient morality as a robustness check. The results are reported in the reviewer's appendix and the relationships remain the same as those reported in the next section. In addition, I also ran tests using an alternative measure of disease burden — disability-adjusted life years (DALYs). The results remained the same and are reported in the reviewer's appendix.

disease is especially prevalent are more likely to be afflicted by that disease and facilitate its spread. A donor's payoff is largest when the intervention is directed at countries where a large number of its immigrants originate *and* targets a high burden disease within those countries. Thus, I include an interaction variable that is the produce of migration and recipient burden of disease.

4.3 Control Variables

In order to account for potential confounding factors, I include several control variables. First, I control for the effects of colonial legacy a dichotomous variable base on the Issue Correlates of War projects colonial history data (Hensel, 2014). Alesina and Dollar (2000) found that colonial ties were a strong predictor of foreign aid allocations. In addition, colonial ties may affect levels of migration between donors and recipients. Thus, it is necessary to control for colonial legacy in order to isolate the impact of migration on aid allocations.

I also control for the effect of regime type using polity scores from Marshall and Jaggers (2002). The role of regime type — democracy in particular — in aid allocations remains disputed. Some scholars have identified democratic status of recipients as a key determinant of aid allocations. thus regime type may affect donor aid decisions (Lumsdaine, 1993; Alesina and Dollar, 2000). In addition Lake and Baum (2001) finds that democracies are more responsive to population need and are better at providing public services. As a public service, disease control interventions may be more effective when targeted at democracies. Thus, donors may be more likely to select democratic recipients.

Natural disasters can influence both decisions to give aid and outbreaks of infectious disease — as illustrated by the case of Haiti used in the introduction. Countries that experience natural disasters are more likely to receive aid and aid amounts may be influenced by the amount of damage caused by the natural disaster. In addition, emergency aid responses often include aid for health and disease control prior to the emergence of an outbreak. Natural disaster data are available through the International Disaster Database or EM-DAT (Guha-Sapir and Hoyois, N.d.). I include to measures of natural disasters. The first is a count variable, indicating the total number of disasters experienced by the recipient country between 2005 and 2011. The second is a measure of total amount of damage caused by natural disasters in the recipient country between 2005 and 2011, in millions of US dollars (2000).

Variation in the cost of interventions across diseases may affect the amount of allocations. Diseases with relatively expensive interventions will likely receive more aid than diseases with inexpensive interventions. To account for the variation in disease control costs I collected estimated costs of averting a single disability-

adjusted life year (DALY)[8] for all interventions identified by Laxminarayan and Shahid-Salles (2006) for each disease. I then calculated the average cost per DALY averted in (2000) US dollars for each disease.

Finally, I control for the potentially confounding affects of HIV/AIDS by including a dichotomous variable for HIV/AIDS. Previous research has shown that HIV/AIDS receives a disproportionately large amount of disease-specific aid given its global burden (Shiffman, 2006, 2008). Indeed, HIV/AIDS receives nearly 76% of total aid in the sample. Previous research has not provided an adequate explanation for these disproportionate allocations. Thus, I am not only controlling for the potentially confounding affects of HIV/AIDS, I am also better able to distinguish whether disproportionate allocations are a result of specific characteristics — distribution and severity — or if HIV/AIDS itself driving distortions. See Table 1 for summary statistics.

4.4 Heckman Selection Model

I test the hypotheses using a Heckman selection model. The Heckman selection model is appropriate when the sample cannot be assumed to be random — as is the case with aid allocations — and allows one to model both selection and allocation. In the first stage, a donor decides whether or not to give aid and in the second stage, donors decide on the amount of aid given to those units that passed the gate-keeping stage. Public good and donor interest variables could affect allocation decisions at either or both stages. The Heckman model allows me to examine why some units receive aid while others do not, as well as why those that do receive aid receive more or less. All results are produced by Stata 13.

5 Results

Tables 2 and 3 displays the effects of disease and recipient characteristics on disease-specific aid allocations from 2005 to 2011. All four models are Heckman selection models. The top portion of the table is the selection stage of the model. It begins with all possible donor-recipient-disease combinations and estimates the effect of disease and recipient characteristics on the probability that a unit receives aid. The bottom portion of the table is the allocation stage of the model. It uses an OLS regression model to estimate the effect of disease and recipient characteristic on the amount of aid allocate among only units that received aid.

[8]Disability-adjusted life years combine the number of years of life lost due to premature death — using a state's average life expectancy — with the number of years lived with a disability. Thus, a DALY is a single year of life lost due to death or disability as a result of a single cause. For example, if a three-year-old child in Uganda, where the average life expectancy is 53 years (UNICEF, 2009), this death would be recorded as measles causing 50 disability-adjusted life years within Uganda.

Model 1 is the base model. Model 2 extends the base model by including two relevant interaction terms. Models 3 and 4 control for HIV/AIDS. The results suggest that, while a variety of factors influence aid decisions at the selection stage, donor burden of disease is the primary predictor of the amount of aid allocated.

In the selection stage of Model 1 the result indicate that poorer countries are more likely to receive aid. In addition, diseases that cause the more death in recipient countries and around the world are more likely to receive aid. These results provide initial support for Hypotheses 1, 2, and 3. Likewise, the probability of aid allocations also increases for diseases for which mortality rates have increased between 2005 and 2011. In contrast, diseases that cause more deaths in donor countries are less likely to receive aid, failing to support Hypothesis 6. However, donors are also more likely to give aid to countries from which more of their immigrants originate and with whom they share more trade. This suggests that, while donors engage in some public good maximizing behavior in the selection stage, it is not the only criteria used when deciding whether or not to give aid.

Unlike in the selection stage, donor behavior reflects only self-interest at the allocation stage. GDP per capita is not significantly correlated with the amount of aid a recipient receives for a specific disease. Likewise, recipient mortality and change in recipient mortality are insignificant while global mortality is negative and significantly correlated with the amount of aid allocated to a recipient for a given disease, failing to support any of the public good maximizing hypotheses. These results indicate that while donors may incorporate public goods maximizing calculations when deciding whether or not to give aid, they are not attempting to maximize the public good when deciding how much aid to give.

Among the donor-interest variables, only donor mortality is a significant predictor of the amount of aid allocated — neither trade nor migration is significant. Donor mortality has a positive and significant effect on the amount of aid allocated to a recipient for a specific disease, supporting Hypothesis 6. Among donor/recipient/disease units where aid was allocated, for every 1 additional death in the donor country caused by the specified disease there is a 20% predicted increase in aid. The substantive difference in amount of aid is impressive. The average amount of aid given to units that received aid was approximate $15 million. Thus, an additional death in the donor country would mean a $3 million increase for recipients receiving aid for that disease. In contrast, recipient mortality is not a significant predictor of aid amounts and global morality is a negative predictor.

The results from Model 1 indicate that public good production and maximization may influence the selection stage, but that when deciding how much aid to give, donors behave in a largely self-interested

manner. Differing behaviors at the selection and allocation stages are not entirely surprising. Donors use foreign aid in pursuit of a variety of foreign policy objectives. Previous research suggests donors attempt to serve different and potentially competing interests by using different decision criteria at each stage of the aid process (Cingranelli and Pasquarello, 1985). The use of public good maximizing behaviors at the selection stage while relying on self-interested behaviors at the allocation stage suggests that donors have a sophisticated understanding of how the benefits of disease control will be distributed. The total size of the public good associated with disease control increases as donors contribute more to the public good. Thus donors select recipients and diseases where their contribution will create the most benefit. At the allocation stage, having already selected diseases and recipients where aid will have the largest impact, donors strategically allocated aid according to the distribution of the benefit — specifically, donors give more money for diseases that are most likely to affect their domestic populations. In this way, donors are able to pursue two foreign policy objectives.

The relationships in Model 1 are largely consistent across the other 3 models. Model 2 includes interaction variables — one interacting trade with recipient mortality and the other interacting migration with recipient mortality. The results of Model 2 also indicate that while donors may include public good maximization in their decisions at the selection stage, decisions about the amount of aid to allocate reflect donor interests. Although GDP per capita, recipient mortality, change in recipient mortality and global mortality are all significant positive predictors at the selection stage, lending initial support for the public good maximizing hypotheses (Hypotheses 1-3), at the allocation stage all are insignificant, except for global mortality, which is negative and significant. In contrast, while donor mortality is not a significant predictor of aid at the selection stage, it is positive and significant at the allocation stage with strong substantive effects. Trade and the interaction of trade with recipient mortality are not strong predictors of aid. Likewise, migration alone is not a strong predictor of aid. However, the migration-recipient mortality interaction variable is positive and marginally significant, suggesting that donors give more aid for diseases that affect more people in places from which more migrants originate — further evidence of self-interested behavior by donors and tentative support for Hypothesis 5.

Model 3 includes a control variable for HIV/AIDS. When controlling for HIV/AIDS, the results remain essentially the same. At the selection stage, both public good maximizing and donor interest variables are strong predictors of whether a unit receives aid or not. At the allocation stage, donor mortality remains a positive and significant predictor of aid amount, providing continued support for Hypothesis 6. Likewise, global mortality remains negative and significant. However, recipient mortality is negatively and significantly

related to the amount of aid allocated. Every 10 additional deaths in the recipient country leads to a 4% reduction in predicted aid for that disease to that recipient. Previous research suggests that HIV/AIDS receives a disproportionate amount of global aid (Shiffman, 2006). As a disease that affects populations in both donor and recipients countries, it is difficult to know whether the large quantities of aid spent on HIV/AIDS would have a disproportionate impact on the variable for recipient mortality or donor mortality. The negative and significant coefficient for recipient mortality when controlling for HIV/AIDS may indicate that donors' dedication in giving large quantities of aid for HIV/AIDS comes at the expense of other high burden diseases. These results not only fail to support, but provide evidence counter to Hypotheses 2 and 3.

In addition to the change regarding recipient mortality, the interaction variables are marginally significant when controlling for HIV/AIDS, providing evidence in support of Hypotheses 4 and 5. Specifically, donors provide more aid for diseases that affect more people in countries with whom they engage in larger quantities of trade. Likewise, donors provide more aid for diseases that affect more people in countries from which more people migrate to the donor country. Thus, while the results at the selection stage remain mixed, Model 3 provides clear evidence of self-interested behavior among donors at the allocation stage of the aid process.

Finally, the previous models examine variables at three levels — donor, recipient and disease. Because of this, some variables include repeated observations that cluster according to level. For example, tuberculosis causes 74.3 deaths for every 1,000 people in Kenya. There are 23 units that includes Kenya as a recipient and tuberculosis as the disease — one for each donor — and the recipient mortality for each is 74.3, regardless of the donor. Heckman selection models do not accommodate multi-level models. However, it is possible to cluster standard errors by different groups. Model 4 includes standard errors clustered by recipient.[9] The results in Model 4 remain the same as in Model 3, with one exception. The interaction of migration and recipient mortality changes from only meeting the marginal 0.1 level of significance to meeting the 0.01 level. Thus, as migrants from the recipient country increase and/or recipient mortality caused by the disease increases, the amount of aid given to that recipient for that disease also increases.

Regarding control variables, the results indicate that while migration, trade, natural disasters, and colonial legacy all have strong positive correlations with countries that get selected to receive aid, only colonial legacy is a significant predictor of aid allocations. Moreover, in the second stage, colonial legacy and the amount of aid allocated are negatively correlated. This suggests that donors give less aid to their former colonies. This is a potentially surprising result, as many studies have found that donors are more generous with their former colonies. However, the negative correlation may be the result of collinearity between the

[9] I also conducted analyses using disease and donor clustered standard errors. The primary findings remained the same. These models are available in the reviewer's appendix.

colonial legacy variable and migration, as former colony/colonizer relationships likely produce higher levels of migration.

In addition, cost per disability-adjusted life year averted is positively correlated with aid allocation amounts in the first two models, as expected. This suggests that donors provide more aid for diseases that cost more to control. However, when controlling for HIV/AIDS, the variable for cost has a strong — although substantively small — negative correlation with the amount of aid. Essentially, for every additional $1,000 of cost to avert a single disability-adjusted life year, one would expect a 0.8% decrease in aid for that disease. Although the substantive effects are small, the result is counter to expectations. If this result were consistent across all models, it may suggest that donors are actually seeking efficiency — focusing on diseases that cost less to control. However, the appearance of the result only when controlling for HIV/AIDS indicates that donors' priorities override cost and efficiency concerns.

In total, these models indicate that while public good maximization may be a consideration in the selection stage, donors seek to maximize their own payoffs when deciding how much money to allocate. The four models provide evidence supporting all of the public good hypotheses and two of the self-interest hypotheses at the selection stage. However, at the allocation stage, all four models fail to provide support for any of the public good hypotheses. In contrast, donor mortality is a strong predictor of the amount of aid allocated in all four models, supporting Hypothesis 6. Moreover, Models 3 and 4 provide evidence supporting all three donor-interest hypotheses. This evidence suggests that donors seek to contribute to the public good of disease control, but opt to do so in a way that maximizes their enjoyment of the benefits through strategic allocation of aid. Ultimately, donors' preferences over which diseases to prioritize may trump the clear collective objective of controlling disease.

6 Conclusion

Development aid for health has become a key component of developing countries' health funding. As a result, allocation decisions can have grave consequences for health outcomes in developing countries. Although development aid for health comprises approximately 20% of all development aid, it has been largely neglected by political science scholars. Among the projects that have investigated development aid for health, many have identified distortions in DAH while offering little theoretical explanation.

This project provides a theory-based explanation for previously identified distortions in development aid for health while also examining donors' use of foreign aid for the production of a public good — infectious

disease control. The empirical models lend support to the argument that, like other forms of development aid, DAH may be subject to and potentially distorted by political interests. While recipient need and public good maximization may affect the selection stage of aid decisions, allocation decisions are largely influenced by donor interests. Specifically, this analysis finds no support for traditional dyadic measures of recipient importance to donor influencing allocation amounts.

This analysis is only a small step in addressing development aid for health — examining only disease-specific aid for a limited time period. Understanding DAH allocations requires additional study. Specifically, there are many opportunities to test the usefulness of other explanations for aid allocation decisions on a variety of forms of development aid for health. In addition, there remains a need for more complete theorizing on aid allocations. By examining the structure of development objectives — both in health and other types of development aid — scholars can move beyond simple "buying influence" explanations of donor-interest.

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Table 1: Summary Statistics

	Obs.	Mean	Min	Max	Std. dev.
Dependent Variables					
Aid (Dichotomous)	44758	0.034	0	1	0.180
ln(Aid)	42812	0.476	0	21.26	2.53
Theoretical Independent Variables					
Rec. Mortality 2004	44758	22.173	0	1463.355	73.06
ΔRec. Mortality	44758	-10.0192	-1193.75	76.00	45.2901
Donor Mortality 2004	44758	2.435	0	78.027	8.894
Global Mortality	44758	3275.093	0.644	14375.96	4654.448
Migration	42896	0.677	0	75.01	2.828
Trade (mean)	42490	2.154	0	388.788	13.019
Rec. Mort. $*$ Migration	42896	15.67	0	30165.6	214.179
Rec. Mort. $*$ Trade	42490	13.980	0	9385.66	152.052
Control Variables					
Cost/DALY averted	44758	835.85	7	3929.107	1037.459
GDP/capita (mean)	43792	4.669	0.156	57.16	7.984
Polity 2 (mean)	44114	2.708	-10	10	6.184
Colony	44758	0.030	0	1	0.172
Disasters	44758	19.302	0	220	28.231
Damage	44758	3.828	0	258.892	22.699
HIV/AIDS	44758	0.072	0	1	0.258

Table 2: The effect of mortality on disease-specific aid allocations

	Model 1		Model 2	
Dependent Variable	Dichotomous	ln(Aid)	Dichotomous	ln(Aid)
Rec. Mortality	0.0038(***)	-0.001	0.0033(***)	-0.0023
	(0.0004)	(0.0017)	(0.0004)	(0.0016)
Δ Rec. Mortality	0.0025(***)	0.0003	0.0022(***)	-0.0007
	(0.0005)	(0.0019)	(0.0005)	(0.0020)
Donor Mortality	-0.077(***)	0.2065(***)	-0.7856(***)	0.2173 (***)
	(0.0039)	(0.0326)	(0.0040)	(0.0326)
Global Mortality	0.0001(***)	-0.0003(***)	0.0001(***)	-0.0004(***)
	(0.000004)	(0.00005)	(0.000004)	(0.00005)
GDP/cap	-0.112(***)	-0.0199	-0.1126(***)	-0.0237
	(0.0076)	(0.0531)	(0.0077)	(0.0535)
Migration	0.0166(***)	0.0210	0.0147(***)	0.0159
	(0.0038)	(0.0189)	(0.0042)	(0.0197)
Trade	0.0028(***)	-0.0014	0.0018(***)	-0.0019
	(0.00076)	(0.0034)	(0.0008)	(0.0035)
Democracy	0.0078(***)		0.0069(***)	
	(0.0026)		(0.0026)	
Number of Disasters	0.0028(***)		0.0027(***)	
	(0.0004)		(0.0004)	
Damage		-0.0041		-0.0045(*)
		(0.0026)		(0.0025)
Colony	0.838(***)	-1.590(***)	0.8356(***)	-1.7285(***)
	(0.054)	(0.354)	(0.05440)	(0.3497)
Cost/DALY averted		0.0002(*)		0.0002(*)
		(0.0001)		(0.0001)
R.Mort.(Migration)			0.0001	0.0002(*)
			(0.00008)	(0.0001)
R.Mort.(Trade)			0.0003(***)	0.0002
			(0.00006)	(0.0002)
Constant	-2.2072(***)	20.0006(***)	-2.196(***)	20.412(***)
	(0.0283)	(0.9071)	(0.0283)	(0.8714)
Rho		-0.7598		-0.7892
		(0.0586)		(0.0508)
Observations	39270		39270	
Uncensored Observations		1371		1371
Wald Chi^2	108.37(***)		128.23(***)	
LR Test Ind. Equ	15.16(***)		19.09(***)	
	(0.0283)		(0.9071)	

Standard errors in parentheses. *= $p < 0.1$, **= $p < 0.05$, ***= $p < 0.01$

Table 3: The effect of mortality on disease-specific aid allocations, controlling for HIV/AIDS

	Model 3		Model 4	
Dependent Variable	Dichotomous	ln(Aid)	Dichotomous	ln(Aid)
Rec. Mortality	0.0350(***)	-0.0035(**)	0.0035(***)	-0.0035(**)
	(0.0004)	(0.0016)	(0.0008)	(0.0017)
Δ Rec. Mortality	0.0021(***)	-0.0020	0.0021	-0.0020
	(0.0006)	(0.0020)	(0.0016)	(0.0019)
Donor Mortality	-0.0431(***)	0.2042(***)	-0.0403(***)	0.2042(***)
	(-0.0044)	(0.0272)	(0.0060)	(0.0595)
Global Mortality	0.00003(***)	-0.0003(***)	0.00003(***)	-0.0003(***)
	(0.000006)	(0.00004)	(0.000008)	(0.00006)
GDP/cap	-0.1164(***)	0.0065	-0.1164(***)	0.0064
	(0.0078)	(0.0516)	(0.01577)	(0.0701)
Migration	0.0128(***)	0.0067	0.0128(**)	0.0067
	(0.0042)	(0.0195)	(0.0073)	(0.0297)
Trade	0.0018(**)	-0.0026	0.0018	-0.0026
	(0.0008)	(0.0035)	(0.0012)	(0.0025)
Democracy	0.0066(***)		0.0066	
	(0.0025))		(0.0060)	
Number of Disasters	0.0028(***)		0.0028(***)	
	(0.0004)		(0.0007)	
Damage		-0.0037		-0.0037
		(0.0025)		(0.0029)
Colony	0.8220(***)	-1.834(***)	0.8219(***)	-1.835(***)
	(0.0544)	(0.3249)	(0.0738)	(0.4304)
Cost/DALY averted		-0.0008(***)		-0.00076(***)
		(0.0002)		(0.0001)
R.Mort.(Migration)	0.0002(**)	0.0002(*)	0.0002(*)	0.0002(***)
	(0.00009)	(0.0001)	(0.0001)	(0.00005)
R.Mort.(Trade)	0.0003(***)	0.0003	0.0003(***)	0.00026
	(0.00006)	(0.0002)	(0.00007)	(0.00016)
HIV	0.9692 (***)	1.805 (***)	0.969(***)	1.8046(***)
	(0.0637)	(0.5771)	(0.0826)	(0.6365)
Constant	-2.0732(***)	21.1777(***)	-2.073(***)	21.1777(***)
	(0.02834)	(0.7181)	(0.0435)	(0.8628)
Rho		-0.8294		-0.8294
		(0.0378)		(0.0456)
Observations	39270		39270	
Uncensored Observations		1371		1371
Wald Chi^2	197.42(***)		211.28(***)	
LR Test Ind. Equ	31.98(***)		66.04(***)	

Standard errors in parentheses. *= $p < 0.1$, **= $p < 0.05$, ***= $p < 0.01$