A DROP IN THE BUCKET?

THE EFFECTIVENESS OF FOREIGN AID IN THE WATER, SANITATION, AND HYGIENE (WASH) SECTOR

By

Joshua Wayland

Submitted to the

Faculty of the School of International Service

of American University

in Partial Fulfillment of

the Requirements for the Degree of

Master of Arts

In

Global Environmental Politics

Chair:

Ken Conca, Ph.D.

Daniel Esser, Ph.D.

Dean of the School of International Service

May 8

Date

2013

American University

Washington, D.C. 20016

For my children.

A DROP IN THE BUCKET?

THE EFFECTIVENESS OF FOREIGN AID IN THE WATER, SANITATION, AND HYGIENE (WASH) SECTOR

BY

Joshua J. Wayland

ABSTRACT

This paper investigates the effectiveness of development assistance in the water, sanitation, and hygiene (WASH) sector at the global, country, and local levels. Two components of effectiveness- the impact of WASH aid on health outcomes and its responsiveness to recipient need- are defined and tested independently using a wide variety of statistical models applied to a cross-country panel dataset of 133 recipient countries over the fifty year period from 1960 through 2009. The global analysis is supported by two country level studies based on geo-coded datasets of WASH aid projects. Impact is examined using propensity score matching applied to survey data on 12,271 households and 56,218 individuals in the Republic of Malawi. Responsiveness is tested by comparing the location of World Bank funded WASH projects in the Republic of the Philippines with the geographic distribution of water-related disease among 82 provinces and 56 cities in that country. Results of the global and country level studies are broadly consistent and lead to three general conclusions. First, WASH aid is found to have had a measurable and positive impact on both individual and national level health outcomes. Second, the allocation of WASH aid across and within countries seems to be responsive to the relative need of intended beneficiaries, although it is not the sole factor driving WASH aid allocation. Finally, WASH aid appears to have the greatest impact in countries and communities with median, rather than high, levels of relative need. Based on these results, a framework is developed to understand aid effectiveness in the WASH sector, in which impact is constrained in high need countries by technical and environmental factors and in low need countries by diminishing returns to aid funding. This framework is applied to evaluate major donors of WASH aid and emerging modalities of aid delivery.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ADB	Asian Development Bank
ABEDA	Arab Bank for Economic Development in Africa
AFDB	African Development Bank
BOD	Biochemical Oxygen Demand
CDB	Caribbean Development Bank
BSWM	Bureau of Soils and Water Management (Philippines)
CIDA	Canadian International Development Agency
COD	Cash On Delivery
DALY	Disability-Adjusted Life Years
DENR	Department of Environment and Natural Resources (Philippines)
DfID	Department for International Development (United Kingdom)
DILG	Department of Interior and Local Government (Philippines)
DPM	Dynamic Panel Model
DPWH	Department of Public Works and Highways (Philippines)
EIB	European Investment Bank
EPA	Environmental Protection Agency (United States)
FDI	Foreign Direct Investment
FHSIS	Field Health Service Information System (Philippines)
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHO	Global Health Observatory
GLAAS	Global Analysis and Assessment of Sanitation and Drinking Water
GLS	Generalized Least Squares
GPS	Generalized Propensity Score
GRDP	Gross Regional Domestic Product

IHS3	Third Integrated Household Survey (Malawi)
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
IO	International Organization
JICA	Japan International Cooperation Agency
JMP	Joint Program for Water and Sanitation
LGM	Latent Growth Model
LWUA	Local Water Utilities Administration
MWK	Malawi Kwacha
MDGs	Millennium Development Goals
MHP	Ministry of Health and Population (Malawi)
MIWD	Ministry of Irrigation and Water Development (Malawi)
MWSS	Metropolitan Waterworks and Sewerage System (Philippines)
MLG	Ministry of Local Government (Malawi)
NSO	National Statistics Office (Philippines)
NCR	National Capital Region (Philippines)
NPC	National Power Corporation (Philippines)
NWRB	National Water Resources Board (Malawi/Philippines)
NWDP	National Water Development Program (Malawi)
NWDP II	Second National Water Development Program (Malawi)
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PEM	Philippines Environmental Monitor

PSM	Propensity Score Matching
RWB	Regional Water Boards (Malawi)
UN	United Nations
UNICEF	United Nations Children's Fund
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
USAID	United States Agency for International Development
WASH	Water, Sanitation, and Hygiene
WDI	World Development Indicators
WHO	World Health Organization

CHAPTER 1

Introduction

"Thousands have lived without love, not one without water." - W.H. Auden

The human race, including even its poorest and most marginalized members, is healthier today than ever before. Since 1960, average life expectancy at birth has increased by some 33 percent globally, and by a full 20 years, from around 47 to 67 years, in the developing world. The number of children who die before their fifth birthday has declined by some 65 percent globally, using best available measures. In every country for which data is available, infant and child mortality rates, the most widely accepted indicators of public health, have declined, in some cases by triple digits.[1]

This is not to say that there do not remain enormous challenges in the realms of international development and global health. Even as the proportion of the global population living in dire poverty has fallen, the absolute number of impoverished people has risen, and inequality, in health as well as income, is at or near all-time highs. In a handful of countries, all of them in sub-Saharan Africa, best estimates of life expectancy have stagnated or even declined in recent decades.[2] Yet, I strongly maintain that, in order to look forward, we must first look back at where we have been. And, the historical trend in global health has been one of definitive and near universal improvement.[3]

If this is a victory, however, whose is it? The sources of progress are well known- better nutrition, early childhood vaccinations, improved prenatal care, widening availability of antibiotic medications, and, perhaps most importantly, expanded access to clean drinking water, sanitation, and

[1] World Bank (2013a), UNDP (2010), See also Amad et al. (2000)

[2] World Bank (2013a)

[3] Those who would question this assertion would do well to ask themselves by what other mechanism the global population has continued to expand, more than tripling since 1900, if not because of the simple fact that fewer people die young.

hygiene.[4] More controversial is the extent to which the international community, through interventions such as development assistance, played a role in bringing about this sea change. Has foreign aid been a worthwhile investment in the health and wellbeing of the developing world? Or is it just a 'drop in the bucket,' a small and insufficient answer to the massive challenges of global poverty and deprivation? Such are the questions that this paper seeks to address.

In the following, I examine the effectiveness of foreign aid for the provision of water and sanitation, often referred to as the water, sanitation and hygiene (WASH) sector. Using a variety of established and emerging methods of statistical analysis, I test for a relationship between WASH aid and health at the local, national, and global levels. My findings indicate that foreign aid in the WASH sector has been an important factor in explaining the worldwide reduction in disease burden, particularly among children. I present evidence that donors of foreign aid have been responsive to the needs of recipient countries and communities for improved drinking water and sanitation. I show that WASH aid has had the greatest impact in countries where opportunities for improvement are present, but technical and environmental constraints are minimized. And, I develop a conceptual model for understanding how, why, and when WASH aid works.

I should admit from the outset that this was not the paper I expected to write. Given the widespread pessimism surrounding aid effectiveness in the existing academic literature, I fully anticipated that my results would converge with the prevailing academic fashion, and my own biases, toward the conclusion that foreign aid has largely failed in its mission to promote development. This might well have made my own task easier; in many ways, it is a less challenging proposition to point out why policies fail than to try to understand how they succeed. If this study contributes at all to this understanding, it is thanks to the many individuals who lent their time to advise, edit, critique, and challenge it in all of its various stages. Among those to whom I am most grateful are my advisors, Ken

[4] This is not to imply that the specific causal chain of global health and mortality is well understood; it is not, and indeed is the subject of great debate. However, there can be little doubt that these general causes are the primary drivers of the historical declines in child and infant mortality, and increasing life expectancy. See Amad et al. (2000), UNICEF (2012).

Conca and Daniel Esser, both of American University's School of International Service; Jennifer Hadden of the University of Maryland, Department of Government and Politics; Natalia Radchenko of American University, Department of Economics; Michael Brody of the U.S. Environmental Protection Agency; Alexander Golub of Environmental Defense Fund; Olivia Jensen of Global Water Intelligence; Robin Lumsdaine of American University's Kogod School of Business; Douglas Pelsey of the U.S. Surface Transportation Board, Office of Economics; Daniel Souleles of Columbia University, Department of Anthropology; and David Parker of American University, School of International Service. Their contributions to this paper have been invaluable; any omissions, errors, and mistakes are mine.

Why WASH?

Few needs are as basic as water. As biological beings, we humans are made of the stuff, to the tune of some 60 percent by body weight. Each of the basic physiological functions that undergird our daily lives can be themselves reduced, in large part, to the movement and manipulation of this single substance. It follows that the management of water at the macro-scale, that of the community, city, or state, must rank among the most important tasks of a well-functioning society.

As Victor Hugo famously observed, "the history of mankind is reflected in the history of sewers." Indeed, so crucial is it to the maintenance of civilization that the link between clean drinking water, along with its counterpart, sanitation, and human wellbeing was a well-established principle of planning and governance millennia before the advent of modern theories of disease and public health. Archaeological evidence confirms that, even as humans first began to congregate into settlements large enough to be called cities, the provision of fresh water and the management of wastewater emerged as a paramount concern.[5]

As early as 3500 BC, the Mesopotamian cities of Ur and Babylonia were constructing urban drainage systems to ferry domestic wastewater away from houses, as well as public latrines connected to cesspits. A millennium later, Indus Valley civilizations employed not only impressive systems of

[5] See, for instance, Salzman (2012), Lofrano and Brown (2010), Hendon and Joyce (2004), Matthews (2003), Gray (1940).

terracotta piping, but also sophisticated water treatment processes, some of the earliest on record. Ancient Egyptians, the wealthiest of whom had interior bathrooms fitted with limestone toilet seats, also used portable toilets, examples of which have been discovered in the tombs of senior officials, presumably to add a measure of hygiene to the afterlife.[6]

Modern water management systems draw directly from the achievements of the ancient Greeks, who developed closed sewerage systems to divert wastewater from private and public latrines, as well as storm water drainage, out of urban areas entirely and on to agricultural fields for use in fertilizing and irrigation. The sewer at Palace of Minos in Knossos, which connected to Egyptian-inspired indoor toilets, was so well-designed that it remains fully functional today, after four millennia. The aqueducts, baths, and sewers (including the famed Cloaca Maxima) of Rome and its empire are included among the wonders of the ancient world, and some are still in regular use.[7]

The European Medieval period, often characterized in terms of its dearth of literature and other products of high culture, was also and perhaps more fundamentally, defined by a collapse of water and sanitation infrastructure, planning, and management, in what has been called the 'Sanitary Dark Ages.'[8] Historian Harold Gray describes scenes in Berlin, Vienna, and other great capitals of Europe that seem obscene even by the standards of the most impoverished modern slums, for example:

> Paris in the Middle Ages was the metropolis of Europe and at least superficially the focus of refinement in living. But the streets were foul with filth. Montaigne complained that he found it difficult to rent lodging where the reek from the streets did not assault his nose. Parisians freely emptied chamber-pots from their windows, only the nimble and the lucky escaped being drenched. The poorer classes defecated indiscriminately wherever most convenient…A favorite locality was the terrace of the Tuileries, which eventually became so fouled that the superintendent of the royal grounds installed a latrine, charging an admission fee of two sous.[9]

---

[6] Lofrano and Brown (2010), Matthews (2003), Gray (1940)

[7] Lofrano and Brown (2010), Gray (1940)

[8] Lofrano and Brown (2010)

[9] Gray (1940): 943

The direct results of this failure of water and sanitation management were the infamous pandemics of cholera, plague, and yellow fever that repeatedly decimated urban populations. It was not until the latter half of the nineteenth century, when the emergence of the germ theory of disease coincided with the development of improved forms of urban water management, as well as new standards of personal hygiene, that the dark ages of water finally gave way to the 'Sanitary Great Awakening' in the world's wealthier nations.[10] The role of the nascent WASH sector during the formative period of today's developed nations cannot be overstated. According to at least one study, improvements in water quality in the United States was responsible for nearly one-half of the decline in total mortality, two-thirds of the decline in child mortality, and three-quarters of the decline in infant mortality during the early decades of the twentieth century.[11]

From the aqueducts of the ancient Rome, China, and Mesoamerica to the sewers of nineteenth century Paris and London, water and sanitation infrastructure has been among the hallmarks of what we think of as advanced civilizations. Time and time again throughout history, cities, empires, and entire cultures have risen and fallen with the ebb and tide of water management. Whether it is an outcome or a cause of development is a distinction far less important than the incontrovertible conclusion that the two are definitively and inextricably linked. Indeed, if a concept as nebulous as 'development' can be said to have a definition at all, water then is undoubtedly a, if not the, central component.

It is for this reason that I choose the WASH sector as the development 'yardstick' against which to measure the efficacy of foreign aid. As such, I feel that it is a far superior indicator than such 'traditional' concepts as gross domestic product (GDP), a relatively recent and conceptually limited invention. After all, economic indicators, although they have been granted a preeminent, indeed almost sacred position in the study of development, were never intended to be more than proxy measurements for a more comprehensive, but largely immeasurable concept. As William Easterly, among the most widely-

[10] See Salzman (2012), Melter and Schwartz (2007), Bean (1963), Hecker (1859)

[11] Cutler and Miller (2005)

cited and respected scholars of development, explains on the very first page of his *The Elusive Quest for Growth*:

> As I pursue my career as a self-anointed expert on poor countries, the differences in the lives of the poor and the rich supply motivation. We experts don't care about rising gross domestic product for its own sake. We care because it betters the lot of the poor and reduces the proportion of people who are poor. We care because richer people can eat more and buy more medicines for their babies.[12]

And we care, presumably, because being rich means not having to wonder where one's next drink of water will come from, to worry at work or in the home whether one will have access to a toilet, or to face choices between being clean, being thirsty, or going broke. Perhaps in no other sector are the distinctions between rich and poor, between development and under-development, as stark as with regard to water and sanitation. Rather than settling for partial measures of poverty, I therefore propose to cut out the middle man and examine development directly through the lens of the WASH sector.

As I will discuss in later chapters, the choice of a development indicator is not inconsequential; the extent to which an intervention is or is not 'successful' depends largely on how success is defined. Accordingly, the preceding foray into the history of water management is no mere sidetrack, but an essential foundation on which my analysis is built. By choosing to focus on water, rather than GDP, I am effectively claiming that development is distinct from, although undoubted related to, wealth alone. Aid, therefore, as a development tool, ought to be evaluated under this framework in terms of its effect on the former, regardless of the latter. If I am right, and if Hugo's axiom holds true, then history will judge aid not by the economic growth that it did or did not produce, but by the wells it dug, the pipes it laid, the sewers it built, and, above all, the lives it saved.

The World Water Crisis

If development can be measured by the extent to which the need for clean drinking water and effective sanitation is met, then by this standard, much of the world remains severely and tragically undeveloped. Estimates differ, but by any measure, as much as one-third of the global population today

[12] Easterly (2001): 4

lives without access to even the basic facilities pioneered by ancient urban planners millennia ago.[13] This section outlines the scope of the 'world water crisis,' which, despite decades of effort and many billions of dollars spent, remains among the most pressing and costly (in terms of dollars and human lives) development challenges facing the world today.

With regard to the scale of the problem, the numbers largely speak for themselves. The World Health Organization (WHO), the most widely-cited source of global health data, estimates that more than 780 million people lack access to an improved source of drinking water, while some 2.5 billion have no access to improved sanitation.[14] The categorization of facilities as 'improved' and 'unimproved' is an interesting and not uncontroversial process, and one that will be discussed at length in Chapter 6; for the time being it is enough to acknowledge that a large proportion of the global population relies today on drinking water and sanitation considered by the international community's leading health experts to be of unacceptable quality.

The human cost of this shortfall is staggering. In its most recent reports, WHO estimates the number of water-related deaths at approximately 3.57 million each year, around 6 percent of all deaths worldwide.[15] Estimates elsewhere in the literature vary from fewer than 2 to more than 12 million, a range which speaks both to the difficulty of tracking health in the developing world and to the complexity of establishing a clear casual connection between water and disease. According to even the lowest figures, however, water-related diseases kill more people than all of the world's wars and other violent conflict combined.

More troubling still, it is children who bear the greatest burden of water-related disease and mortality. WHO has estimated the number of water-related deaths among children less than 14 years old at as many as 3 million per year, accounting for more than one-quarter of total mortality for this age

[13] See Gleick (2009), UNICEF/WHO (2012), WHO (2012), UN (2012)

[14] UNICEF/WHO (2012), WHO (2012), UN (2012)

[15] Prüss-Üstün et al. (2008)

group. The majority of these deaths are among the youngest children, those under five years of age.[16] Also at disproportionate risk for water-related mortality are the elderly and those with compromised immune systems due to HIV infection and other chronic conditions.[17]

Mortality rates alone, however, do not tell the whole story. Water-related diseases are also responsible for significant morbidity, again particularly among children. Using a measure of overall disease burden known as Disability-Adjusted Life Years (DALYs), WHO estimated that in 2004 water-related diseases accounted for some 135 million years of life lost due to death and morbidity. As a result of its effects on public health, inadequate drinking water and sanitation in developing countries has also been linked to a myriad of other social ills, including educational non-attainment, gender inequality, poor economic productivity, and outbreaks of violent conflict.[18]

All of these data should be taken with more than a grain of salt. Differing assumptions, definitions, and accounting procedures can lead to vast disparities between various estimates, and none of them can be authoritatively cited as capturing the true scope of the world water crisis. Aside from the obvious problem of how best to account for the cost of morbidity in relation to mortality, there is also a more fundamental question of what, exactly, is a water-related disease?

WASH expert Peter Gleick disaggregates water-related diseases into four classes based on their connection to water quantity and quality. 'Waterborne diseases' are those caused by pathogenic bacteria and viruses ingested along with water contaminated by human or animal feces and include cholera, typhoid, amoebic and bacterial dysentery, and other diarrheal diseases. 'Water-washed diseases,' such as scabies, trachoma, and flea, lice, and tick-borne diseases, are associated with poor personal hygiene, as well as skin or eye contact with contaminated water. 'Water-based diseases,' which include dracunculiasis, schistosomiasis, and other helminthic parasites, are found in intermediate organisms

[16] Ibid.

[17] UNDP (2006)

[18] UNDP (2006), WHO (2012), UNICEF/WHO (2012)

inhabiting contaminated water. Finally, 'water-related insect vectors' are diseases spread by insects that breed or feed in or near contaminated water, including malaria, onchocerciasis, filariasis, trypanosomiasis, and yellow fever.[19]

To these recognized categories might be added a fourth, 'water-enabled diseases,' such as malnutrition, vitamin deficiency, anemia, and immune system conditions which, although not directly caused by water, may be exacerbated by chronic water deprivation, and a fifth, 'water-related injury,' which includes drowning due to floods and extreme weather events. Diseases related to the contamination of drinking water with toxic chemicals, including those linked to cancer, are generally not included in most measures of water-related disease, despite the fact that they have long been the primary water quality concern in wealthier countries and are of increasing importance in the developing world.[20]

Among water-related diseases, the first category, waterborne illnesses, is the most widely associated with the WASH sector, and indeed many reports and studies on water and sanitation in developing world restrict their analysis solely to diarrheal diseases, which in any event account for a plurality, if not a majority, of all water-related mortality.[21] Others include all or most of the diseases included in some classes but not others; the WHO figures cited above, for instance, include water-borne and water-based diseases, as well as malnutrition and drowning, but exclude water-washed diseases.[22]

Further complicating the situation is the issue of underreporting of diseases, particularly in those developing countries where they are most likely to occur, which is likely to lead observers to underestimate their occurrence.[23] Nor are water-related diseases likely to occur in isolation; populations with limited access to clean water and sufficient sanitation face simultaneous exposure to all categories of

[19] Gleick (2002)

[20] See Parkin (2007), Salzman (2012)

[21] See, for instance, Prüss-Üstün et al. (2004)

[22] Prüss-Üstün et al. (2008)

[23] Cash and Narasimhan (2000), Prüss-Üstün et al. (2008)

these illnesses and thus face multiple, repeated, and chronic infection, greatly increasing the risk of mortality. Isolating a specific cause of death in these circumstances is a difficult task made even more so because such communities also tend to lack access to basic medical care and public health programs.[24]

As I will discuss in later chapters, these considerations are of more than passing concern. As the study and practice of international development becomes increasingly preoccupied with concepts of effectiveness and accountability, decisions as to how the burden of water-related disease should be measured have direct and tangible bearing on the ability of scholars and practitioners to set priorities, evaluate progress, and develop strategies. Regardless of how it is measured, however, the water crisis is enormous in scope and profound in its consequences. It is all the more tragic for being almost entirely preventable; the fact that the vast majority (according to some estimates up to 99 percent) of water-related deaths occur in developing countries is evidence of the fact that millions of deaths and untold suffering could be avoided simply by expanding access to the basic water supply and sanitary services that those in the developed world take for granted.[25] If any challenge warrants an international response, then the world water crisis surely tops the list.

Foreign Aid in the WASH Sector

Over the past half century, the international community has poured money, in the form of foreign aid, into the WASH sector. The amount of development assistance committed to water and sanitation projects has grown steadily from approximately $700 million in 1960 to well over $6 billion by 2000, in constant (2009) U.S. dollars.[26] Since the turn of the century, and following the call of the Millennium Development Goals (MDGs) to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation," commitments have increased faster still, at an average

[24] Parkin (2007)

[25] Prüss-Üstün et al. (2008)

[26] See Figure 1 (Source: AidData, 2013)

of 5 percent annually, reaching a high of nearly 12 billion dollars by 2009.[27] In all, nearly one-quarter of a trillion dollars has been allocated as aid for water and sanitation over the past 50 years.[28]

Figure 1.1 below shows this trend across time, from 1960 through 2009. Figure 1.2 displays total WASH aid adjusted for the estimated population of likely recipients, defined in this case as low and middle income countries, using data from the World Bank Development Indicators (WDI) database. Figure 1.3 displays the estimated share of total development assistance from all sources allocated to WASH sector projects. Figures 1.4 through 1.6 show the same data, restricted to the years 1980 through 2009, the period in which the available data is likely the most complete.

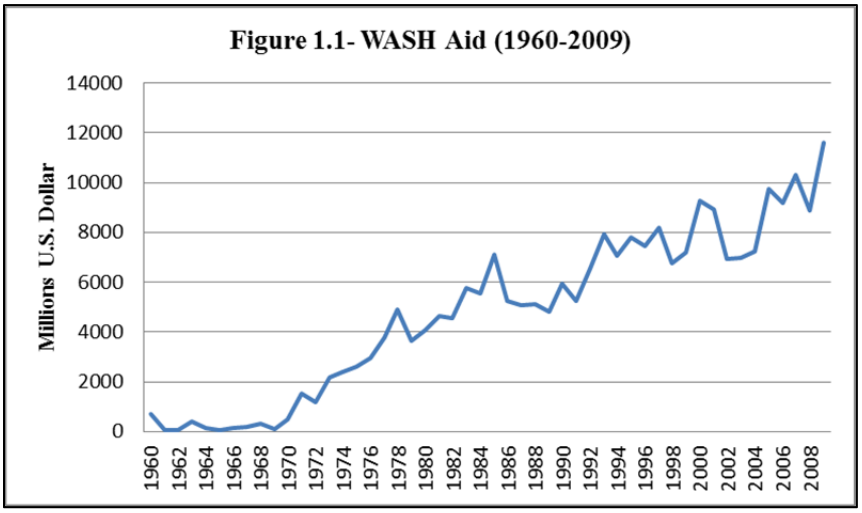
These, like much of the data used in this paper, were obtained from AidData, a partnership between Brigham Young University, the College of William and Mary, and the non-profit Development Gateway that collects and standardizes information on aid disbursements from a wide range of donors and that is widely considered to be the best available source of such data.[29] Broadly, they show that WASH aid has increased relatively steadily across the period, generally keeping pace with population growth in developing countries. However, the WASH sector's share of total aid is decreasing, a phenomenon that has been noted in a number of recent publications. The most recent Global Analysis and Assessment of Sanitation and Drinking Water (GLAAS) reports, compiled by WHO and the United Nations' UN-Water, for instance, cite this trend as justification for a renewed emphasis on the WASH sector.[30]

[27] OECD 2012

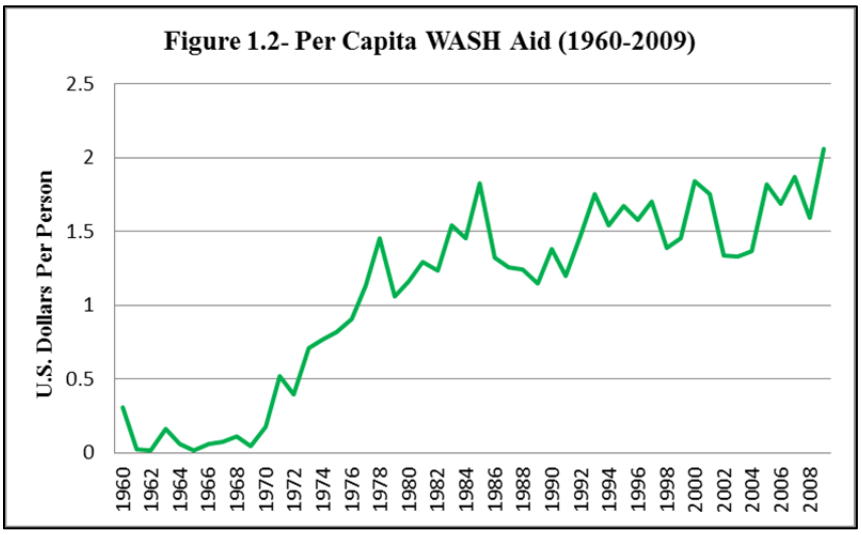
[28] I use the term WASH aid, here and throughout the paper, except where otherwise specified, to mean all development assistance, whether in the form of grants or loans, from multilateral and bilateral sources for development projects related to the provision of drinking water, sanitation, and non-agricultural water resources management, including projects with both Official Development Assistance (ODA) and non-ODA components.

[29] AidData (2013)

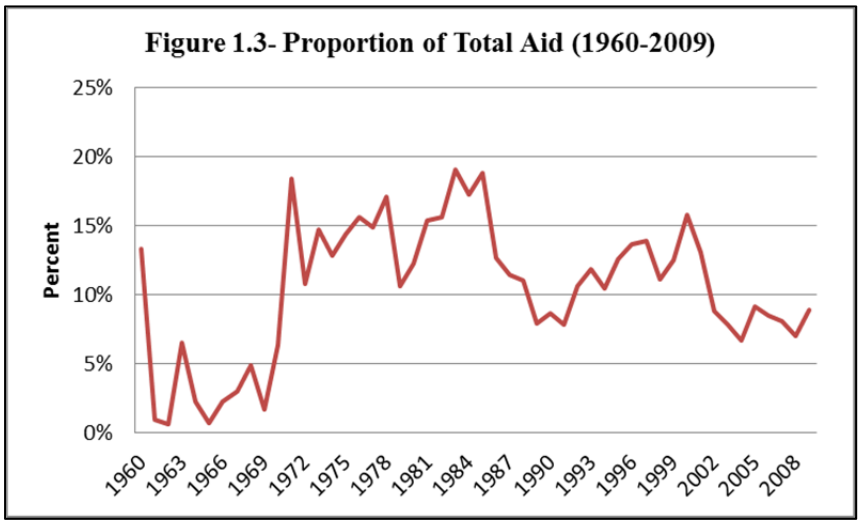
[30] WHO (2012); Gleick (2002)



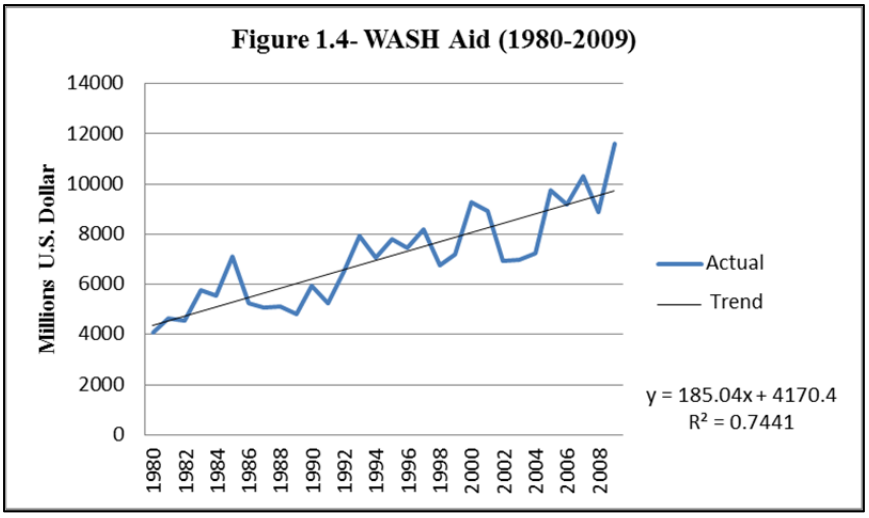
Source: Compiled from AidData (2013), World Bank (2013a)



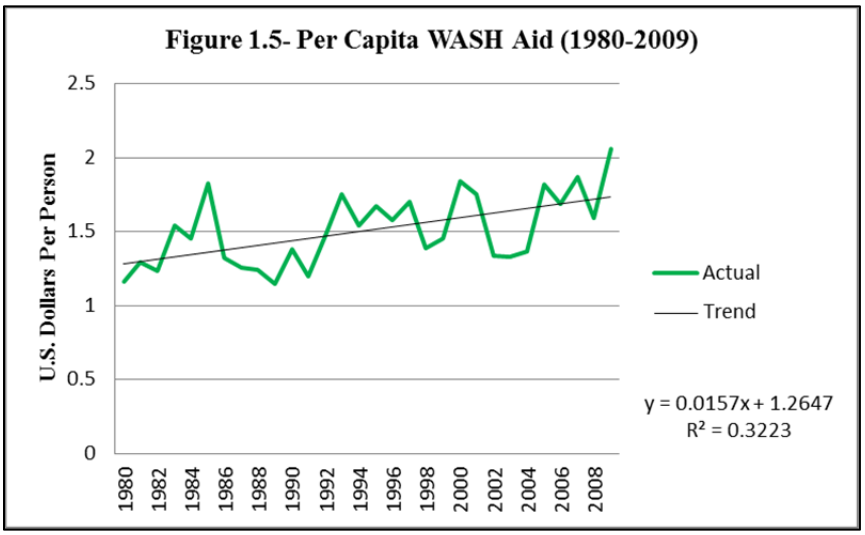
Source: Compiled from AidData (2013), World Bank (2013a)



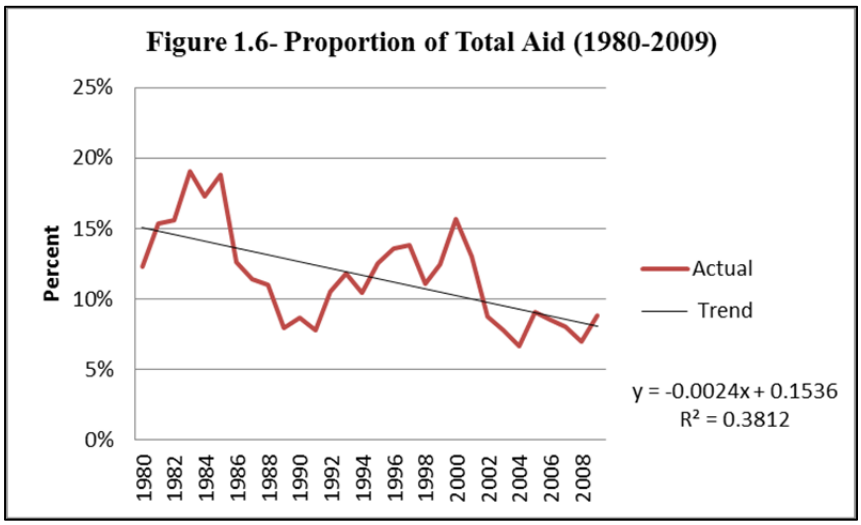
Source: Compiled from AidData (2013), World Bank (2013a)



Source: Compiled from AidData (2013), World Bank (2013a)



Source: Compiled from AidData (2013), World Bank (2013a)



Source: Compiled from AidData (2013), World Bank (2013a)

Indeed, there is a widespread call for increased spending on WASH projects, premised on the assumption that these projects save lives and, by extension, that the decision not to fund them effectively kills people. Writing in 2002, Gleick predicted that, "Even if the official United Nations Millennium Goals set for water are met- which is unlikely given the current level of commitments by national governments and international aid agencies- *as many as 76 million people will die by 2020 of preventable water-related diseases*" (emphasis in original).[31] This explicit connection between WASH aid and mortality is a common theme, but one which, aside from a handful of project-specific case studies and reports, has until now gone largely untested.

For the purposes of this paper, I adopt AidData's Water Supply and Sanitation Purpose Code Group as the means of defining WASH aid.[32] These comprise a number of water-related development activities, including the construction of wells and other drinking-water infrastructure, desalination projects, water conservation initiatives, water management capacity building, water pollution control, sewage construction, dam and reservoir construction, municipal waste management, and water assessment studies, among others, as shown in Table 1.1 below.

Not all of the activities included in the table can be linked to human health in any immediately intuitive sense. It is beyond the scope of this study to isolate only those projects with an explicit health objective; indeed, given the limited coverage of available data and the inherently integrative nature of water resource management, such a study would be prohibitively difficult to undertake. Thus, this study is premised on the hypothesis that WASH aid, even for projects without an explicit human health objective, should have an indirect impact on mortality and life expectancy by improving the efficiency and effectiveness of water management in general. As I will show, this assumption is not unreasonable; although in practice WASH sector aid is often multi-purpose and cross-sector, the ultimate aim, whether

[31] Gleick (2002): 1

[32] AidData uses a detailed coding scheme based on donor-provided description of each aid-funded project. For the purposes of this study, I use the broad Purpose Code Group for Water and Sanitation, rather than the more specific Activity Code Groups for water-related projects. For more information on the construction and function of AidData, see Tierney et al. 2011.

explicit or unspoken, of this aid is to improve human health, either directly, by preventing water-related diseases, or indirectly, through poverty alleviation.

Table 1.1- Activity Codes in the Water and Sanitation Sector	
CRS Code	**Description**
14005.01	Water Supply and Sanitation, activity unspecified
14010.01	Water resources policy and administrative management, activity unspecified
14010.02	Water sector policy, planning and programs
14010.03	Institution capacity building, Water
14015.01	Water resources protection, activity unspecified
14015.02	Inland surface waters
14015.03	Water conservation
14015.04	Prevention of water contamination
14020.01	Water supply and sanitation - large systems, activity unspecified
14020.02	Water desalination plants
14020.03	Sewerage
14020.04	Intakes, storage, pumping stations, conveyance and distribution systems
14020.05	Domestic and industrial waste water treatment plants
14020.06	Water supply assessments and studies
14030.01	Basic drinking water supply and basic sanitation, activity unspecified
14030.02	Water supply and sanitation, low-cost technologies
14030.03	Small system sewerage
14040.01	River development, activity unspecified
14040.02	Integrated river basin projects
14040.03	River flow control
14040.04	Dams and reservoirs
14050.01	Waste management/disposal, activity unspecified
14050.02	Municipal and industrial solid waste management
14050.03	Collection, disposal and treatment
14050.04	Landfill areas
14050.05	Composting and reuse
14081.01	All water supply and sanitation education/training activities
14082.01	All water research activities
14082.02	Hydrogeology

Source: Adapted from AidData (2012)

Table 1.2 below shows the top donors of WASH aid over the past 50 years.[33] The World Bank Group has historically been, and continues to be, by far the largest source of WASH aid, accounting for nearly thirty percent of the total commitments. Among the bilateral donors, Japan heads the pack, with

[33] Data from AidData (2013)

more than twice the total funding as the next largest donor in this category. The Inter-American Development Bank and Germany also contributed relatively large shares, but aside from these few, the impression seems to be that WASH aid is a fairly open sector, with wide and generally equitable participation among multilateral and bilateral agencies. Altogether, some sixty-five donors have been involved in the sector, with the majority accounting for less than one percent each of the total.

Table 1.2- Top Donors of WASH Aid (1960-2009)

Multilateral			Bilateral		
Donor	**Commitments (millions)**	**Percent of total**	**Donor**	**Commitments (millions)**	**Percent of total**
World Bank Group[34]	$68,258.00	28.58%	Japan	$33,090.24	13.85%
Inter-American Development Bank	$21,828.55	9.14%	Germany	$14,986.89	6.27%
Asian Development Bank[35]	$12,796.04	5.36%	United States	$11,567.37	4.84%
European Communities	$11,942.39	5.00%	France	$8,072.79	3.38%
African Development Bank[36]	$8,905.32	3.73%	Netherlands	$5,594.75	2.34%
Arab Fund for Economic and Social Development	$5,544.00	2.32%	Kuwait	$5,234.41	2.19%
European Bank for Reconstruction and Development	$2529.70	1.06%	Denmark	$3460.73	1.45%
Andean Development Corporation[37]	$1509.36	0.63%	Italy	$3280.86	1.37%
North American Development Bank[38]	$1303.12	0.55%	United Kingdom	$2942.61	1.23%
Islamic Development Bank	$1038.73	0.43%	Saudi Arabia	$2644.80	1.11%

Source: Compiled from AidData (2012) **Commitments in constant (2009) U.S. dollars**

[34] International Bank for Reconstruction and Development (IBRD), International Development Association (IDA), International Finance Corporation (IFC), World Bank Managed Trust Funds, and Carbon Finance Unit (CFU)

[35] Including Asian Development Fund

[36] Including African Development Fund

[37] Latin American Development Bank

[38] Bi-national financial institution governed by the United States and Mexico; included here as a multilateral organization.

On the beneficiary side, 200 countries received WASH aid over the period, including a number of autonomous and non-self-governing territories. Not all of these can be considered developing countries, even by the loosest definition. The United States, for instance, received a total of approximately US$625 million over a number of years from the North American Development Bank, a partnership between the U.S. and Mexico dedicated to the development of their shared border region. Table 1.3 below shows the top ten recipients of WASH aid from 1960 to 2009, in terms of both total dollars received and scaled by population.

Table 1.3- Top Recipient of WASH Aid (1960-2009)

Largest Overall Recipients			**Largest Per Capita Recipients**		
Recipient	**Total aid (millions)**	**Percent of total**	**Recipient**	**Aid per capita**	**Total aid (millions)**
China	$15,510.32	6.49%	Saint Lucia	$1208.13	$164.75
India	$14,816.12	6.20%	Cayman Islands	$1176.06	$23.32
Brazil	$12,855.85	5.38%	Seychelles	$1158.29	$83.04
Morocco	$8,596.62	3.60%	Dominica	$1107.04	$78.43
Egypt	$7,759.25	3.25%	St. Kitts & Nevis	$1091.59	$46.36
Mexico	$6,802.81	2.85%	Tuvalu	$1005.00	$9.68
Indonesia	$6,654.11	2.79%	Samoa	$931.46	$158.30
Philippines	$5,860.11	2.45%	Jordan	$929.22	$3,214.24
Argentina	$5,439.93	2.28%	Cape Verde	$711.00	$286.00
Turkey	$5,406.58	2.26%	Turks and Caicos[39]	$697.31	$9.26

Source: Compiled from AidData (2012) **Amounts in constant (2009) U.S. dollars**

Neither format is particularly informative regarding the underlying drivers of aid allocation. Unsurprisingly, countries with large populations tended to be the largest overall recipients and, in per capita terms, island states with very small populations dominate. Table 1.4 offers a more revealing illustration by ranking recipients on per capita terms and excluding small island countries. Here, the largest recipients, with the exception of Belize, are concentrated in the Middle-East and Africa. Given

[39] Currently a Non-Self-Governing Territory under the administration of the United Kingdom.

this region's environmental propensity toward water scarcity, it is perhaps not unreasonable to suspect that WASH aid may indeed be distributed at least partially on the basis of need.

Table 1.4- Top Recipients of Per Capita WASH Aid Excluding Small Island States

Recipient	Aid per capita	Total aid (millions)
Jordan	$929.22	$406.23
Tunisia	$681.47	$5210.66
Palestinian Territories	$562.36	$1773.04
Djibouti	$555.84	$302.87
Belize	$508.40	$93.46
Mauritania	$495.48	$113.37
Bahrain	$476.14	$290.09
Nigeria	$463.43	$3756.32
Lesotho	$446.97	$790.55
Lebanon	$439.86	$1606.28

Source: Compiled from AidData (2012)
Amounts in constant (2009) U.S. dollars

An alternative, and more cynical, interpretation of these data might be that the allocation of WASH aid is political, tending to flow to a handful of countries located in a particularly unstable region of the world. This is the conclusion of Hicks, Parks, Roberts, and Tierney in their analysis of the distribution of environmental assistance (including WASH aid) who assert that countries such as Egypt and Turkey appear on the list of the world's largest recipients "because of the geopolitical support they offer to 'patron' states- most notably, the United States and Japan."[40]

In the more specific case of the WASH sector, I would caution that such an inference may be premature, insomuch as these countries do indeed face an obvious and demonstrable need for effective water management. In recognition of these complexities, I present a more comprehensive analysis of WASH aid allocation in Chapters 4 and 5 to follow. From the outset, however, it is important to note that the same set of figures may well inspire different interpretations among different observers, a phenomenon that is all too common in the lengthy and often fierce debate over the effectiveness of foreign aid.

[40] Hicks et al.(2008): 60

The Aid Effectiveness Debate

For nearly as long as countries have engaged in the practice of granting aid, scholars and policy-makers have fiercely debated its utility.[41] As it has intensified following the 2000 adoption of the MDGs and a series of high level meetings among major donors, the dispute has spilled over from policy circles into the public sphere, perhaps best exemplified by the heated 2005 exchange between economists Jeffrey Sachs and William Easterly in *The Washington Post* and elsewhere.[42] The vast academic literature on the subject comprises theoretical treatises, project-level case studies, and empirical analyses at the community, national, and global levels.[43] Cross-country econometric analyses number in the hundreds, and yet their results have been ambiguous at best.[44] Despite decades of trials and oceans of ink spilled, most observers agree that the empirical literature has failed to produce conclusive evidence one way or the other on the question of aid effectiveness.[45]

In the vast majority of quantitative studies, aid effectiveness is conceptualized as its effect on GDP, and advocates have offered numerous theories as to how aid may foster economic growth. Aid might, some claim, promote higher rates of accumulation by supplementing domestic resource mobilization. It may exert a positive effect on balance of payments, allowing recipient countries to import productivity-boosting capital. Alternatively, aid may encourage market-friendly economic reforms, either indirectly by encouraging openness, or directly when aid is made explicitly conditional on such reforms.[46] From a humanitarian perspective, the most appealing argument may be that aid allows developing countries to break free of what Sachs and others call the "poverty trap," by supporting

[41] See, for instance Friedman (1958), Bauer (1972)

[42] Miller (2011)

[43] Doucouliagos and Paldam (2009), Michaelowa (2004)

[44] Michaelowa (2004), Hicks et al. (2008), Asra (2005)

[45] Miller (2011), White (2009), Bourguignon and Sundberg (2007), Mavrotas (2009), Arndt et al. (2009)

[46] Rajan and Subramanian (2005)

investments in health care, education, and other aspects of human capital development.[47] Premised on these theoretical foundations, there is no shortage of studies that have found a statistically significant and positive relationship between aid and wealth creation.[48]

In recent years, the theory that aid is effective only in the presence of certain 'good' political and economic policies has risen to prominence in the aid effectiveness literature, due in part to a widely cited study by Craig Burnside and David Dollar of the World Bank.[49] This model is intuitively appealing because it supports the belief, popular among scholars and policy-makers alike, that factors such as transparency, accountability, openness, and democracy tend to promote development, while corruption, authoritarianism, and protectionism tend to hinder it. By linking these factors to foreign aid, the Burnside and Dollar study also lent credence to the practice of applying policy conditions to aid; by the early 2000s, selectivity on the basis of political and economic policies had become an explicit objective of aid donors worldwide.[50]

For every study in support of aid as a development tool, however, there is another that questions, critiques, or condemns it outright. Easterly is among the leading critics of aid in general and the concept of conditional effectiveness in particular and has, in several studies, presented evidence that aid has either a negligible or negative impact on GDP.[51] Numerous scholars have produced empirical evidence supporting these conclusions, while others have leveled criticisms against aid proponents on empirical and theoretical grounds.[52] Indeed, in terms of volume, it would appear that weight of evidence is on the

---

[47] Sachs (2006)

[48] See for instance, Papanek (1973), Levy (1987), Hansen and Tarp (2000, 2001), Lensink and White (2001), Hudson and Mosley (2001), Irandoust and Ericsson (2005), Mosley et al. (2004), Gyimah-Brempong et al. (2010), and Arndt et al. (2009).

[49] Burnside and Dollar (2000); see also Collier and Dollar (2002), Durbarry et al. (1998), Burnside and Dollar (2004), Islam (2003), Dalgaard et al. (2004), among others.

[50] Including, most notably, the United States' Millennium Challenge Corporation; see Easterly(2006), UN (2003).

[51] Easterly (2003, 2006)

[52] See Griffen and Enos (1970), Boone (1996), Rajan and Subramania (2008), Roodman (2003), Easterly et al. (2004), among others.

side of the critics. In their meta-analyses of hundreds of econometric studies on aid effectiveness, Doucouliagos and Paldam conclude that the literature has utterly failed to produce robust evidence that aid has been successful in promoting growth.[53]

But while the larger debate has centered on the relationship between aid and economic growth, many authors have noted, as I have asserted above, that growth alone is not a sufficient measure of aid effectiveness.[54] Aid has many purposes, ranging from geo-political to humanitarian, many of which are not related to increasing GDP. Indeed, growth as an overall indicator of aid's success or failure may not be appropriate even on theoretical grounds. As Charles Kenny of the World Bank points out:

> It is not immediately clear why we would expect transfers received from rich countries to foster economic growth. After all, it is not the usual justification for income transfers *within* rich countries that they will lead to more rapid output growth amongst the poor at home. The usual argument involves equity concerns and ensuring a basic consumption package. An empirical exercise that suggested the largest welfare recipients in period one saw the fastest wage growth in period two in a group of OECD countries would create significant interest, but this author has not seen such a study.[55]

A more accurate assessment of aid effectiveness, therefore, may be one that disaggregates the various sectors of aid and tests them separately against their specific objectives. While the lack of data coverage has historically prevented researchers from attempting this sort of analysis, newly compiled sources of aid data and emerging testing methods, now allow researchers to examine the flow and effectiveness of specific sectors of aid.[56]

Clemens, Radelet, Bhavani, and Bazzi, for example, compare aid intended to promote short-term growth (such as agriculture, infrastructure, and industry) with aid for humanitarian and other long-term goals (such as education and environmental conservation). They conclude that, when aid with explicit

---

[53] Doucouliagos and Paldam (2009, 2010, 2011). Radelet (2006) and Dalgaard, Hasen, and Tarp (2004) disagree, stating that most recent studies have found a positive effect of aid with diminishing returns; they very fact that observers cannot agree on what the literature says is further evidence of the contentious nature of the debate.

[54] See, for instance, Asra et al. (2005), Gebhard et al. (2008), Tierney et al. (2011)

[55] Kenny (2006)

[56] Hicks et al. (2008), Wilson (2011); see also Tierney et al. (2011)

short-term economic objectives is evaluated separately, aid does appear to have a statistically significant impact.[57] Hicks et al. differentiate between projects on the basis of their potential environmental impact and, for environmentally beneficial projects, between those with global goals, such as biodiversity preservation and climate change mitigation, and those with local focus, such as water and air quality projects. Among many other results, they conclude that the allocation and impact of aid differs among these categories, further bolstering the argument for a sectoral analysis.[58]

In the education sector, Michaelowa and Weber find a statistically significant but numerically small effect of aid for education projects on school enrollment and educational attainment in developing countries.[59] These authors also present evidence that the political environment of recipient countries is an important determinant of aid's impact, to the extent that aid allocated to countries with very low levels of political freedom actually had a negative impact on educational outcomes. Dreher, Nunnenkamp, and Thiele find a stronger relationship between aid for education and primary school enrollment, but do not find a discernable difference between recipients on the basis of political or economic conditions.[60]

In his study of aid effectiveness in the health and population sectors, Wilson applies a wide variety of statistical models to data obtained from AidData and finds no significant relationship between health aid and improved health. In some of his models, Wilson includes aid for water and sanitation as a control variable and finds it too to be insignificant in the majority of cases, suggesting that this aid has not been effective at improving heath in recipient countries.[61] Wilson's study bears some additional discussion, as many of my own methods closely follows his, albeit with different results, and I will revisit it more extensively in Chapter 2 to follow.

---

[57] Clemens et al. (2004)

[58] Hicks et al. (2008)

[59] Michaelowa (2004), Michaelowa and Weber (2006)

[60] Dreher et al. (2006)

[61] Wilson (2011)

If, as Wilson and so many others have found, aid is generally ineffective as a means of promoting development, there are many possible reasons why this may be so. At each stage in the aid disbursement process, there are opportunities for leakages and waste due to corruption, poor planning, or insufficient monitoring and evaluation. Some critics have suggested that it aid fungible, crowding out government investment in development projects, while others maintain that it undermines domestic markets and economic growth.[62] There is also, of course, the moral hazard argument, familiar in debates over domestic poverty-reduction programs, that development assistance fosters dependency in recipient country governments. With aid agencies filling their coffers, some critics claim, these governments face incentives to please donors, rather than responding to the needs of the domestic private sector. Dependency on development assistance also raises political implications; it is a popular contention that aid props up corrupt and authoritarian regimes, subverts the democratic process, and weakens accountability.[63]

Each of these explanations is as plausible with regard to water and sanitation projects as with any other category of aid. Indeed, because the management of water resources is a necessarily integrative process, this sector may be at particular risk for ineffective implementation. The spatially disparate and fluid nature of water resources makes it difficult for small, localized projects to succeed in isolation, while national water management and large-scale infrastructure projects are notoriously prone to mismanagement, inefficiency, and rent-seeking.[64] Large water projects, especially dams, have stirred controversy for a very different set of reasons, owing to their inherently disruptive and sometimes catastrophic impacts to local communities and ecosystems.[65] All of these factors make the WASH sector

[62] See for instance, Pack et al. (1990), Feyzioglu et al. (1998), Khilji and Zampelli (1994), Easterly (2003), Bauer (1972).

[63] See, for instance, Moyo (2009)

[64] Verhoeven et al. (2011), Conca (2006), Salzman (2012)

[65] Salzman (2012), Conca (2006)

a particularly interesting case study; the many and well-established challenges of water management make the sector a strong test of the proposition that aid can be delivered and implemented effectively.

Impact and Responsiveness

If resolution of the aid effectiveness debate has been elusive, it is in part because there is no clear consensus as to what, precisely, effectiveness means. Although most observers focus on high level aid outcomes, and particularly GDP growth, there is, as described above, a growing movement in the literature toward sector-specific analyses. Simultaneously, many scholars and practitioners have begun to distance themselves from a result-oriented conceptualization of effectiveness and to focus rather on the process by which aid is distributed, as an outcome in and of itself.

The 2005 Paris Declaration on Aid Effectiveness, a guiding light in the study of aid effectiveness, set forth five principles for the delivery and implementation of development assistance, purportedly representing the ideal scenario for donor and recipient coordination around aid. These are 'ownership,' or the extent to which developing countries take the lead role in formulating developing policies; 'alignment,' or coordination between donor objectives and recipient country national development strategies; 'harmonization,' the extent to which donors coordinate their activities to minimize duplication and transaction costs; the nebulous 'management for results;' and 'mutual accountability,' which requires that both donor and recipient countries improve transparency to one another, as well as their respective citizenries.[66] In the post-Paris literature, these principles have themselves become bywords for, rather than instruments of, aid effectiveness, to the extent that adherence to them has often been used in place of outcomes or results as an indicator of project success.[67]

These tenets of aid effectiveness, although admirable in spirit, are limited in practice, not least of all because they are, like so many aspirational objectives, intentionally and frustratingly vague. Country ownership, for instance, appears to mean very different things to different people. On the one hand,

[66] OECD (2005); Radelet (2006) offers an interesting description of the different interpretations of the Paris principles.

[67] For example, see Easterly and Williamson (2011).

Bourguignon and Sundberg argue that ownership requires that donors grant more leeway and authority to recipient country governments to delineate development agendas and guide aid implementation.[68] On the other, Booth takes the almost precisely opposite view that true ownership can only be achieved by inducing recipient country governments to prioritize development outcomes, and that the role of donor agencies is one of "nudging county actors towards addressing the identified problems."[69] Even something as seemingly banal as country ownership may mean either less involvement in developing country politics on the part of donors, or else a great deal more.

Aside from the Paris principles, several others have emerged by tacit consensus within the literature as to when aid is and is not effective. Certain donor practices and whole categories of aid are now widely viewed as inherently ineffective and indeed prohibitive of development. Among these are those strategies that appear to prioritize donor country interests, presumably at the expense of recipients. Non-emergency food aid, for instance, has become a classic example of aid that hinders development because it may undercut domestic markets and, through a sort of moral hazard mechanism, encourage dependency. Military aid, having no explicit development objective, is also suspect.[70] Opinions differ as the efficacy of direct budget support and programmatic aid, however, which may, according to various observers, either encourage recipient country control of development agendas, or prop up corrupt and totalitarian regimes.[71]

Among all donor practices, however, none has drawn as much ire from aid critics as that of tied aid, through which recipient country partners commit, as a condition of their acceptance, to use aid funds to purchase goods or services from donor countries. Easterly and Williamson, for instance, in a recent study, rank donors in terms of the proportion of their aid that is tied and equate this measure, albeit with

[68] Bourguigon and Sundberg (2007)

[69] Booth (2011): 12

[70] See Easterly and Williamson (2011)

[71] See Cordella, Tito and Giovanni Dell'Ariccia. (2003)

some caveats, with aid effectiveness. The explicit basis of this approach is that tied aid is always, and in every instance, evidence of a donor putting its own economic self-interest above and in obstruction of the goal of development.[72]

I cautiously submit that defining tied aid as inherently ineffective and, by extension, untied as effective is problematic, for much the same reasons as is defining development simply in terms of GDP. It is thought that tied aid in general is less effective than untied aid, just as, on aggregate, wealthier countries tend to be healthier; however, there are, undoubtedly, examples of tied aid project that have been successful, just as there are certainly many untied aid project that have miserably failed. By equating instruments with outcomes, these critics run the risk of putting the cart before the horse, and may overlook the impact with which they are ultimately concerned.

To avoid falling into the same trap, I eschew the imprecise and politically-charged term effectiveness altogether. Instead, I employ two metrics that I believe encapsulate the overriding concerns of critics of development assistance- responsiveness and impact- and conceptualize effectiveness as the joint function of these two parts. I define impact as the observed effect of aid on outcomes, which is generally what most people mean when they talk about effectiveness. In more technical terms, it is the estimated elasticity of the relationship between per capita aid received and subsequent changes in the level of development indicators among recipients over time. Essentially, it is the answer to the question: does aid actually do what it is supposed to do?

The other side of the coin is responsiveness. Where impact is primarily concerned with the how aid affects aid recipients, responsiveness examines the allocation behavior of donors. For my purposes, responsiveness can be conceptualized as the degree to which aid is allocated on the basis of recipient need. Need is measured in terms of the same development indicators that aid is intended to affect, such that where impact is the effect of aid on development, responsiveness is essentially the effect of

[72] Easterly and Williamson (2011)

development on aid. Responsiveness, therefore, aims to address the question: does aid go to those who most need it?

In an ideal world, aid is both responsive and impactful. Donors allocate aid based on the needs of recipients, who use aid it effectively promote development. Such a system would be both equitable, because those with the greatest need would receive the most aid, and efficient, because aid would flow to those areas with the most 'room for improvement.' Unfortunately, ours is not a perfect world and, as experience and the literature show, both the impact and the responsiveness of aid have been highly questionable in practice.

In this paper, I investigate the impact and responsiveness of aid in the WASH sector at the global, national, and local levels, using a variety of methods and data sources. I find that there is a distinct relationship between the demonstrable impact of aid and its relative responsiveness. Across scales and time, WASH aid tends to have the greatest impact when it is allocated to recipients with median, rather than high, levels of need; its impact is measurably diminished when aid is targeted to those who need it the most. This finding presents a paradox because, as I will argue, those who most need aid are precisely those who are least likely to put it to the best use. On the bright side, however, I believe it also offers an opportunity to understand the specific circumstances under which aid can work to promote development, and how it does so.

The remainder of the paper is structured as follows. Chapter 2 analyzes the impact of WASH sector aid across countries over a 50 year time period using a series of panel data models and project level data from AidData. I find that WASH aid does indeed appear to have had a positive and significant effect on human health in recipient countries, controlling for other exogenous factors. The magnitude and significance of this impact, however, varies over time and across income groups. Among three broadly defined categories of developing countries, WASH aid appears to have had the greatest impact in middle income countries. Impact appears, perhaps surprisingly, to have reached its peak in the 1980s, a period during which the aid effectiveness debate was still in its infancy, and before declining significantly in the 1990s and rebounding in the post-2000 period. I find no evidence that aid's impact is conditional on

political or economic policies, although environmental and technical constraints do appear to be important factors.

Chapter 3 presents a case study of WASH aid impact in the Republic of Malawi. I use household-level survey data to create a sample of more than 50,000 individuals across the country and employ propensity score matching techniques to test for a discernible average treatment effect on those individuals living in areas that received WASH sector aid from 2000 through 2009. I find evidence that households in areas that received aid were significantly more likely to report using an improved source of drinking water as defined by the WHO and United Nations Children's Fund (UNICEF) Joint Monitoring Program for Water and Sanitation (JMP) and were less likely to report contracting a water-related disease. This finding is strongest in those households with median levels of reported income; the positive impacts of aid were less evident among both the wealthiest and the poorest aid recipients.

In Chapter 4, I use the cross-country dataset to examine the allocation of WASH sector aid from 1960 through 2009. I find that health indicators are generally a significant predictor of the amount of aid received by developing countries, suggesting that donors have, on aggregate, been responsive to the needs of recipient countries. This tendency was strongest during the 1990s, precisely the period when WASH aid was the least impactful. Bilateral donors, including the United States, tended to be more responsive to need than multilaterals, also in contrast with previous findings, although these donors were also more likely to respond to economic and political considerations. I examine the practices of the World Bank in detail and find, as expected, that funding from the International Development Association (IDA), the Bank's development arm, to be significantly more responsive to recipient need than that from the International Bank for Development and Reconstruction (IBRD).

Chapter 5 presents a case study of aid allocation in the Republic of the Philippines, focusing on the distribution of projects funded by the World Bank, historically the largest overall donor of WASH sector aid. I develop a model of need by predicting the relative risk in each of the cities and provinces of the Philippines from diarrheal diseases, the primary water-related health concern in that country. I find a significant relationship between the predicted instance of water-borne disease and aid allocation,

suggesting that the Bank has, at least in the case of the Philippines, been responsive to predicted, if not to reported, recipient need.

Finally, Chapter 6 develops a conceptual model of the relationship between the responsiveness and the impact of aid in the WASH sector, and analyzes the trade-offs that the recognition of this relationship presents. I offer and discuss two alternative approaches to WASH sector aid allocation, drawing from the lessons of the previous chapters- an impact-based approach, and a responsive approach, and relate each to emerging aid practices. I argue that an effective and sustainable foreign aid regime is one that is informed by, but not beholden to, each of these strategies. I conclude that, although much may remain in the way of room for improvement, the preponderance of evidence suggests that aid in the WASH sector has been, and continues to be, more than just a drop in the bucket.

CHAPTER 2

The Global Impact of WASH Aid

In the previous chapter, I outlined two distinct but interrelated measures of aid effectiveness- responsiveness and impact. This chapter, along with the subsequent one, focuses on the latter, as it applies to aid in the WASH sector. I begin by developing and testing, under a large variety of specifications, a model of WASH aid impact at the global level, using data from a number of sources on a sample of 133 countries over the 50 year period from 1960 to 2009. Consistent with the practice of previous authors, I rely predominantly on two classes of statistical models- the Dynamic Panel Model (DPM), an extension of the fixed-effects model, and the Latent Growth Model (LGM), a variant of the multi-level mixed-effects model. I find strong evidence for a statistically significant relationship between the amount of WASH aid received by developing countries and positive health outcomes. Although this result is consistent across multiple specifications of the model, its importance varies across time and within sub-categories of recipient countries.

Among other results, I find that WASH aid impact was highest in the 1980s, but declined significantly in the 1990s before beginning to increase once again in the early years of the new century. I find no evidence that aid had a greater impact in countries with more democratic or less authoritarian government regimes. I do, however, find evidence to suggest that the impact of WASH aid was greatest when allocated to middle income recipient countries with median levels of need, rather than to low income countries where need is greatest. My results suggest that this effect is due to environmental and technical factors in the poorest countries that tend to hinder the expansion of access to drinking water and sanitation.

Data Sources

Data for this global analysis were in the form of annual, country-level statistics obtained from a variety of sources, including AidData, the World Bank's WDI database,[73] and the Polity IV database.[74]

[73] World Bank (2013a)

The final sample includes 133 countries, and spans the 50 year period from 1960 through 2009. Readers will no doubt note that this panel is significantly larger and longer than many of those found elsewhere in the literature, a point which bears some discussion.

Many scholars have tended to restrict their analyses of aid effectiveness to only those countries that are currently considered to be developing, in terms of income per capita, poverty rate, and other indicators, and often exclude countries, such South Korea, Taiwan, Israel, and the Czech Republic that, although they have historically been large recipients of foreign aid, are no longer generally considered to be developing. Such an approach creates the potential for selection bias; samples based on current levels of development exclude, by definition, those countries in which development has been most successful, and thus may under-represent the impact of aid or other interventions. Others, indeed most, examine only a limited time frame, usually between ten and twenty years. As my results show, because the impact of aid has varied across time, the choice of time period may affect the extent to which the relationship between aid and outcomes appears significant.

In order to avoid such sources of unintentional bias, I have attempted to be as inclusive as data availability allows. Accordingly, the full sample includes all country-years for which data exist on each of the variables described below. Non-self-governing overseas territories are excluded, as are several small island countries for which data are insufficient. The Palestinian territories, although not an independent state, are included as a separate entity, consistent with the practice of both the AidData and WDI datasets. Of course, the full universe of countries has varied considerably during the time period examined. Over the course of the past half-century, names have changed, borders have shifted, countries have dissolved, and new nations have formed. I have strived to be as consistent as possible in dealing with these confounding factors. In those instances where previously divided entities merged, as is the case with Yemen and Vietnam, I treat the component nations as a single country across the entire time

[74] Marshall et al. (2011)

period.[75] Where countries divided, such as the Soviet Union and, subsequently, Yugoslavia, the situation is more complicated. It is generally not possible to differentiate aid flows within such regions. As a result, I include formerly unified countries in the sample only up to the point of dissolution and thereafter include the new countries.[76]

The definition of development also presents a challenge. Because I am primarily interested in the impact of aid in developing countries, it makes sense to exclude those nations, particularly the United States, Canada, Australia, New Zealand, Japan, and the wealthier nations of Western Europe that cannot be considered to have been 'developing' for the any significant time across the panel. For the reasons outlined above, however, I do not wish to exclude all currently developed countries. Accordingly, rather than including or excluding countries on a case by case basis, which might introduce unintentional bias, I create an index based on the annual per capita income of each country in each year. Based loosely on World Bank definitions, this index defines 'high income' countries as those with a per capita GDP above US$12,000 in constant (2009) dollars; 'upper-middle income' countries are those with a per capita GDP between US$4,000 and US$12,000; 'lower-middle income' countries have a GDP per capita between US$1,000 and $4,000; and 'low income' countries are those with a GDP per capita below US$1000.[77] For each of the models below, I restrict the sample to those countries that meet the criteria for low, upper-middle, and lower-middle countries, during the years in which they met them. This method allows countries to 'graduate' out of the sample as their level of wealth and, presumably, development increases.

[75] This approach is as much a response to data limitations as to theory. Many of the independent variables included in the models are not disaggregated for North and South Yemen or North and South Vietnam. Rather than dropping these country-years from the study, therefore, I have chosen instead to combine aid flows to these recipients for the periods during which they were separate entities, under the assumption that health outcomes in the post-unification country will be influenced by prior WASH aid flows to each of its previously independent components.

[76] This results in the loss of some (potentially valuable) information. Health outcomes in present day Serbia, for instance, may be influenced by WASH aid flows it received during the period in which it was a component part of larger Yugoslavia. However, since there is no way to tell whether WASH aid to Yugoslavia went to the region that would become Serbia, or to some other region, say Macedonia, it is impossible to test for this potential impact. My approach implicitly assumes that aid received prior to independence had negligible impact, a conservative assumption.

[77] World Bank (2013a)

Given these complexities, therefore my sample inevitably includes some inconsistencies and discontinuities, which, although I believe do not present a substantial methodological problem, should nevertheless be kept in mind in the discussion to follow. The full sample, including all years for which each country was included, can be found in the Appendix.

Description of Variables

In the analysis below, I rely on three national health indicators as the primary dependent variables against which to test the impact of WASH aid. These are infant mortality, expressed in the number of deaths per one thousand live births; child mortality, the number of deaths under five years old per one thousand live births; and life expectancy at birth, in years. These three are the most widely used indicators of overall health at the country level; because water-related illness disproportionately affects children, infant mortality and under-five mortality rates are particularly appropriate, and most of my analysis will focus on these two indicators.[78] All the dependent variables were drawn from the WDI dataset, and are based on estimates developed by national census agencies and various divisions of the United Nations.

The explanatory variable of interest is aid for water and sanitation projects (WASH aid), which was constructed using data from AidData. As discussed in the previous chapter, only projects classified under the AidData's Water Supply and Sanitation Purpose Code Group were selected for inclusion.[79] This group includes projects that are explicitly related to water provision, water quality, sanitation, and water management. Excluded are those projects that are primarily for irrigation or large hydroelectric dams, although such project may have water management components. Other sectors as well may include water-related components. Overall, however, I believe that my approach of examining only those

[78] Gebhard et al. (2008), Wilson (2011)

[79] AidData uses a detailed coding scheme based on donor-provided description of each aid-funded project. For the purposes of this study, I use the broad Purpose Code Group for Water and Sanitation, rather than the more specific Activity Code Groups for water-related projects. For more information on the construction and function of AidData, see Tierney et al. (2011).

projects specifically and exclusively for WASH sector initiatives is consistent both with theory and best established methods, given the constraints imposed by data availability.

Several control variables were included in each of the models estimated. It is well established that economic development is a strongly correlated health; wealthier countries tend to have access to better health care systems, more doctors, and more effective water and sanitation infrastructure, and a healthier population is generally more economically productive.[80] As a measure of overall economic strength, therefore, annual GDP per capita, measured in constant (2009) U.S. dollars, was included in each of the models discussed below.

Total Official Development Assistance (ODA), measured in per capita, constant dollar terms, is included in order to control for any aid effects unrelated to water. It is possible, for instance, that non-WASH aid may improve health through a general wealth effect, or through the impact of other specific sectors, especially the health sector. Alternatively, countries that tend to receive more aid may, for any number of reasons, exhibit common characteristics which systematically affect mortality. Generally speaking, nations that intentionally avoid international relationships through trade, political, or strategic alliances, and that therefore tend to receive less ODA, might also exhibit lower overall health for reasons unrelated to the effectiveness of WASH aid.[81] To further account for economic openness specifically, I include a variable measuring the openness to international trade, expressed as the combined value of all imports and exports as a percentage of GDP. Both the ODA and trade variables were obtained from WDI and are based on data from the Organization for Economic Co-operation and Development's (OECD) Development Assistance Committee and the International Monetary Fund (IMF), respectively.

Two WASH sector-specific variables were also included. The first is rural population, expressed as a percentage of total population and based on data from WDI, in recognition of the distinct challenges with respect to water management and sanitation faced by rural communities. The second is a water

[80] Wilson (2011)

[81] See Wilson (2011), Gebhard et al. (2008)

scarcity index calculated using WDI estimates of annual renewable freshwater resources for each of some 177 countries and territories. For each country-year, annual renewable freshwater resources were divided by current population in order to obtain a measure of naturally available freshwater per capita. Adopting the definitions of water stress, water shortage, and water scarcity cited by the United Nations Environmental Program and others, I assigns each county-year a value from 0 to 3 based on the level of water availability per population.[82] Countries with less than 1,700 cubic meters of available freshwater per capita (water stress) in any given year were assigned a value of 1; those with between 1,000 and 1,700 cubic meters per capita (water shortage) were assigned a value of 2; and those with less than 1,000 cubic meters (water scarcity) were assigned a value of 3; all other countries were given a value of 0.

I also include a governance variable constructed from the Polity IV index, which measures the degree of institutional democracy and authoritarianism in each country. In the models described below, the polity score is constructed as an integer from -10 to 10, with higher values indicating higher degrees of democracy and lower levels of autocracy. In particular, this score accounts for three general principles- the existence of institutions, such as free elections, by which citizens can effect change on national policy and leadership; the presence of institutional constraints on executive power; and the extent to which civil liberties are guaranteed under law and in practice.[83] The relationship between these factors and either general wellbeing or health as measured by mortality indicators can and should be debated elsewhere; for the purposes of this study, I include the polity score only as a general measure of regime structure, under the admittedly tenuous theory that more democratic governments are more responsive to the health needs of their citizens. In some of the models, the joint effect of water sector aid and the polity score is tested by including an interaction term constructed as the product of these two variables.

[82] Falkenmark and Widstrand (1989), cited in UNEP/WMO (2001); although these are controversial definitions, not least of all because they do not account for annual water withdrawals, I believe they offer a useful proxy for environmentally-imposed water availability.

[83] Marshall et al. (2011)

In addition to these primary variables, I also use the percentage of the population with access to improved drinking water as an alternative dependent variable of interest. This variable was also obtained from the WDI and includes estimates for most countries in each of the years 1990 through 2009. With the exception of this variable, the polity score, and the water scarcity index, all independent and dependent variables were constructed as natural logs, unless otherwise noted, in order to obtain linear relationships.[84] A detailed description of the variables and data sources used in this section is included in Appendix A. Summary statistics for each are shown in Table 2.1 below.

Table 2.1- Summary of Key Variables

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
WASH Aid (constant US$ per capita)	10611	3.50	19.313	0	918.65
Child Mortality Rate (<5 years, per 1000)	8361	86.78	80.46	2.1	449.8
Infant Mortality Rate (<1 year, per 1000 births)	8363	58.04	47.20	1.7	242.1
Life Expectancy at Birth (years)	9565	62.55	11.59	26.82	83.00
Gross Domestic Product (constant US$ per capita)	7648	8131.30	14204.53	79.10	171545.80
Polity Index (-10 to 10 integer scale)	7141	0.28	7.49	-10	10
Foreign Trade (percentage of GDP)	7119	76.69	49.19	0.18	445.91
Official Development Assistance (constant US$ per capita)	7005	94.78	409.99	-203.59	12014.40
Rural Population (percentage of total population)	10390	51.58	25.16	0	97.96
Water Scarcity (1 to 3 categorical)	11096	0.08	0.41	0	3
Improved Water Access (percentage of population)	3631	82.84	19.43	1.92	100

Source: Compiled from Aid Data (2013), World Bank (2013a), World Bank (2013b), Marshall et al. (2011)

Models and Results

The hypothesis that WASH aid improves health rests on two assumptions: that aid dollars can be translated into increased access to clean drinking water and adequate sanitation, and that access to

[84] The use of the natural logarithms, as opposed to other potential transformations, is not uncontroversial. Among other drawbacks, this construction leads to the loss of information by dropping observations for which a variable is equal to zero- e.g. countries that received no WASH aid in a given year. I have followed convention by following this approach and I believe that the choice is justified given the distribution of the variables in question. Additional sensitivity analysis revealed similar results using the untransformed dependent variables and the independent WASH aid variable.

sanitation and drinking water improves health. Therefore, before comparing WASH aid and health directly, it is useful to independently examine these underlying assumptions. I test the impact of access to an improved source of drinking water on health using a fixed effects panel regression of the form:

$$Y_{i,t} = \beta_0 + \beta_1 X_{1,i,t} + \alpha_i + \mu_{i,t}$$

Where Y is a measure of health, X is the vector of explanatory variables, including the percentage of the population with access to an improved source of drinking water, α is the unobserved county-specific effect, and μ is the error term. Estimating this equation using generalized least squares (GLS) indicates that, as expected, access to clean drinking water is a statistically significant and numerically important predictor of health, as measured by infant mortality, child mortality, and life expectancy.[85]

Table 2.2- Impact of Water Access on Health (Fixed Effects by GLS)

Variable	Child Mortality Rate	Infant Mortality Rate	Life Expectancy
Water Access	-0.015***	-0.013***	0.002***
	(0.001)	(0.001)	($2.4x10^{-4}$)
ODA	0.010**	0.008*	0.008***
	(0.005)	(0.004)	(0.001)
GDP	-0.186***	-0.178***	0.016***
	(0.010)	(0.010)	(0.003)
Polity Score	$2.6x10^{-4}$	$-2.9x10^{-5}$	$3.4x10^{-4}$
	(0.001)	(0.001)	($3.5x10^{-4}$)
Rural Population	0.025***	0.023***	-0.004***
	(0.001)	(0.001)	($4.2x10^{-4}$)
Water Scarcity	-0.036	-0.029	0.019
	(0.039)	(0.037)	(0.012)
Trade	-0.001***	-0.001***	$8.5x10^{-5}$
	($1.9x10^{-4}$)	($1.8x10^{-4}$)	($6.0x10^{-5}$)
Constant	5.438***	4.999***	3.927***
	(0.155)	(0.144)	(0.048)
Observations	2183	2183	2183
R^2 (within)	0.598	0.590	0.223
R^2 (between)	0.623	0.598	0.524
R^2 (overall)	0.629	0.604	0.504
Rho	0.951	0.951	0.883

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level
Cluster robust standard errors in parentheses

This basic model also lends some insight into the behavior of the other explanatory variables. As Table 2.2 shows, both GDP and the trade variable had a significant and negative impact on child and infant mortality, and a positive impact on life expectancy. This suggests that both wealth and economic

[85] All models were estimated using STATA 12 software.

openness are important contributors to health. The proportional size of the rural population had a significant and negative impact on health, implying that, as cited extensively in the literature, that rural areas face especially difficult public health challenges. Neither the polity score nor the water scarcity index was statistically significant.

Using the same equation as above, I test the effect of WASH aid for water on access to an improved source of drinking water. In this case, the WASH aid variable is constructed as a sum of all the aid for water and sanitation received by a given country during the past ten years. This use of a ten-year sum is common in the literature and is appropriate because aid, and particularly WASH aid, entails lengthy disbursement and implementation processes. As Table 2.3 shows, the WASH aid is both positive and significant at the one percent level. GDP, the polity score, and openness to trade were also significant and positive, while the rural population rate was significant and negative.

Table 2.3- Impact of Water Aid on Water Access (Fixed Effects by GLS)

Variable	Coefficient	
Water Aid (10 year sum)	0.332***	(0.097)
GDP	1.085***	(0.285)
ODA (10 year sum)	0.043**	(0.021)
Polity2	0.166***	(0.031)
Rural Population	-0.777***	(0.034)
Trade	0.041***	(0.006)
Water Scarcity	-1.996*	(1.076)
Constant	105.841***	(3.273)
Observations	2161	
R^2 (within)	0.367	
R^2 (between)	0.451	
R^2 (overall)	0.440	
Rho	0.940	

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Cluster robust standard errors in parentheses

Taken together, these results imply that WASH aid tends to increase access to clean drinking water and, in turn, that access to clean drinking water tends to improve health. By extension, it is reasonable to hypothesize that aid does have a beneficial impact, by way of expanding access. Because it is measured only in several years, however, the inclusion of the water access variable restricts the model to a small number of panels. Therefore, in the models to follow, I estimate the impact of WASH aid

directly on health outcomes, clustering by country to obtain heteroskedasticity-robust standard errors. As Table 2.4 shows, WASH aid is significant, at the five percent level or above, and of the expected sign for all three indicators.

Table 2.4- Impact of Water Aid on Health (Fixed Effects by GLS)			
Variable	**Child Mortality Rate**	**Infant Mortality Rate**	**Life Expectancy**
WASH Aid (10 year sum)	-0.041*** (0.009)	-0.038*** (0.008)	0.008*** (0.002)
GDP	0.151*** (0.036)	-0.149*** (0.032)	0.003 (0.009)
ODA (10 year sum)	-0.001 (0.002)	-0.001 (0.001)	0.001 (0.001)
Polity Score	-0.015*** (0.003)	-0.014*** (0.003)	0.002** (0.001)
Water Scarcity	0.022 (0.054)	0.030 (0.056)	-0.003 (0.020)
Rural Population	0.036*** (0.006)	0.032*** (0.005)	-0.006*** (0.001)
Trade	-0.003*** (0.001)	-0.003*** (0.001)	$2.9x10^{-4}$ ($2.0x10^{-4}$)
Constant	3.599*** (0.383)	3.460*** (0.339)	4.329*** (0.091)
Observations	3633	3633	3655
R^2 (within)	0.645	0.648	0.381
R^2 (between)	0.537	0.525	0.461
R^2 (overall)	0.528	0.517	0.440
Rho	0.916	0.916	0.845

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level
Cluster robust standard errors in parentheses

As an extension of the fixed effects model, I estimate a Dynamic Panel Model (DPM), in which a time variable and the lagged dependent variable are included as explanatory variables, according to the structural equation:

$$Y_{i,t} = \beta_0 + \beta_1 X_{1,i,t} + \beta_2 Y_{i,t-j} + \alpha_i + t + \mu_{i,t}$$

Where $Y_{i,t-j}$ is the dependent variable lagged over j years and t is a time variable. By including both time and the lagged dependent variable as explanatory variables, this construction accounts for any global 'background' changes in health in over time, such as the development and diffusion of new medical technologies, and adjusts for any joint trends among the other variables. Although some have suggested that least squares estimates of DPM may be biased and inconsistent, the main source of this bias is thought to concern the estimated coefficient of the lagged dependent variable term, rather than the

explanatory variables of interest, and thus is not of concern here.[86] In estimating the DPM, I include as an independent variable the dependent variable (child mortality rate, infant mortality rate, or life expectancy, as appropriate) lagged over ten years. The results of this trial are shown in Table 2.5 below.

Table 2.5- Impact of WASH Aid on Health (Dynamic Panel Model)

Variable	Child Mortality Rate	Infant Mortality Rate	Life Expectancy
WASH aid per capita	-0.014***	-0.013***	0.002**
(10 year sum)	(0.004)	(0.004)	(0.011)
GDP	-0.067***	-0.068***	0.001***
	(0.017)	(0.016)	($2.2x10^{-4}$)
ODA	-0.004	0.006	0.001**
	(0.015)	(0.014)	($2.3x10^{-4}$)
Polity Score	-0.003*	-0.003*	0.001***
	(0.002)	(0.001)	($2.3x10^{-4}$)
Trade	-0.001*	-0.001**	$1.1x10^{-4**}$
	($3.3x10^{-4}$)	($2.8x10^{-4}$)	($4.7x10^{-5}$)
Rural Population	-0.001	-0.001	-0.001**
	(0.004)	(0.003)	($2.6x10^{-4}$)
Water Scarcity	0.148***	0.117***	-0.120
	(0.037)	(0.034)	(0.011)
Lagged Dependent	0.727***	0.746***	0.375***
Variable	(0.050)	(0.049)	(0.018)
Time	-0.008***	-0.007***	0.001***
	(0.002)	(0.002)	($1.8x10^{-4}$)
Constant	1.836***	1.653***	2.461***
	(0.382)	(0.346)	(0.078)
Observations	3519	3519	3631
Rho	0.883	0.883	0.761
R^2 (within)	0.891	0.899	0.496
R^2 (between)	0.958	0.956	0.920
R^2 (overall)	0.930	0.928	0.820

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level
Cluster robust standard errors in parentheses

Using this model, the water scarcity index was a significant contributor to both child and infant mortality. Trade is again significant, as is GDP; the polity score was significant for child and infant mortality, but not for life expectancy. Rural population had a significant and negative impact on life expectancy, but was insignificant in the infant and child mortality models. WASH aid again had a significant and positive impact on health as measured by each of the indicators.

As an alternative specification, each of the previous tests was repeated using the Latent Growth Model (LGM), a variant of the multi-level mixed effects regression in which an independent time variable

[86] Wilson (2011)

is estimated for each panel group, in this case individual countries. The structural equation for this model takes the generalized form:

$$Y_{i,t} = (\beta_0 + \gamma_{0,i}) + \beta_1 X_{,i,t} + (\beta_5 + \gamma_{t,i})(T) + \mu_{i,t}$$

Where the term $(\beta_0 + \gamma_{0,i})$ is the country-specific intercept term and $(\beta_1 + \gamma_{t,i})(T)$ represents the estimated rate of change over time. This flexible construction allows both random coefficients and random slopes, which is appropriate insomuch as health in recipient countries may begin at different initial levels, and change at different rates.[87] Some authors have suggested that LGM may be subject to endogeneity bias, though this effect can be minimized by employing maximum likelihood estimation as opposed to least squares estimation methods. No lagged dependent variable is included in the LGM method.[88]

Table 2.6 shows the results using the LGM specification. WASH aid again appears to have had a positive impact on health (a negative impact on mortality and a positive impact on life expectancy) and was significant at the five percent level or above for each of the three health indicators. As expected, GDP was also significant in each of the models. The rural population rate had a positive and significant impact on child and infant mortality and a negative and significant impact on life expectancy, while the water scarcity index was significant and positive in the infant and child mortality models, but was insignificant in the life expectancy model. Openness to foreign trade had a negative effect on mortality, but was insignificant as a predictor of life expectancy. On the other hand, the polity score was an insignificant predictor of infant and child mortality, but did have a positive and significant impact on life expectancy.

[87] See Wilson (2011) for further discussion of the use of latent growth models in the study of aid effectiveness; for a description of the construction and functionality of latent growth models, see Beck and Katz (2007)

[88] Wilson (2011)

Table 2.6- Impact of WASH Aid on Health (Latent Growth Model)			
Variable	**Child Mortality Rate**	**Infant Mortality Rate**	**Life Expectancy**
WASH aid per capita	-0.003**	-0.003**	0.003***
(10 year sum)	(0.001)	(0.001)	(0.001)
GDP	-0.049***	-0.044***	0.011***
	(0.004)	(0.004)	(0.002)
ODA	0.001*	0.001*	0.001***
	($3.5x10^{-4}$)	($3.1x10^{-4}$)	($1.6x10^{-4}$)
Polity Score	$3.2x10^{-4}$	$3.5x10^{-4}$	$-4.0x10^{-4}$**
	($3.9x10^{-4}$)	($3.4x10^{-4}$)	($1.8x10^{-4}$)
Trade	$-2.8x10^{-4}$***	$-2.5x10^{-4}$***	$1.7x10^{-5}$
	($8.3x10^{-5}$)	($7.2x10^{-5}$)	($3.9x10^{-5}$)
Rural Population	0.006***	0.003***	-0.006***
	(0.001)	(0.001)	($3.5x10^{-4}$)
Water Scarcity	0.060**	0.045**	$2.0x10^{-4}$
	(0.025)	(0.022)	(0.011)
Time	-0.032***	-0.031***	0.001***
	(0.002)	(0.002)	($4.4x10^{-4}$)
Constant	5.151***	4.917***	4.325***
	(0.088)	(0.075)	(0.033)
Observations	3633	3633	3655
R.E. Parameters			
Sd (t)	0.018	0.018	0.004
	(0.001)	(0.001)	($2.9x10^{-4}$)
Sd (Constant)	0.597	0.502	0.189
	(0.040)	(0.033)	(0.012)
Corr (t, constant)	-0.087	-0.114	-0.735
	(0.090)	(0.091)	(0.042)
Sd (Residual)	0.065	0.057	0.031
	(0.001)	(0.001)	($3.8x10^{-4}$)

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

Taken together, these results offer a compelling case for the role of WASH aid in improving health in recipient countries, especially as measured by the infant and child mortality rates. In each of the trials described above, the WASH aid variable is constructed as a sum over ten years of all of the WASH aid received. As Table 2.7 shows, WASH aid also has a significant impact on health when constructed as a five year sum and, under DPM but not LGM, as a five year sum lagged over five years; additional sensitivity analysis indicated that the impact of aid is maximized when it is lagged between one and five years, suggesting, as expected, that it takes several years from the date of commitment for aid to be disbursed and implemented.

Table 2.7- Impact of WASH Aid on Child Mortality						
Variable	**Model 1**		**Model 2**		**Model 3**	
Model	DPM	LGM	DPM	LGM	DPM	LGM
Water Aid (current year)	-0.005* (0.003)	$1.7x10^{-4}$ (0.001)				
WASH Aid (5 year sum)			-0.012*** (0.004)	-0.003*** (0.001)		
WASH Aid (5 year lagged sum)					-0.006*** (0.002)	-0.001 (0.001)
GDP	-0.042* (0.022)	-0.053*** (0.005)	-0.068*** (0.016)	-0.048*** (0.004)	-0.063*** (0.006)	-0.050*** (0.004)
ODA	-0.001 (0.001)	-0.006** (0.002)	$-2.1x10^{-4}$ (0.001)	0.001*** ($3.3x10^{-4}$)	$2.5x10^{-4}$ (0.001)	0.001 ($4.4x10^{-4}$)
Trade	$-7.6x10^{-6}$ ($3.5x10^{-5}$)	$-3.4x10^{-4}$*** ($9.3x10^{-5}$)	-0.001*** ($1.2x10^{-4}$)	$-2.9x10^{-4}$*** ($8.3x10^{-5}$)	-0.001*** ($1.3x10^{-4}$)	$-7.2x10^{-5}$ ($8.4x10^{-5}$)
Polity Score	-0.001*** ($2.0x10^{-4}$)	-0.001 ($4.4x10^{-4}$)	-0.003*** (0.001)	$2.6x10^{-6}$ ($3.9x10^{-4}$)	-0.002*** (0.001)	0.001* ($3.9x10^{-4}$)
Rural Population	$4.5x10^{-4}$ ($3.5x10^{-4}$)	0.004*** (0.001)	-0.002** (0.001)	0.006*** (0.001)	-0.002** (0.001)	0.007*** (0.001)
Water Scarcity	0.017*** (0.004)	0.056** (0.025)	0.155*** (0.025)	0.064*** (0.025)	0.135*** (0.025)	0.040*** (0.024)
Lagged Dependent Variable	0.994*** (0.005)		0.729*** (0.127)		0.680*** (0.014)	
Time	-0.001** ($2.1x10^{-4}$)	-0.031*** (0.002)	-0.009*** (0.001)	-0.032 (0.002)	-0.010*** (0.001)	-0.030*** (0.002)
Constant	0.810* (0.042)	5.416*** (0.103)	1.839*** (0.101)	5.158*** (0.088)	2.043*** (0.110)	5.064*** (0.095)
Observations	2901	2903	3453	3579	2994	3048

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level
Standard errors in parentheses

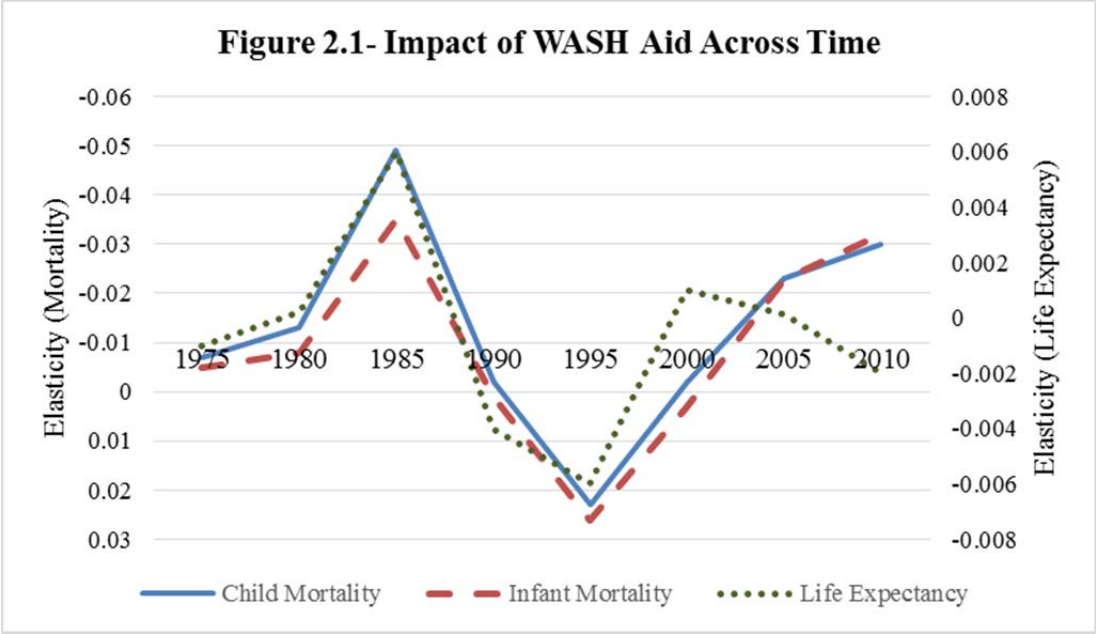
While it is significant overall, the impact of WASH aid appears to have varied considerably across time. In both the DPM and LGM models, the ten year sum of WASH aid is significant when the panel is restricted to the first half of the time series, but is insignificant afterward, suggesting a generally decreasing trend. Table 2.8 below shows the estimated impact of WASH aid in each decade of the period beginning with the year 1970. For these trials, the ten year sum of WASH aid was multiplied by a series of binary variables indicating the decade in which the aid was committed. Thus the variable WASH aid (1970-1980) is defined as the per capita value of WASH aid received by a given country if that aid was committed between the years 1969 and 1980, summed over ten years.

Table 2.8- Impact of WASH Aid on Health Across Time						
Variable	**Child Mortality Rate**		**Infant Mortality Rate**		**Life Expectancy**	
Model	DPM	LGM	DPM	LGM	DPM	LGM
WASH Aid (1960-1969)	0.007 (0.016)	0.001** (0.004)	0.007 (0.013)	0.006* (0.003)	-0.001 (0.002)	-0.005*** (0.002)
WASH Aid (1970-1979)	-0.014** (0.005)	$1.9x10^{-4}$ (0.001)	-0.013** (0.005)	$-3.2x10^{-4}$ (0.001)	0.004*** (0.001)	0.004*** (0.001)
WASH Aid (1980-1989)	-0.016*** (0.003)	-0.011*** (0001)	-0.013*** (0.003)	-0.010*** (0.001)	0.004*** (0.001)	0.005*** ($4.0x10^{-4}$)
WASH Aid (1990-1999)	0.005 (0.004)	-0.001 (0.001)	0.004 (0.003)	-0.001 (0.001)	-0.003** (0.001)	-0.002*** ($4.3x10^{-4}$)
WASH Aid (2000-2009)	-0.016*** (0.005)	-0.014*** (0.002)	-0.014*** (0.005)	-0.015*** (0.001)	0.005*** (0.001)	-0.002*** (0.001)
GDP	-0.052*** (0.017)	-0.043*** (0.004)	-0.057*** (0.015)	-0.038*** (0.004)	0.004** (0.002)	0.013*** (0.002)
ODA	$-2.9x10^{-4}$ (0.002)	0.002*** ($2.3x10^{-4}$)	-0.001 (0.002)	0.002*** ($2.0x10^{-4}$)	$-5.5x10^{-5}$ ($1.8x10^{-4}$)	0.001*** ($9.5x10^{-5}$)
Trade	$-3.4x10^{-4}$ ($2.7x10^{-4}$)	$-3.3x10^{-4}$*** ($8.1x10^{-5}$)	$-3.5x10^{-4}$ ($2.3x10^{-4}$)	$-3.2x10^{-4}$*** ($7.1x10^{-5}$)	$6.5x10^{-5}$ ($4.2x10^{-5}$)	$7.4x10^{-5}$** ($3.3x10^{-5}$)
Polity Score	-0.004** (0.002)	$-1.6x10^{-4}$ ($3.6x10^{-4}$)	-0.003** (0.001)	$-2.5x10^{-4}$ ($3.1x10^{-4}$)	0.001 (0.002)	$-4.2x10^{-4}$*** ($1.5x10^{-4}$)
Water Scarcity	0.127*** (0.039)	0.112*** (0.021)	0.101*** (0.037)	0.091*** (0.018)	0.003 (0.001)	-0.002 (0.008)
Rural Population	-0.001 (0.003)	0.005*** (0.001)	-0.001 ($2.3x10^{-4}$)	0.004*** (0.001)	-0.001*** ($2.3x10^{-4}$)	-0.005*** ($2.7x10^{-4}$)
Time	-0.007*** (0.002)	-0.033*** (0.002)	-0.006*** (0.002)	-0.031*** (0.002)	0.001** ($1.7x10^{-4}$)	0.003*** ($3.5x10^{-4}$)
Lagged Dependent Variable	0.785*** (0.046)		0.807*** (0.046)		0.434*** (0.159)	
Constant	1.336*** (0.330)	5.002*** (0.085)	1.218*** (0.315)	4.691*** (0.073)	2.319*** (0.070)	4.192*** (0.027)
Observations	3965	4625	3965	4625	4174	4770

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

For each indicator, WASH aid was highly significant in the 1980s, but insignificant in the 1990s; results in the 1970s and 2000s were mixed. This suggests that WSAH aid had the greatest impact on recipient country health in the 1980s. This trend is also evident in Figure 2.1 below, which displays the estimated coefficients of the WASH aid variable on each health indicator estimated using by series cross-section OLS regressions within individual panels at five year intervals beginning in 1975. Although the estimated coefficient of the WASH aid variable was insignificant in many of these regressions, their values follow a clear trend over time; while WASH aid had a positive impact on health during the 1970s and 1980s, its effectiveness declines rapidly in the 1990s before improving in the post-2000 period.



Source: Compiled from AidData (2013), World Bank (2013a), Marshall et al. (2011)

If the impact of WASH aid varies over time, it may also differ among recipient countries. As a starting point, I test for a relationship between the impact of WASH aid and the per capita income level in recipient countries using the definitions of low income, lower-middle income, upper-middle income, and high income countries described in the previous section. For each income level, a binary variable was generated and multiplied by the ten year sum of WASH aid received. These joint effect variables were then included as potential predictors of recipient country health using both the DPM and LGM specifications, as shown in Table 2.9 below. Accordingly, the variable WASH aid (Low Income) in the table corresponds to all the WASH aid received by a low income country over the previous ten years.

As the table shows, only WASH aid allocated to lower-middle income and upper-middle income countries had a statistically significant impact on infant and child mortality. WASH aid did not have a significant impact on mortality rates in the low income recipient countries (those with per capita GDP less than US$1000) or in high income recipient countries (those with per capita GDP greater than US$12,000).

Table 2.9- Impact of WASH Aid on Health by Recipient Income Level						
Variable	**Child Mortality Rate**		**Infant Mortality Rate**		**Life Expectancy**	
Model	DPM	LGM	DPM	LGM	DPM	LGM
WASH aid	-0.002	0.001	0.001	-4.3×10^{-4}	0.002**	0.006***
(Low Income)	(0.006)	(0.002)	(0.005)	(0.002)	(0.001)	(0.001)
WASH aid	-0.018***	-0.006***	-0.014**	-0.004***	0.006***	0.006***
(Low-Middle Income)	(0.006)	(0.002)	(0.006)	(0.001)	(0.001)	(0.001)
WASH aid	-0.020**	-0.010***	-0.021**	-0.010***	0.002***	0.001*
(Upper-Middle Income)	(0.009)	(0.002)	(0.094)	(0.002)	(0.001)	(0.001)
WASH aid	0.005	-0.005	0.005	-0.003	0.001	-0.001
(High Income)	(0.016)	(0.003)	(0.016)	(0.003)	(0.001)	(0.001)
GDP	-0.052***	-0.036***	-0.054***	-0.032***	0.008	0.013***
	(0.017)	(0.004)	(0.016)	(0.004)	(0.002)	(0.002)
ODA	-0.002	0.002***	-0.002	0.001***	2.7×10^{-5}	0.001
	(0.002)	(2.2×10^{-4})	(0.001)	(2.0×10^{-4})	(1.5×10^{-4})	(8.4×10^{-5})
Trade	-0.001*	-1.7×10^{-4}**	-4.4×10^{-4}*	-1.5×10^{-4}**	8.5×10^{-5}**	4.5×10^{-5}
	(2.6×10^{-4})	(7.9×10^{-5})	(2.3×10^{-4})	(7.2×10^{-3})	(1.9×10^{-5})	(3.0×10^{-5})
Polity Score	-0.003*	-3.5×10^{-5}	-0.003*	-1.8×10^{-4}	0.001***	-0.001***
	(0.002)	(3.6×10^{-4})	(0.001)	(3.3×10^{-4})	(1.8×10^{-4})	(1.4×10^{-4})
Water Scarcity	0.043	0.071***	0.020	0.048***	0.002	-0.006
	(0.043)	(0.016)	(0.045)	(0.015)	(0.055)	(0.006)
Rural Population	4.2×10^{-4}	0.009***	-0.001	0.006***	-0.001***	-0.005***
	(0.003)	(0.001)	(0.003)	(0.001)	(1.9×10^{-4})	(2.2×10^{-4})
Time	-0.008***	-0.031***	-0.007***	-0.030***	0.001**	0.002
	(0.002)	(0.001)	(0.002)	(0.001)	(1.2×10^{-4})	(2.9×10^{-4})
Lagged Dependent	0.735***		0.757***		0.418***	
Variable	(0.044)		(0.041)		(0.140)	
Constant	1.507***	4.642***	1.373***	4.420***	2.356***	4.205***
	(0.336)	(0.078)	(0.313)	(0.070)	(0.626)	(0.023)
Observations	4897	5595	4897	5595	5114	5741

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

The results are similar when the model is estimated independently for each income group. Table 2.10 shows the results of a series of tests in which the child mortality rate is regressed on the ten year sum of WASH aid and other explanatory variables. Three models were tested under both the DPM and LGM specifications. For each model, the sample of recipient countries was restricted to one of three general income categories- low income, middle income (including both upper and lower income), and high income countries, using the same definitions of income level discussed above. As the table shows, WASH aid had a statistically significant and negative impact on child mortality only among middle income countries. The coefficient of the WASH aid variable was not statistically significant when the sample was restricted to low income countries and was positive (and, under LGM, statistically significant) among high income recipient countries.

Table 2.10- Impact of WASH Aid on Child Mortality by Recipient Income Level						
Variable	**Low Income**		**Middle Income**		**High Income**	
Model	DPM	LGM	DPM	LGM	DPM	LGM
WASH Aid	-0.005	0.001	-0.021***	-0.005**	0.012	0.007***
	(0.006)	(0.002)	(0.005)	(0.002)	(0.007)	(0.002)
GDP	-0.075***	-0.078***	-0.045*	-0.016***	-0.025	0.039***
	(0.027)	(0.006)	(0.024)	(0.007)	(0.027)	(0.020)
ODA	-0.003	0.017***	0.001	0.001	$2.0x10^{-4}$	-0.001*
	(0.002)	($6.4x10^{-4}$)	(0.002)	(0.001)	(0.001)	($4.1x10^{-4}$)
Trade	-0.001**	-0.001***	-0.001	$1.5x10^{-5}$	0.002***	$4.0x10^{-4}$
	($3.7x10^{-4}$)	($1.1x10^{-4}$)	(0.001)	($1.2x10^{-4}$)	($3.0x10^{-4}$)	($2.0x10^{-4}$)
Polity2	$2.0x10^{-4}$	0.001**	-0.005**	$2.7x10^{-4}$	0.066**	-0.012
	(0.002)	($4.8x10^{-4}$)	(0.002)	(0.001)	(0.031)	(0.008)
Water Scarcity	0.127***	0.026	0.152***	0.107**	-0.007	-0.023
	(0.037)	(0.028)	(0.049)	(0.042)	(0.030)	(0.018)
Rural Population	0.004	0.005***	-0.004	0.001***	-0.051***	0.015**
	(0.004)	(0.002)	(0.005)	(0.001)	(0.017)	(0.006)
Year	-0.011***	-0.024***	-0.012***	-0.033***	-0.014**	-0.037***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.006)	(0.006)
Lagged Depend Variable	0.489***		0.693***		0.729***	
	(0.143)		(0.057)		(0.097)	
Intercept	2.999***	5.220***	1.867***	4.312***	1.843**	3.848***
	(0.852)	(0.003)	(0.471)	(0.150)	(0.670)	(0.443)
Observations	1572	1572	1947	1947	163	163

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

While it is not surprising that WASH aid does not appear to improve health in high income countries, where access to drinking water and sanitation is widespread, it is somewhat counterintuitive that WASH aid seems to have a greater impact in middle income than in low income countries. There are several potential explanations for this finding. It may be the case that middle income countries are more likely to have in place effective institutions that allow for the more efficient absorption of aid funds. These countries may be more economically open and thus better poised to take full advantage of international partnerships for development. Alternatively, low income countries may tend to face technical and environmental constraints not present in wealthier nations that affect both their relative income level and the potential impact of WASH aid.

Perhaps the most controversial, and widely cited, explanation is that politics holds the key to the effective implementation of aid; democratic governments may face incentives, absent in autocracies, to implement projects effectively for the benefit of their constituencies. To test this hypothesis, I include as

an explanatory variable the product of WASH Aid and the polity score under several different specifications. If democracy is indeed a prerequisite for impactful aid, this joint effect of the polity score and the WASH aid variable would be expected to be statistically significant, controlling for the independent effects of WASH aid and the polity score. As Table 2.8 below shows, however, this joint impact was not significant in any of the trials.

Table 2.11- Joint Effect of WASH Aid and Polity Score on Child Mortality

Variable	**10 Year Sum**		**5 Year Sum**		**5 Year Lagged Sum**	
Model	DPM	LGM	DPM	LGM	DPM	LGM
WASH Aid and Polity Score (Joint)	$1.6x10^{-4}$ (0.001)	$-2.1x10^{-5}$ ($1.6x10^{-4}$)	$1.9x10^{-4}$ (0.001)	$6.1x10^{-5}$ ($1.4x10^{-4}$)	$5.0x10^{-4}$ (0.001)	$1.6x10^{-4}$ ($1.5x10^{-4}$)
WASH Aid	-0.014*** (0.005)	-0.003** (0.001)	-0.012*** (0.003)	-0.003** (0.001)	-0.006* (0.004)	0.001 (0.001)
GDP	-0.067*** (0.017)	-0.049*** (0.004)	-0.068*** (0.018)	-0.048*** (0.004)	-0.064*** (0.018)	-0.048*** (0.005)
ODA	$-1.2x10^{-4}$ (0.001)	0.001* ($3.5x10^{-4}$)	$-2.5x10^{-4}$ (0.001)	0.001*** ($3.3x10^{-4}$)	$3.5x10^{-4}$ (0.002)	0.001 (0.001)
Trade	-0.001* ($3.3x10^{-4}$)	$-2.8x10^{-4}$*** ($8.3x10^{-5}$)	-0.001 ($3.3x10^{-4}$)	$-2.8x10^{-4}$*** ($8.3x10^{-5}$)	-0.001** ($3.4x10^{-4}$)	$-7.7x10^{-5}$ ($8.4x10^{-5}$)
Polity Score	-0.004 (0.002)	$3.9x10^{-4}$ ($6.3x10^{-4}$)	-0.003** (0.002)	$3.9x10^{-4}$ ($5.1x10^{-4}$)	-0.003* (0.002)	-0.001** ($5.2x10^{4}$)
Water Scarcity	0.147*** (0.02)	0.060** (0.025)	0.154*** (0.036)	0.064** (0.025)	0.132*** (0.039)	0.038 (0.024)
Rural Population	-0.001 (0.004)	0.006*** (0.001)	-0.002 (0.004)	0.006*** (0.001)	-0.001 (0.004)	0.007*** (0.001)
Lagged Dependent Variable	0.727*** (0.051)		0.729*** (0.050)		0.680*** (0.056)	
Time	-0.008*** (0.002)	-0.032*** (0.002)	-0.009*** (0.002)	-0.032*** (0.002)	-0.010*** (0.002)	-0.030*** (0.002)
Constant	1.834*** (0.383)	5.151*** (0.087)	1.839*** (0.389)	5.159*** (0.088)	2.050*** (0.443)	5.063*** (0.096)
Observations	3519	3633	3453	3633	2994	3048

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

In fact, there is some evidence to suggest that WASH aid may actually have a larger impact in countries with less democratic governments. Figure 2.12 below shows the results of a series of regressions performed within three subgroups based on the level of the polity score. In this trial, 'autocratic' countries are those with a score of less than -4; 'democratic' countries are those with a score greater than 4; and 'median' countries are those with a score between -4 and 4.

Among the three groups, only in those with low polity scores, the autocratic countries, was WASH aid a significant predictor of improved health. The natural interpretation of this result would be that autocratic countries use WASH aid more effectively than do democracies, a stark deviation from the prevailing consensus regarding aid impact and governance. While not taking a stand on this controversial conclusion, I do propose that such an outcome is evidence that the nature of the relationship between foreign aid and democracy is far from clear.

Table 2.12- Impact of WASH Aid on Child Mortality by Recipient Country Polity Score

Variable	**Autocratic Countries**		**Median Countries**		**Democratic Countries**	
Model	DPM	LGM	DPM	LGM	DPM	LGM
WASH Aid	-0.012**	-0.008***	-0.005	-0.002	-0.006	-0.001
	(0.005)	(0.002)	(0.008)	(0.002)	(0.010)	(0.002)
GDP	-0.061**	-0.020***	-0.078***	-0.076***	-0.050	-0.050***
	(0.024)	(0.006)	(0.026)	(0.006)	(0.037)	(0.011)
ODA	$-1.6x10^{-4}$	0.001	-0.003	0.001	0.002	-0.002***
	(0.002)	(0.001)	(0.008)	(0.001)	(0.002)	(0.001)
Trade	$-2.7x10^{-4}$	$1.5x10^{-4}$	$4.8x10^{-4}$	$4.6x10^{-4}$	-0.001	$-2.4x10^{-4}$
	($3.8x10^{-4}$)	($1.1x10^{-4}$)	($4.2x10^{-4}$)	($1.1x10^{-4}$)	(0.001)	($1.6x10^{-4}$)
Water Scarcity	0.171***	0.046*	0.115***	0.013	-0.532***	-0.009
	(0.028)	(0.023)	(0.016)	(0.046)	(0.132)	(0.044)
Rural Population	$1.4x10^{-4}$	0.016***	0.001	0.001	$3.4x10^{-4}$	-0.002
	(0.006)	(0.001)	(0.003)	(0.002)	(0.007)	(0.002)
Lagged Dependent Variable	0.920***		0.706***		0.418***	
	(0.107)		(0.052)		(0.087)	
Year	-0.002	-0.023***	-0.011***	-0.032***	-0.016***	-0.036***
	(0.004)	(0.003)	(0.002)	(0.002)	(0.004)	(0.003)
Constant	0.568	4.476***	1.987***	5.716***	2.844***	5.026***
	(0.622)	(0.121)	(0.423)	(0.146)	(0.671)	(0.163)
Observations	1023	1059	1761	1806	1202	1266

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level
Standard errors in parentheses

If not politics, what then can explain the relationship between income and impact? In order to identify the underlying explanatory mechanism, I estimate both the DPM and LGM constructions within groups of countries based on their relative level of key political, institutional, economic, and environmental characteristics. I use as a political indicator the polity score described above, as well as perceived political stability, as reported in the World Bank Group's Worldwide Governance Indicators (WGI) dataset. Based on enterprise, citizen, and expert surveys, the WGI quantifies perceptions of

governance quality in some 215 economies from 1996 through 2011.[89] The political stability indicator is constructed as an index ranging from approximately -2.5 for poor performance to approximately 2.5 for strong performance.

Two institutional variables were also selected from the WGIs. These were perceived government effectiveness and corruption control, each of which is also constructed as an approximately -2.5 to approximately 2.5 score. Openness to foreign trade and foreign direct investment (FDI) were selected as economic indicators measuring the degree of economic openness. These indicators were obtained from the WDI dataset, and are constructed as the sum of the value of all imports and exports and total FDI, respectively, divided by current GDP. Population density, in persons per square kilometer and the water scarcity index, both of which were constructed using data from the WDIs, were chosen as potential environmental constraints.

For each indicator, recipient countries were assigned to one of two groups based on their relative ranking. In the case of corruption control, government effectiveness, the economic indicators, and population density, those above the median were placed in the 'high' category and those below in the 'low.' For the water scarcity index, all countries with a value greater than zero, approximately one third of the total, were placed in the low category. The impact of WASH aid on child mortality was then estimated using LGM and DPM within each group by restricting the sample of recipient countries to those that met either the high or the low category definition for each indicator. For example, to test the relationship between population density and the impact of WASH aid, one model was estimated for those countries in which more than 54 percent (the median value of the rural population variable) of the population lived in rural areas in a given year and a second model was estimated for those countries in which less than 54 percent of the population lived in rural areas in a given year.

Accordingly, two models were estimated using both the DPM and the LGM approaches for each of the six political, institutional, economic, and environmental indicators, for a total of 16 separate

[89] World Bank (2013b)

regressions, the results of which are shown in Table 2.13. In the table, only the coefficients of the WASH aid variable are shown; results were similar across the models for the other control variables. Because the WGI variables are available only for the years since 1995, all of the models were restricted to this period.

Table 2.13- Impact of WASH Aid on Health by Recipient Country Conditions

		Low		High	
		DPM	LGM	DPM	LGM
Political Conditions	Democracy	-0.015**	-0.002	-0.001	-0.003
		(0.007)	(-0.002)	(0.006)	(0.002)
	Political Stability	-0.015**	-0.007***	-0.001	-0.001
		(0.006)	(0.002)	(-0.007)	(0.002)
Institutional Conditions	Government Effectiveness	-0.014***	-0.002*	0.004	-0.003
		(0.003)	(0.001)	(0.004)	(0.003)
	Corruption Control	-0.015***	-0.004***	0.007	0.003
		(0.002)	(0.001)	(0.005)	(0.004)
Economic Conditions	Openness to Trade	-0.010***	0.001	-0.012***	-0.006**
		(0.003)	(0.001)	(0.003)	(0.002)
	Openness to Investment	-0.008**	0.002	-0.009***	-0.002
		(0.004)	(0.002)	(0.003)	(0.002)
Environmental Conditions	Density	-0.004	0.001	-0.013***	-0.006***
		(0.003)	(0.002)	(0.003)	(0.002)
	Water Availability	-0.008	0.001	-0.007***	-0.003**
		(0.005)	(0.003)	(0.003)	(0.001)

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

Once again, I find no evidence that democracy increases the impact of aid. The same is true of institutional conditions; indeed, in some cases, aid appears to have been more impactful in countries with lower levels of government effectiveness and higher levels of corruption. Economic conditions had a mixed effect, with openness to trade appearing to provide some improvement to aid impact. Environmental conditions, however, had a consistently significant relationship with aid impact. The estimated coefficient of WASH aid was negative and significant under both DPM and LGM only in countries with higher levels of water availability and larger urban populations. This suggests that technical, rather than political, institutional, or economic, constraints may be the primary limiting factor for aid impact.

Discussion

The results above raise a number of interesting implications. Contrary to previous studies, I find WASH to have had a positive impact on health in recipient countries. This finding is consistent across numerous specifications of the model, suggesting that it is a robust result. The theoretical rationale for this impact is fairly straightforward- aid that goes to fund projects such as the construction of sewers or wells serves to increase access to sanitation and clean drinking water, which in turn decreases mortality due to water-borne illnesses, particularly among children. WASH aid, even for those projects which are not explicitly related to health, may help facilitate the development of more effective water resource management programs and thus indirectly lead to reduced mortality.

The impact of WASH aid for improving health also appears to have varied in importance over time. This finding might be partially explained by analyzing the history of water aid. The years from approximately 1970 through 1990, the period in which my results suggest that water aid was most effective, was marked by the rapid expansion of urban water and sanitation infrastructure across developing countries, much of it funded in part by foreign aid. Cities such as Manila, Istanbul, Jakarta, and Nairobi, among many others, underwent major infrastructure expansions and rehabilitations during this period; to help meet growing demand in urban areas, large dam and reservoir projects sprang up across the developing world, in some cases over fierce local and international opposition.[90] During the "International Drinking Water Supply and Sanitation Decade" from 1981-1990, an effort often proclaimed as a failure in the contemporary literature, the number of people without access to an improved source of drinking water fell by more than half a billion, an accomplishment, although falling far short of the programmatic objective of universal access, that has remained unmatched in any comparable time period before or since.[91]

[90] UNDP (2006), Skytta (1996), World Bank (2003), Demirci and Butt (2010), Black (1998)

[91] WHO estimated the number of people without access to clean drinking water to have been approximately 1.8 billion in 1980 (Black, 1998). This fell to 1.3 billion by around 1990 (Gleick, 1993), a decline of around 500 million over ten years. By way of comparison, it has taken more than 20 years for the number to fall an additional 500 million to an estimated 800 million in 2012 (WHO, 2012). These are admittedly imprecise estimates that do not

In some sense, therefore, the expansion of access to clean drinking water and sanitation, and the corresponding improvements in health during the years 1970-1990 can likely be characterized as a period of 'low-hanging fruit' in the reduction of water-related disease. The proliferation during this period of water and sanitation infrastructure in developing cities was a relatively efficient and cost-effective, albeit often controversial, undertaking that rapidly increased access to clean drinking water and sanitation among large segments of the developing world population, with the clear and immediate effect of improved health as measured by national-level indicators.

Beginning in 1990, however, the expansion of access slowed. Today, people living without access to clean water and adequate sanitation are far more likely to live in remote rural areas where the expansion of infrastructure is considerably more difficult.[92] Thus, the apparent decrease in WASH aid effectiveness during the 1990s may not be indicative of any detrimental change in aid allocation or project management, but rather of the technical challenges inherent in reaching those segments of the population for whom the expansion of access entails the greatest physical difficulties and monetary costs. In other words, WASH aid may have become less effective because its goals have become more difficult to achieve.

Alternatively, it may be the case that the allocation pattern of aid across time explains some of the variance. As I will show in Chapter 4, during the 1980s, WASH aid flowed predominantly to middle income rather than low income countries, a trend that is also well documented in the literature. As my results imply, and as I will argue in later chapters, WASH aid appears to have had a greater impact in these middle income countries than in the poorest countries, which were favored by donors beginning in the 1990s. The recent rise in aid impact since 2000 may also represent a shift from needier countries to those with more impressive records of aid effectiveness, although this trend is less clear.

---

account for either population growth or the convergent trajectory of sanitation access over time; however, they do serve to illustrate the point that, in retrospect, the "International Drinking Water and Sanitation Decade" was perhaps more successful than critics allow. See Christmas and Rooy (1991), Najlis and Edwards (1991), Cairncross (1992).

[92] See UNDP (2006), UNICEF/WHO (2012)

The finding that WASH aid has the greatest impact in middle income countries, and with median levels of need, is discussed in detail in Chapter 6. Importantly, to the extent I am able to identify the underlying cause of this phenomenon, it appears that environmental and technical constraints, rather than political or economic conditions, are the primary factor limiting aid effectiveness in low income countries. Despite a diligent search, I find no evidence to suggest that WASH aid has a greater impact in more democratic countries, as defined by the best available measures.

Because we adopt similar methodologies, but arrive at starkly different results, it is important to briefly compare my approach with Wilson's study of aid effectiveness in the health and population sectors. Wilson finds both health aid and WASH aid to be insignificant predictors of health as measured by the child mortality rate, infant mortality rate, and life expectancy at birth. However, his methods, while rigorous, present several issues worth mentioning. First, he uses a significantly shorter and smaller panel than I, limiting his analysis to 'high mortality countries,' which he defines as having a mortality rate greater than 50 per 1000 in the current period, thus excluding those countries in which aid likely had the greatest impact. He also examines only the period from 1975 through 2005, and only at five year intervals, limiting his analysis to just six panels and losing significant information in the process.

A second potential concern is Wilson's choice of control variables, and in particular total population. Although he does not discuss the rationale for including total population, it has been suggested elsewhere that countries with higher populations may face a disadvantage in terms of meeting public health needs.[93] The glaring issue with this variable is endogeneity; indeed it seems almost tautological to point out that mortality quite literally determines population. Although Wilson expresses mortality in per capita terms, this transformation is not sufficient, as it is well established, and indeed obvious, that the cause of population growth across all countries over time is the direct result of declining mortality rates, particularly among infants and children.

[93] Gebhard et al. (2008)

I do not include population as a control variable in any of my models, a decision that I believe is fully justified. To the extent that initial differences in population between countries are a determinant of health, this effect should be sufficiently captured as a fixed effect in both the DPM and LGM specifications. If the argument is rather that increasing population puts strain on existing resources, then this issue is addressed in my approach by the presence of the water scarcity index, which changes as population grows. The remaining proposition, that population growth reduces the efficiency of health care systems and thus leads to higher mortality rates, is not only circular, but is also refuted by Wilson's own results. In many of his models, population bears a negative sign, suggesting, in his framework, that population growth reduces mortality; clearly, the reverse is true.

Wilson and I differ also in our interpretation of the magnitude of aid's impact, which he dismisses as inconsequential. In my study, as well as his, the estimated elasticity of aid, while numerically small, is comparable to other explanatory factors. When WASH aid is constructed as a 10-year sum, the elasticity of its relationship with child mortality was -0.003 under the LGM specification and -0.014 under DPM. This implies that a one percent increase in water aid over in any one year was associated with an approximately 0.003 to 0.014 percent decrease in child mortality. By comparison, a proportional increase in GDP per capita decreased child mortality by between 0.049 and 0.067 percent. Because average GDP per capita across the period is approximately 500 times larger than per capita water aid, however, a one percent increase in water aid is considerably less in absolute dollar terms than a one percent increase in GDP, such that every dollars of per capita water aid was associated with an average 0.050-0.50 percent decrease in child mortality, as compared with a 0.002-0.005 percent decrease for every dollar of GDP per capita.[94]

More importantly, it should be emphasized that these estimates represent a relationship between what are generally localized projects and national statistics; it may be the case that the impact of aid, when examined at the level of its local beneficiaries, appears much more impressive. To explore this

[94] Ranges based on partial-logarithmic LGM and DPM regressions.

possibility, the following chapter examines the impact of WASH sector aid at the most local of scales, using household-level survey data from the Republic of Malawi. Therein, I employ propensity score matching analysis to test for a relationship between WASH aid and various individual and household outcomes. Consistent with the present chapter, I find strong evidence to suggest that aid has expanded access to improved sources of drinking water, particularly among households in low to middle income communities.

CHAPTER 3

The Local Impact of WASH Aid: Evidence from Malawi

The previous chapter examined the impact of WASH sector aid across all developing countries over 50 years. In this chapter, the analysis focuses on a single country, the Republic of Malawi, and a more limited time frame of approximately ten years. Using geo-coded aid disbursements and national survey data, I employ propensity score matching to compare the allocation of WASH aid with individual and household-level health outcomes. My results suggest that WASH aid had an impact in recipient communities as measured by the self-reported use of improved sources of drinking water. I also find limited evidence that recipients of WASH aid were more likely to use improved sanitation facilities and less likely to experience water-related illnesses. As measured by each of these indicators, I find that the impact of WASH aid is greatest among middle income households and communities.

Background

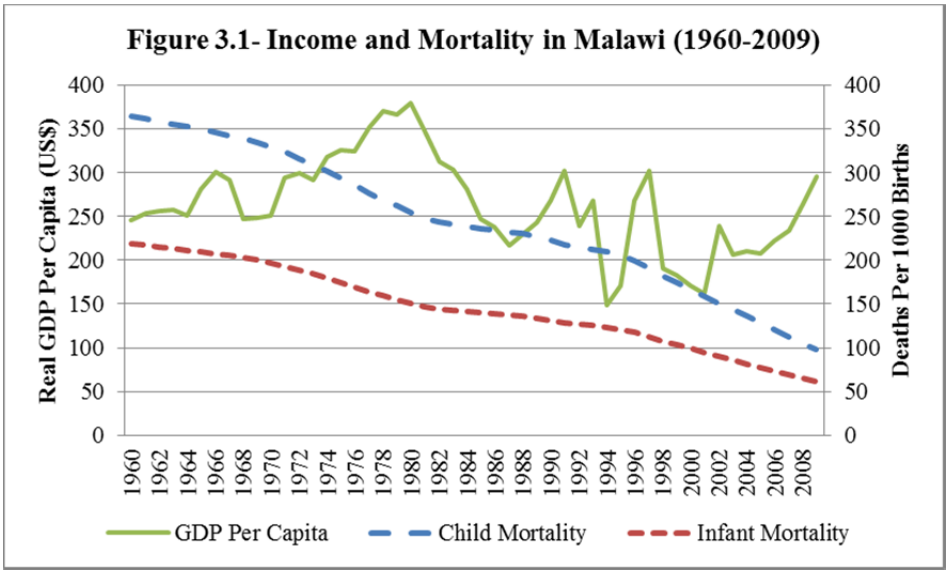
Malawi is one of a small number of countries, the majority of which are also located in Sub-Saharan Africa, in which GDP growth has been largely stagnant since 1960, when adjusted for inflation and population. It is one of the poorest nations in the world, with an average per capita income of around $340 in current U.S. dollars. A population in excess of 13 million and a land area of just under 9.5 million hectares make Malawi also one of the most densely populated countries in the region, averaging some 140 persons per square kilometer.[95] With less than 1,700 cubic meters of annual available renewable freshwater per capita, it is already considered a water stressed nation, and is projected to become water scarce by approximately 2015 as its growing population puts increasing stress on limited natural resources.[96]

Despite these challenges, however, Malawi has seen major and sustained improvements in health over the past several decades. Since 1960, the child and infant mortality rates in Malawi have fallen by

[95] Malawi Environmental Affairs Department (2010)

[96] USAID (2007)

some 73 percent and 72 percent, respectively, while life expectancy at birth has climbed from 38 to 53 years. As of 2007, more than 80 percent of households reported using an improved source of drinking water, exceeding the MDG target of 74 percent for the country.[97] Although rural areas lag behind urban centers in terms of access, they too have exceeded the MDG objective for drinking water.[98]



Source: Compiled from World Bank (2013a)

These positive trends, however, should not obscure the immense health challenges that remain. Malawi continues to rank among the bottom fifth of countries in terms of all three health indicators. Sanitation remains an area of major concern; with less than half of the population using facilities that are considered by the WHO and United Nation Children's Fund (UNICEF) Joint Monitoring Program on Water Supply and Sanitation (JMP) to be inadequate, the spread of disease through the contamination of water is a serious threat to public health.[99] WHO estimated in 2004 that the mortality from water-related illnesses in Malawi was approximately 138 per 100,000 population, for a total of 18,150 deaths in that

[97] Department of Environmental Affairs (2010)

[98] Mortality and life expectancy level out considerably during the 1980s and 1990s, a likely result of the HIV/AIDs epidemic the swept the country, and the continent, during this period. Population growth also slows in this period, for the same reason (see Figure 3.1). Data from World Bank (2012).

[99] Department of Environmental Affairs (2010)

year. The vast majority of these, nearly 15,000, were children under five years of age, among whom the water-related mortality rate was approximately 617 per 100,000.[100]

Overall responsibility for the governance of the WASH sector in Malawi rests with the Ministry of Irrigation and Water Development (MIWD), an agency which the United States Agency for International Development (USAID) describes as "functionally weak with often vacant district posts and generally low institutional capacity."[101] A National Water Resources Board (NWRB), which administers the 1969 Water Resources Act, advises the national government on water policy, reviews applications for the construction of dams and provides regulatory authority alongside the MIWD and five para-statal Regional Water Boards (RWBs). These boards, which are located in each of the three administrative regions as well as in the cities of Blantyre and Lilongwe and are overseen by the Ministry of Finance, are responsible for supplying water to cities and towns at commercial rates, under the Authority of the 1995 Water Works Act. A new water policy framework, established under the 2005 Water Policy and the 2002 National Irrigation Policy and Development Strategy, emphasizes the decentralization of water resources management to the district level, in coordination with the Ministry of Local Government (MLG) and the Ministry of Health and Population (MHP), which oversees sanitation and hygiene issues.[102]

Alongside this panoply of national and local actors, the international donor community has also played an important role in Malawi's WASH sector. Since 1960, multilateral and bilateral donors have allocated some US$700 million for water and sanitation in the country, making it seventy-third among all recipients in terms of total WASH aid received.[103] Figure 3.2 below shows the trend in WASH aid commitments over time. The spike in 1995 is the result of a single project, the National Water

[100] WHO (2013)

[101] USAID (2007): 1-2

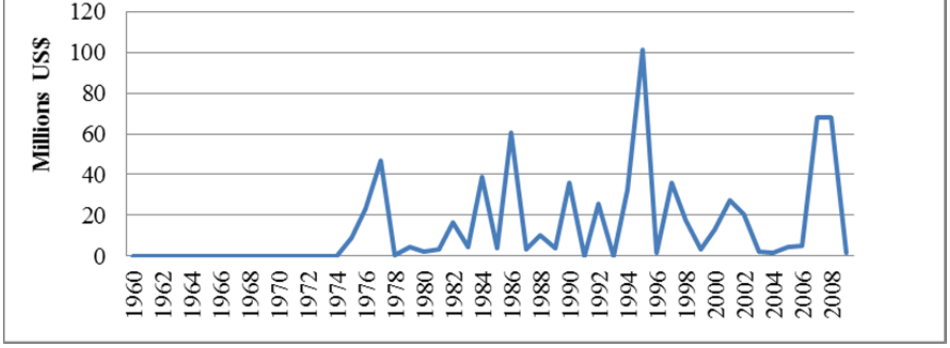
[102] USAID (2007)

[103] AidData (2013)

Development Project (NWDP), to which the World Bank committed approximately $79 million (in 1994 dollars).

The current centerpiece of donor activity, also discernible in Figure 3.2, is the Second National Water Development Project (NWDP II), which includes some $50 million in Work Bank funding as well as an additional $25 million from the Africa Catalytic Growth Fund. As a Sector-Wide Approach program, NWPD II provides a framework for multi-donor coordination and has garnered support and participation from USAID, the European Union, the European Investment Bank (EIB), the Canadian International Development Agency (CIDA), UNICEF, the United Nations Development Program (UNDP), the Japan International Cooperation Agency (JICA), and the Netherlands, among others.[104]

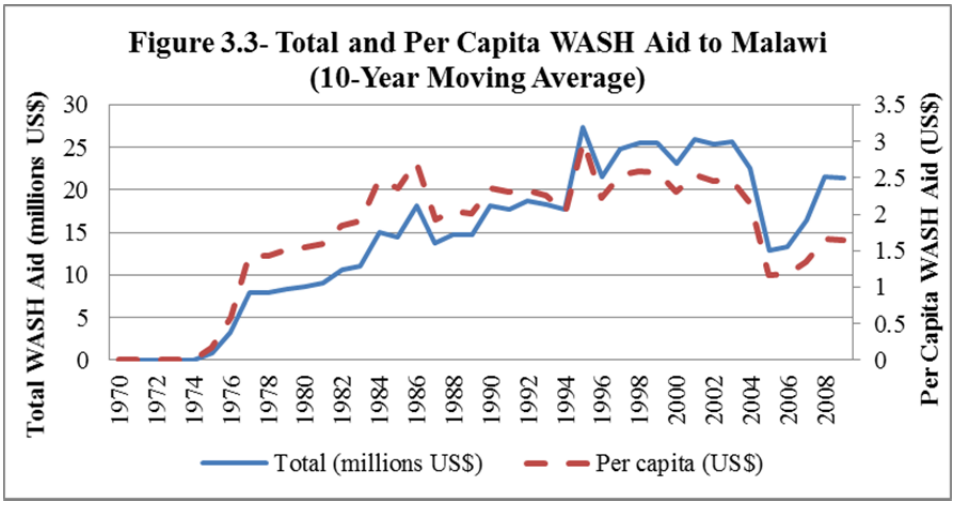
Figure 3.2- WASH Aid to Malawi 1960-2009



Source: Compiled from AidData (2012), World Bank (2013a)

Because aid is typically disbursed over a number of years following the initial commitment, Figure 3.3 shows what may be a more accurate representation of these data. Here, both total and per capita WASH aid since 1970 are shown as ten-year moving averages.

[104] USAID (2007)



Source: Compiled from AidData (2013), World Bank (2013a)

Whether this aid has contributed to improvements in health is an open question, and one which this study hopes to partially address. A cursory comparison of Figure 3.1 and Figure 3.3 does broadly suggest that the decline in mortality accelerated beginning in approximately 1974 and again in approximately 1995, roughly corresponding to large increases in WASH aid spending, but this is hardly evidence of any causal relationship. Unsurprisingly, aid agencies have presented a generally optimistic assessment of their own impact; the completion report for the NWDP, for instance, asserts that "the works constructed under the project have provided new or substantially upgraded service to some 1,150,000 people. A further estimated 350,000 people have received improved services through more responsive operations provided by the trained and equipped employees of the RWBs."[105] In the following, I propose and apply an emerging method of program evaluation in order to put such claims to an empirical test.

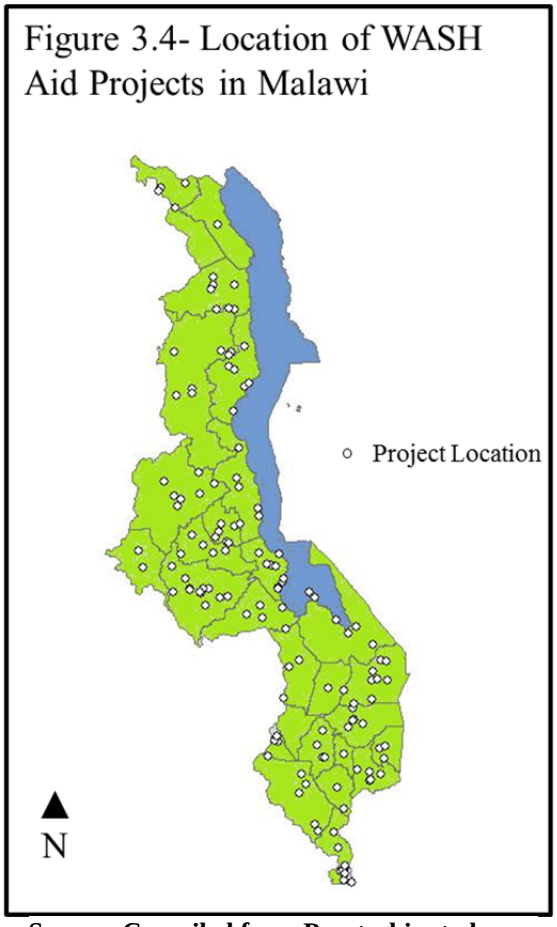
Data Sources

The analysis relies on two distinct categories of data. To construct the dependent and control variables, I use the Third Integrated Household Survey (IHS3), conducted in 2010 and 2011 by the National Statistics Office of the Government of Malawi.[106] This survey consists of a stratified random sample of 56,218 individuals in 12,271 households, or approximately 0.5 percent of the total population

[105] World Bank (2004): 5

[106] NSO (2011)

of households in the country. The results, available through the World Bank's Central Microdata Catalog, include household level data on income, employment, health, educational attainment, school enrollment, and other factors, as well as geographic data that allow responses to be disaggregated to the district and village levels.



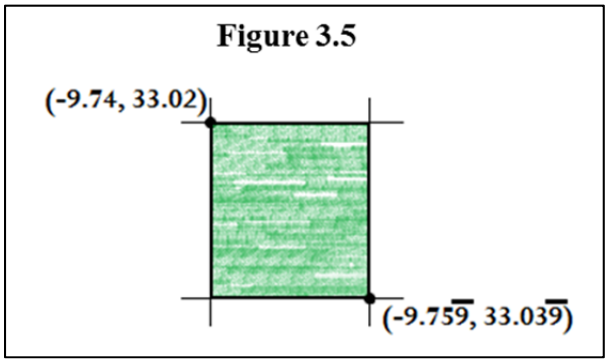
Source: Compiled from Peratsakis et al. (2012), World Bank (2013c)

The key independent variable is constructed from project-level aid data obtained from the Malawi Aid Management Platform. This initiative assigns geographic coordinates to closed and ongoing aid projects in all sectors throughout the country, allowing researchers to study the allocation of aid at the scale of the local community. In all, the dataset includes $5.3 billion in commitments from 30 donor agencies, for a total of 548 projects, or approximately 80 percent of the total reported development assistance to Malawi from external sources since the year 2000. Among these, 170 projects, comprising some US$417 million, were explicitly related to the provision or management of water and sanitation.

Figure 3.4 shows the approximate locations of these projects, the majority of which fall under the umbrella program of NWDP II. [107]

To convert from spatial to cross-sectional data, a virtual grid was imposed on the country of Malawi, based on the second decimal place in the latitude and longitude coordinates. Each coordinate pair represents a rectangle on the grid, referred to hereafter as a block, with a perimeter of 0.08 degrees, and an area of approximately 3.25 square kilometers.[108] The estimated commitment amount associated with all of the projects located within each block was then summed to generate an estimate of the total monetary commitment to that block. For example, the aid total for the area corresponding to latitude -9.74 and longitude 33.02 is calculated as the cumulative water aid disbursed in the block shown Figure 3.5. All disbursed aid is thus systematically accounted for and summed without any overlap.

Figure 3.5

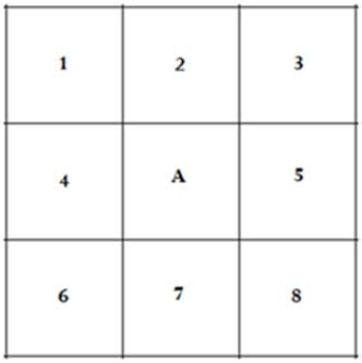


Because WASH aid in one area is likely to have spillover effects into surrounding areas, and because the precision of the coordinates assigned to each project vary, strict use this grid would fail to accurately represent the true impact of aid. For example, project located near a gridline, or those that spanned multiple blocks would show a positive aid value for one of four equally adjacent sections, but would not count toward the total for the other three. To account for this problem, the aid totals for each area represent the *sum* of disbursed aid associated with each of the projects located in a given section and each of the eight adjacent sections. Figure 3.6 illustrates this concept.

[107] Peratsakis et al. (2012); all maps were generated using ArcGIS 10.1 for Desktop

[108] Planetary curvature implies that the exact area of each block will vary according to its latitude. For the purposes of this study, because it is confined to a single and relatively small country, I consider this variation to be minor enough to ignore.

Figure 3.6



In the models below, the total aid received by any one block is defined as the sum of aid disbursement in block A and blocks 1 through 8. This approach more accurately approximates the likely spillover effects of aid as shown in Figure 3.6, and accounts for variation in the precision of the assigned coordinates. The following section describes the variables derived from this procedure and the household survey data from IHS3.

Description of Variables

Three dependent variables of interest were obtained from the IHS3 dataset. The first two are binary variables based on the self-reported access to improved water and sanitation. Based on responses to questions regarding the source of drinking water and the type of toilet used, I assign a value to each individual equal to one if their response corresponds to the JMP definition of an improved source, and zero otherwise.[109] For example, an individual who reported having a private, covered well and using an open pit latrine toilet would be assigned a value of one for the water variable and zero for the sanitation variable.

[109] Improved sources of drinking water include water piped into the dwelling or yard; public taps and standpipes; tube-wells and borehole wells; protected dug wells; protected springs; rainwater collection; and bottled water. Non-improved sources are unprotected dugs wells; unprotected springs; vendor provided water; carted water; tanker truck water; and surface water from rivers, ponds, lakes, and streams. Improved sanitation includes flush toilets; piped sewer systems; septic systems; flush or pour-flush toilets to a pit latrine; ventilated improved pit (VIP) latrines; pit latrines protected by a slab; composting toilets; and some special cases. Non-improved sanitation are public or shared latrines; flush or flush-pour toilets not connected to a pit, septic tank, or sewer; unprotected pit latrines; open pit latrines; bucket latrines; hanging toilets and latrines; and the absence of any facility. See UNICEF/WHO (2012).

The third dependent variable of interest is also binary, and codes for the instance of potentially water-related disease. Respondents were asked to provide a yes or no answer to the question, "During the past two weeks have you suffered from an illness or injury?" Those who answered 'yes' were then asked to categorize the nature of their injury or illness. Individuals who reported potentially water-related illness were assigned a value of one for the illness variable, while those who did not experience an illness, or reported an illness that was not potentially water-related were given a value of zero.[110] Among the 56,218 respondents, 9731 reported experiencing an illness or injury within the preceding two weeks; 5444 of these were considered potentially water-related.

Depending on the structure of the model, I use of one two explanatory variables of interest, each of which concerns WASH aid. Because the ISH3 dataset contains geospatial information for each respondent household, it is possible to assign each individual to one of the blocks within the virtual grid described in the previous section. I construct a binary 'treatment' variable that is equal to one if the individual lives in a block in which one or more WASH aid projects was located, and zero otherwise. This variable essentially indicates whether or not an individual was part of the target population, but does not account for the level of project funding. An alternative, continuous variable was constructed as an approximate measure of the amount of aid benefiting each individual. Population in each block was estimated using district-level data obtained from the Malawi National Statistics Office; respondents were then assigned a value based on the aid total in his or her block, divided by the estimated population of that block.[111]

Several control variables were also included in the models below. In order to control for regional differences and geographic distribution of disease across Malawi, I include three binary variables

[110] I define 'potentially water-related illnesses' in this case as reported cases of diarrhea, other gastrointestinal complaints, skin diseases, undiagnosed fever, and insect-vector-borne diseases. Heart disease, respiratory illnesses, headache, physical injury, and complications from HIV/AIDS were not considered to be potentially water-related.

[111] This use of aggregated, district-level population data is not ideal, as actual population will vary considerably within each district. However, in the absence of more precise figures, it serves as a reasonable approximation of the relative level of aid funding in each locality.

controlling for the administrative region in which each respondent lives. Population density, measured in terms of persons per square kilometer, was also included to account for differences in health outcomes between rural and urban areas. This variable was estimated using district-level data obtained from Malawi National Statistics Office.[112]

Self-reported monthly household income was constructed as the sum of all documented sources of income including salaries and wages, gratuities, and rental income; it is measured in Malawi Kwacha (MWK) received per household per month. Informal and in-kind remuneration, being sporadic and generally not amenable to quantification, are not included in this measure. The mean reported income was MWK8090.10 per month, around US$20.88. Approximately one-quarter of all respondents reported having no household income; the wealthiest household reported more than MWK 4 million, or about US$10,000 per month.[113]

For models examining the impact of aid on illness, I include several variables corresponding to personal risk factors. Because young children and the elderly are generally more susceptible to illness, age is an important consideration. Accordingly, I construct two binary variables based on respondent age, equal to one if the individual is younger than five years of age, or older than sixty, respectively, and zero otherwise. An additional binary variable codes for gender. Table 3.1 shows descriptive statistics for each of these variables.

[112] NSO (2008)

[113] The reported occupation of the individual with the largest reported income was 'Environmentalist.'

Table 3.1- Summary of Key Variables					
Variable	**Description**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
WASH Aid	=1 if any aid projects in block	0.175	0.380	0	1
WASH Aid per capita	WASH aid per person in block (MWK)	1635.538	9208.538	0	135,659.10
Density	Persons per square kilometer in district	437.484	770.487	36.07	3007.71
Household Income	Total monthly income of household (MWK)	8090.10	73638.05	0	1,105,000
Average Income	Average income in district (MWK)	8113.253	11890.98	1123.71	58,853.34
Central	=1 if in Central Region	0.359	0.480	0	1
Southern	=1 if in Southern Region	0.445	0.496	0	1
Northern	=1 if in Northern Region	0.196	0.397	0	1
Water-Related Illness	=1 if experienced illness in past 2 weeks	0.097	0.295	0	1
Improved Water	=1 if using improved source of water	0.817	0.387	0	1
Improved Sanitation	=1 if using improved sanitation facility	0.731	0.443	0	1
Female	=1 if female	0.511	0.450	0	1
Elder	=1 if over 60 years old	0.047	0.212	0	1
Child	=1 if under 5 years old	0.466	0.499	0	1

Source: Compiled from NSO (2011) Peratsakis et al. (2012), World Bank (2013c)

Models and Results

As a preliminary test of significance, I perform a logit model on each of the three binary outcome variables described in the previous section, the results of which are shown in Table 3.2. The explanatory variable of interest in this model is the continuous per capita WASH aid variable. This variable, as well as the monthly household income and population density variables are constructed as natural logarithms.

The results suggest that households in areas that received higher levels of aid in the past were more likely to use improved sources of drinking water and improved sanitation facilities, as defined by the JMP. There does not appear to be a statistically significant relationship between the level of aid received and the probability of contracting a water-related disease, however. Among the control variables, the regional binary variables and income level were statistically significant for all three outcome variables. Population density tended to increase the likelihood of using an improved source of drinking water and an improved sanitation facility, and aridity tended to decrease the use of improved sanitation. As expected, women, children, and the elderly were all more likely to report having experienced a water-related illness.

Table 3.2- Impact of Per Capita WASH Aid on Household and Individual Outcomes (Logit Model)			
Variable	**Improved Water**	**Improved Sanitation**	**Water-Related Illness**
WASH Aid	0.060***	0.014***	-0.010
	(0.006)	(0.005)	(0.023)
Population Density	0.253***	0.273***	-0.012
	(0.019)	(0.017)	(0.003)
Income Level	0.221***	0.260***	-0.100***
	(0.019)	(0.016)	(0.023)
Northern Region	0.584***	0.274***	-0.531***
	(0.043)	(0.041)	(0.056)
Southern Region	0.374***	-0.632***	-0.199***
	(0.026)	(0.041)	(0.034)
Arid Climate	-0.017	-0.125***	-0.133***
	(0.028)	(0.041)	(0.036)
Female			0.178***
			(0.029)
Child			0.606***
			(0.030)
Elder			0.506***
			(0.066)
Constant	-1.912***	-2.237***	-1.514***
	(0.133)	(0.112)	(0.066)
Observations	56409	56409	56218
Pseudo R-Squared	0.034	0.047	0.018

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

The potential issue with this simple model is bias due to sample selection. For many reasons, practical as well as political, aid agencies and their recipient government partners are unlikely to allocate aid projects randomly. As I will discuss in the following chapter, the allocation decisions of donors are complex, and involve considerations of recipient community need and capacity, among others. Whereas epidemiologists often perform randomized control trials to test the effectiveness of medical interventions, the use of this technique in policy effectiveness testing raises both feasibility and ethical concerns. Because of this non-randomness of the sample, the observed difference in outcome between those households and individuals that did and not receive aid may be due to underlying differences between the two groups, rather than the impact of the aid itself.

In order to adjust the analysis to control for sample selection bias, I employ a method of impact evaluation known as propensity score matching (PSM). Originally proposed by Rosenbaum and Rubin, the procedure was further developed by Heckman, Ichimura, and Todd as a means of accounting for

selection bias in non-experimental data. In addition to the traditional PSM, I adopt a technique developed by Hirano and Imbens and described in Bia and Mattei, which allows for the testing of continuous, as opposed to strictly binary, treatment variables.[114]

The basic PSM methodology consists of three steps. First, a limited dependent variable model is estimated for the entire population such that a binary dependent variable *T* takes the value of 1 if the individual is in the treatment group and 0 otherwise. This model can be estimated using either a probit or a logit regression. The generalized equation takes the form:

$$T^* = \beta_0 + \beta_1 X + e,\ T = 1[T^* > 0]$$

Where X is the vector of explanatory variables deemed relevant to selection for treatment and e is the unobserved error term. Once the value of the coefficients β have been estimated for each X, it is then possible to estimate a value of T^* for each observation i. This is the propensity score, the estimated probability of being selected for treatment given X. I estimate the propensity score for receiving WASH aid by regressing the binary treatment variable on regional and socioeconomic explanatory variables as shown in Table 3.3.

Table 3.3- Estimation of the Propensity Score for the Binary Treatment (Logit Model)

Variable	**Coefficient**	**Standard Error**
Population Density (Natural Log)	0.655***	0.018
Income Level (Natural Log)	-0.084***	0.020
Northern Region	0.573***	0.046
Southern Region	0.151***	0.033
Arid Climate	-0.265***	0.033
Constant	-4.457***	0.110
Observations	56409	
Pseudo R^2	0.100	

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level

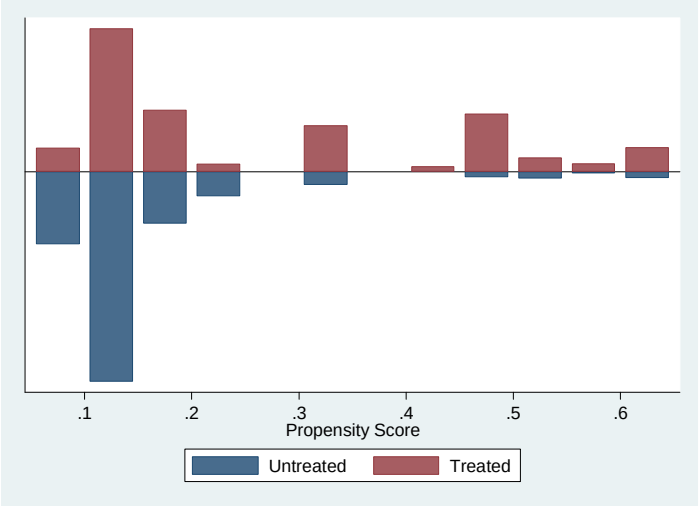
Once the propensity scores have been estimated, the next step is to match treated and non-treated individuals based on these scores. There are several methods for doing this, including nearest neighbor matching, caliper matching, kernel matching, and stratification matching. However, the purpose of each of these strategies is the same – to create one or more subgroups within the population, including both

[114] See Rosenbaum and Rubin (1983), Heckman et al., (1998), Hirano and Imbens (2004), Bia and Mattei (2008)

treated and non-treated individuals, within which there is no significant difference across individuals' estimated propensity scores. In other words, the objective of this step is to group individuals by their expected probability of having been selected for treatment, regardless of whether or not they were actually selected. This allows for the effect of treatment to be analyzed as though selection had been conducted randomly.

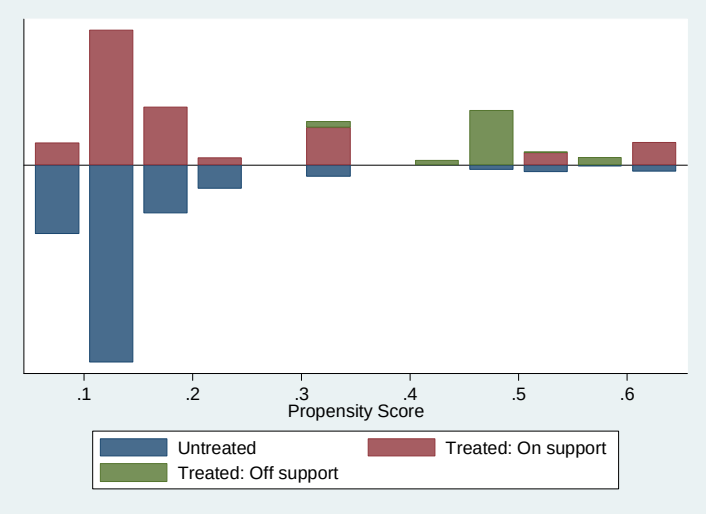
The process is made more difficult by the distribution of the propensity score, which is, by definition, related to the treatment status of individual observations. Ideally, the number of treated and untreated individuals should be approximately equal for any value of the propensity score. However, as illustrated in Figure 3.7, the density of untreated observations decreases as the value of the propensity score increases. This means that at higher levels of the score, there are fewer individuals available from which to generate a control population.

Figure 3.7- Distribution of the Propensity Score



In order to account for this potential source of bias, I impose common support by removing from the sample the top 20 percent of treated observations for which the value of the propensity score has the lowest density of untreated observations. The new sample is distributed on the propensity score as shown in Figure 3.8.

Figure 3.8- Distribution of the Propensity Score Corrected for Balance



I use nearest-neighbor matching with replacement to create matched sample of treated and untreated respondents. Table 3.4 shows the balancing properties of the sample before and after the matching procedure. The overall reduction in bias between treated and untreated observations resulting from this process is approximately 100 percent, suggesting that there is essentially no difference across the independent variables between the treated and untreated groups.

Table 3.4- Balancing Properties of the Propensity Score

Before Matching				
Variable	Mean (Treated)	Mean (Control)	% bias	t-stat
Population Density	5.964	5.058	72.4	75.93
Income Level	8.693	8.312	56.1	57.96
Northern Region	0.225	0.190	8.7	7.99
Southern Region	0.499	0.434	13.1	11.83
Arid Climate	0.395	0.582	-38.1	-34.24
After Matching				
Variable	Mean (Treated)	Mean (Control)	% bias	t-stat
Population Density	5.667	5.667	0.0	-0.00
Income Level	8.693	8.693	0.0	0.00
Northern Region	0.272	0.272	0.0	0.00
Southern Region	0.396	0.396	0.0	-0.00
Arid Climate	0.467	0.467	0.0	-0.00

Once the matched sample has been generated, the average treatment effect on the treated (ATT) can be calculated as the average of the difference in outcomes between treated and untreated individuals across all of the matched pairs. This procedure is repeated for each of the dependent variables described

above- use of improved water source, use of improved sanitation facility, and instance of water-related disease.

Table 3.5 shows the results of the propensity score matching procedure. The estimated standard errors and the resulting t-statistics imply that the ATT is statistically significant at the five percent level for the Improved Water variable, at the ten percent level for the Water-Related Illness variable. The ATT for the Improved Sanitation variable was not statistically meaningful at traditionally accepted levels of significance.

Table 3.5- Impact of Receiving WASH Aid (Average Treatment Effect on Treated)

Sample	Treated	Controls	Difference	Std. Error	t-stat
Improved Water (Unmatched)	0.872	0.805	0.067***	0.004	15.53
Improved Water (ATT)	0.852	0.587	0.264**	0.132	2.01
Improved Sanitation (Unmatched)	0.790	0.719	0.072***	0.005	14.60
Improved Sanitation (ATT)	0.761	0.732	0.029	0.132	0.22
Water-Related Illness (Unmatched)	0.076	0.101	-0.025***	0.003	-7.54
Water-Related Illness (ATT)	0.076	0.220	-0.144*	0.080	-1.80

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level

In Chapter 2, I presented evidence that the impact of WASH aid is largest in middle income countries. In order to test whether this trend holds within countries, I repeat the PSM procedure within three subgroups based on the reported monthly household income of survey respondents. In Table 3.6 below, the 'low income' group consists of those households that reported having no formal income, including those relying primarily on subsistence agriculture. This group constituted the majority (approximately 55 percent) of households in the sample. The remaining households were then split into two groups- 'middle income' and 'high income'- based on the median level of reported income. The middle income category included those households reporting a monthly income of less than MWK5000, and the high income categories comprised those with an income in excess of MWK5000.

I should note that these levels are intended only as general measures of relative income, and do not represent any official measure of income class. Indeed, all of those in the middle income group and many in the high income group as I have defined them would, like some three-quarters of Malawi's

population, fall well below the widely cited 'international poverty line' of US$1.25 of income per day.[115] This categorization, therefore, is not so much one of class, but rather of gradations of poverty. Table 3.6 shows the results of the propensity score matching procedure within each income group.

Among the five groups, the ATT of WASH aid was largest and most significant for those households with reported income of less than MWK5000 per month. The impact was not as evident among those with no reported monthly income, although it was still significant, and it was undetectable in those with income greater MWK5000. Generally, this supports the hypothesis that, even at the local level, aid has the greatest impact among the low-middle to upper-middle income levels.

Table 3.6- Impact of Receiving WASH Aid on Use of Improved Water Source by Income Group (Average Treatment Effect on Treated)

Income Level	Monthly Household Income	Observations	ATT	Std. Error	t-stat
Low Income	No reported income	30,830	0.242**	0.122	1.97
Middle Income	MWK 0-5000	11,274	0.335***	0.137	2.44
High Income	> MWK 5000	13,521	-0.011	0.105	-0.10

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level

As an alternative method of impact assessment, I employ the Generalized Propensity Score (GPS), as described in Bia and Mattei, to estimate the effect of different levels of aid apart from the binary variable of treated versus untreated.[116] The GPS was designed as a means of estimating the effect of varying or continuous treatments in a dose-response model. Although it was designed for epidemiological purposes, the study of aid effectiveness presents a useful application of this method because of the continuous nature of the treatment variable.

At a basic level, the estimation of continuous treatment effects follows a similar procedure to the binary case described above. First, it is necessary to delineate a series of dosage intervals *k*, defined according to the distribution of the treatment variable and relevant economic theory. For each *k*, the mean value of continuous treatment variable *T* is regressed on the independent variables *X* such that:

$$T_k = \beta_0 + \beta X + e$$

[115] UNICEF (2013)

[116] Bia and Mattei (2008)

Where T_k is the mean value of T within the interval k. The estimated coefficients β can then be used to generate the GPS as the predicted value of T given X for each observation. The population is then divided into j number of subgroups based on the value of the GPS. Within each subgroup j, the independent variables of X are regressed on T_k in order to confirm that there is no systematic difference between the observations with similar predicted values of GPS but different observed values of T. I estimate the GPS of the continuous WASH aid per capita variable as shown in Figure 3.7 below. For this procedure, I define ten subgroups k corresponding to percentiles of the GPS.

Table 3.7- Estimation of the Generalized Propensity Score

Variable	Coefficient	Standard Error
Log Density	0.917***	0.015
Log Income Level	0.332***	0.018
Northern Region	0.283***	0.040
Southern Region	0.057**	0.026
Arid Climate	0.115***	0.028
Constant (Eq.1)	-6.776***	0.107
Constant (Eq. 2)	2.494***	0.008
Observations	52647	
Log likelihood	-122808.1	

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level

Once the GPS has been estimated, and its balance properties evaluated, the conditional expectation of the outcome variable Y can be estimated as a flexible function of the treatment level T and the GPS within each subgroup j:

$$E[Y_i \mid T_i, R_i] = \beta_0 + \beta_1 T_i + \beta_2 T_i^2 + \beta_3 R_i + \beta_4 R_i^2 + \beta_5 R_i T_i$$

Where R is the GPS calculated in the previous stage. Although the coefficients estimated from this model cannot be interpreted directly, the estimated treatment effect function can be calculated by averaging the estimated conditional outcome over each observation within the treatment variable subgroup k. The population-level function can then be obtained by estimating this average potential outcome for each treatment level k. Figure 3.8 shows these estimated coefficients from the treatment effect function of aid on the outcome variables using the flexible form function described above.

Table 3.8- Impact of Per Capita WASH Aid (Dose-Response Function)			
Variable	**Improved Water**	**Improved Sanitation**	**Water-Related Illness**
WASH Aid	-4.52×10^{-5}***	-2.56×10^{-5}***	4.29×10^{-6}
	(8.40×10^{-6})	(4.14×10^{-6})	(5.56×10^{-6})
WASH Aid squared	5.95×10^{-10}***	1.95×10^{-10}***	-6.93×10^{-12}
	(1.09×10^{-10})	(4.16×10^{-11})	(5.27×10^{-11})
GPS	8.451***	8.829***	-0.039
	(12.885)	(2.000)	(2.693)
GPS squared	-82.253***	-90.207***	8.911
	(2.535)	(10.338)	(13.942)
WASH Aid x GPS	0.0145***	0.006***	-0.003***
	(0.001)	(0.006)	(0.001)
Constant	2.022***	1.655***	-2.379***
	(0.101)	(0.078)	(0.103)

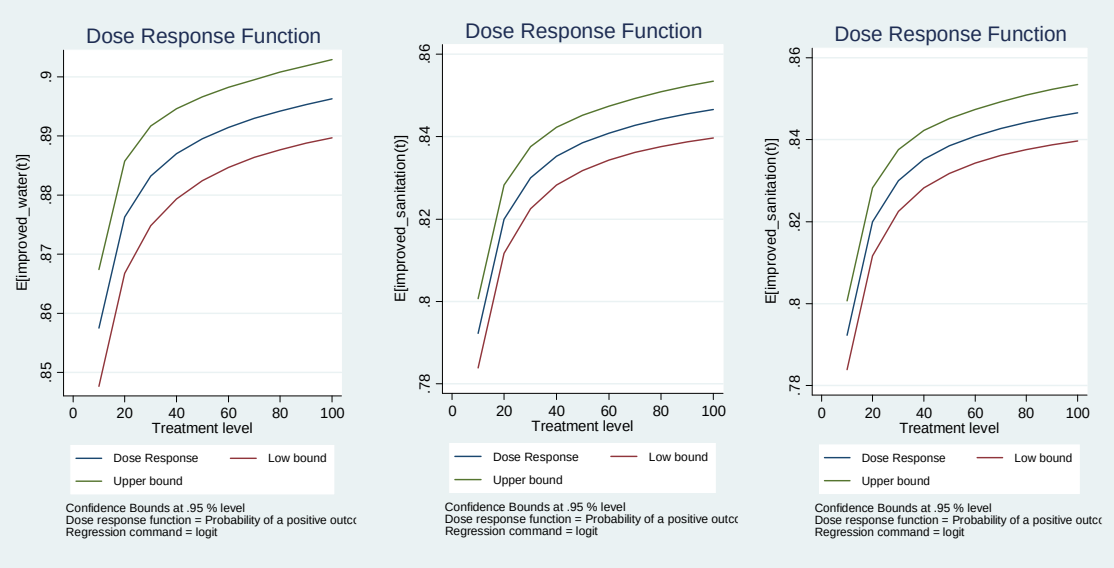
* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

Direct interpretation of these estimates is difficult; however, they do seem to suggest that WASH aid plays a role in expanding access and improving health. The squared value of the per capita WASH aid variable has a significant and positive relationship with both the likelihood of using an improved source of drinking water and the likelihood of using an improved sanitation facility. For each of the three outcome variables, the joint effect of per capita WASH aid and the GPS was significant and of the expected sign, suggesting that, among individuals with similar conditional probability of receiving aid, the amount of aid received tended to have a positive impact on the likelihood of using an improved water source and using an improved sanitation facility, and had a negative impact on the likelihood of contracting a water-related disease.

It should be noted that the coefficients estimated for per capita WASH aid, although significant, are numerically small in comparison to those associated with the GPS. This is partly due to the size of the variables- the GPS has a mean value of 0.132, while the per capita WASH aid has a mean value of approximately 1636. It also may be the case that much of the variation in outcomes between observations can be explained by the components of the GPS, perhaps especially geographic factors. Neither explanation, however, suggests that the general finding of a significant impact of WASH aid on outcomes is invalid. Figure 3.9 presents a graphical representation of the response to aid at different levels, controlling for the GPS.

Figure 3.9- Impact of Per Capita WASH Aid (Dose-Response Function)



Discussion

The results of the analysis described above suggest that WASH sector aid in Malawi has played a role in improving health through expanded access to clean drinking water. Although there is not a clear significant relationship between per capita WASH aid and the probability of experiencing a water-related illness, there is a significant and positive relationship between aid and the probability of using an improved source of drinking water. Because drinking water quality is strongly correlated with health, it can be reasonably inferred by extension that aid in this sector also has an impact on health. The effect of WASH aid on the likelihood of using an improved sanitation facility is somewhat ambiguous, a result that is consistent with the Malawi's poor overall performance in the sanitation sector, and suggests that renewed emphasis in this area is warranted.

The methods described above include several original features that differentiate it from traditional program evaluation techniques. First, I use a dataset compiled from geo-tagged aid data to examine the impact of an entire sector of aid at the sub-national level, controlling for site-specific geographic and environmental factors. Secondly, I use household survey data to test for a relationship between aid flows and individual-level outcomes among the population. Third, I make use of an emerging method, PSM, to

control for potential sample selection bias. And finally, I extend the basic PSM procedure to one based on the estimation of the generalized propensity score in order to gain additional insight into the impact of aid among its intended beneficiaries. Taken together, I believe that these features make the current study an interesting counterpart to the one presented in the previous chapter. Where the cross-country analysis explored the relationship between aid and national level health statistics, this chapter digs deeper, examining the extent to which aid can be shown to make a difference in the lives of individuals. It also lends some insight into how and why WASH aid works for its intended beneficiaries, and where problems are likely to remain.

One interesting implication of the results is that the impact of WASH aid appears to be asymptotic, exhibiting decreasing returns as the outcome variables approach some upper (or, in the case of water-related illness, lower) limit. This may reflect the difficulty of effectively reaching certain target populations, such as those in especially remote rural areas, for whom technical barriers exist to the expansion of water and sanitation infrastructure. Further, WASH aid seems to have had the greatest impact among individuals with low to median levels of income, rather than those in the poorest income bracket. Both of these findings are broadly consistent with the results of Chapter 2 and, I submit, for similar reasons. Individuals in the poorest income group are more likely to face a range of constraints, including environmental conditions, affecting their access to water. For middle income individuals and communities, the availability of funding is more likely to be the primary limiting factor.

Thus, a model of the relationship between the need for WASH aid and its potential impact begins to emerge. In those countries and communities where intervention is most desperately warranted, the impact of aid appears to be hampered by some of the same factors that create the need to begin with. To further investigate this relationship, the following two chapters investigate the responsiveness of WASH aid at the global and local levels, respectively.

CHAPTER 4

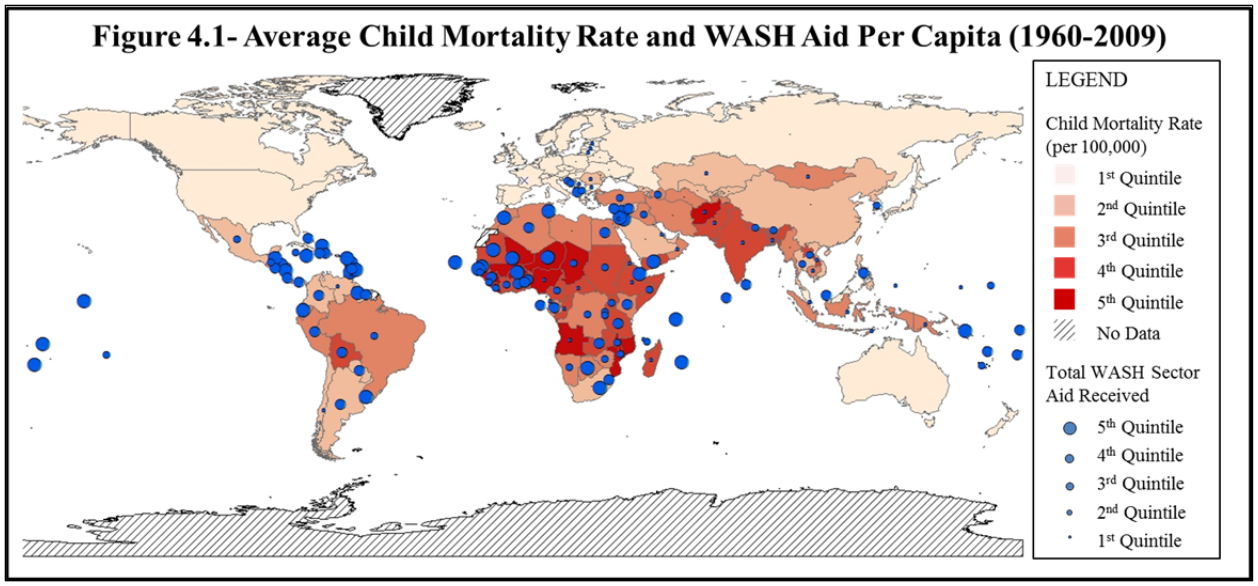
The Global Responsiveness of WASH Aid

The previous two chapters examine the impact of foreign aid in the WASH sector at the global level and in the context of a national level case study. In both cases, I present evidence that WASH aid can have a significant impact on its intended objectives. Because the study of aid impact is largely a study of the dynamics of aid within recipient countries, discussion of donor behavior has been largely absent from the discussion thus far. I turn now to the second dimension of aid effectiveness-responsiveness, and to the donor side of the aid effectiveness equation.

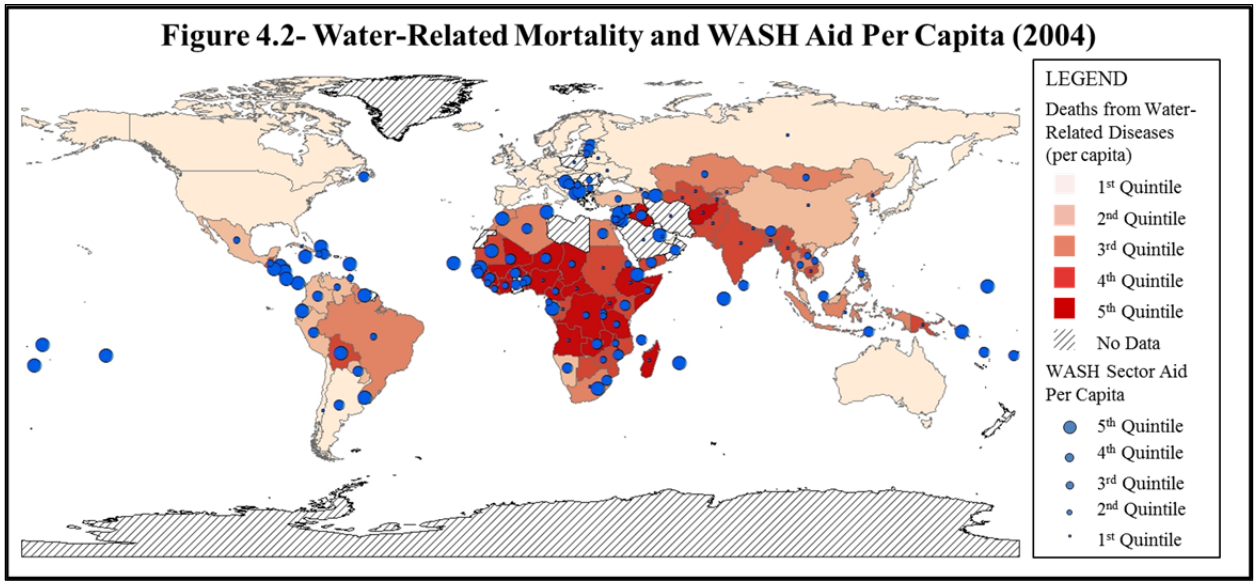
The chapter proceeds as follows. In the first section, I examine responsiveness at the global level, to determine whether WASH aid has indeed tended to follow need, broadly defined. To do so, I develop and test a series of statistical models of the distribution of WASH aid using the dataset described in Chapter 2. Next, I expand this model in order to more explicitly examine the behavior of donors in making aid allocation decisions. In the final section, I narrow my focus to a single donor, the World Bank Group, historically the largest donor of WASH aid. Where preceding chapters have attempted to answer the question 'Does WASH aid have an impact?' the present one therefore asks, 'Does WASH aid go where it is most needed?' I find that, on aggregate, WASH aid has indeed tended to flow to those countries with higher rates of potentially water-related diseases, although this responsiveness has varied over time and among donors.

Responsiveness to Recipient Need

At first glance, the global response to the world water crisis seems to be lacking. Figure 4.1 below shows the distribution of WASH aid from 1960 through 2009 alongside the average child mortality rate in each country over the entire period. Countries are grouped according to quintiles of average mortality rate and quintiles of per capita WASH aid received. As an alternative, cross-sectional illustration, Figure 4.2 shows the distribution of per capita WASH aid in 2004 and the estimated water-related mortality rate, as estimated by WHO, in that year.



Source: Compiled from AidData (2013), World Bank (2013a), Esri (2012)



Source: Compiled from AidData (2013), World Bank (2013a), Esri (2012)

Neither format paints an especially optimistic picture of WASH aid responsiveness. Generally, it does not appear that donors have historically targeted WASH aid to those countries with the highest rates of child mortality, where it is presumably most needed. However, the dynamics of responsiveness are much more complicated than this cursory inspection allows. Donor decisions regarding which recipient countries receive aid, and how much, are influenced by many factors, including how need is

conceptualized and measured. Individual donors are responsive to need to greater and lesser degrees and in different ways, according to their mandates, preferences, and agendas.

It has been proposed that donors follow two distinct processes in determining to which countries to allocate aid and in deciding how much aid to allocate to each recipient. Previous authors have referred to these separate processes as the 'selection' or 'gatekeeping' and 'level' stages of aid allocation, respectively.[117] In the selection stage, donors consider the full population of potential recipients and decide which countries to partner with; and in the level stage they determine how much aid will be allocated to each selected recipient. In order to separately test each of these processes, I perform a series of regressions of different constructions, as explained below.

As in Chapter 2, data on aid flows were obtained for this study from AidData, and includes all developing countries for the years 1960 through 2009. Countries are included in the sample only for those years in which per capita GDP was less than US$12,000 in constant (2009) dollars. Formerly developing countries, such as South Korea and Taiwan, are present in the sample only during the years in which they meet this criterion. Independent variables were constructed using data from the WDI, the Polity IV Index, and WHO.

As the explanatory variable of interest, I use the child mortality rate, expressed in terms of the number of deaths per 1000 of the under-five population. Control variables include GDP in constant (2009) U.S. dollars per capita; total population; openness to foreign trade, expressed as the value of all imports and exports as a percentage of GDP; and a -10 to 10 polity score measuring relative level of democracy and autocracy from the Polity IV index, all of which are described in Chapter 2. I also include FDI, expressed as a percentage of GDP as an additional measure of economic openness. This combination of potentially explanatory factors is intended to partially account for the political, economic, and demographic considerations that donors may or may not consider when deciding to which countries to allocate aid.

[117] See, for instance, Hicks et al. (2008)

Because I am interested in testing for significance, rather than in perfecting a model of allocation, I use the largely same set of independent variables to test both the selection and level stages, with two important exceptions. In some of the models below, I include a time indicator as an explanatory variable in the selection process. This is to control for the fact that, as the total number of WASH potential aid recipients has grown over time, each country's likelihood of being selected as an aid recipient has increased.[118] Secondly, I also include total population as an explanatory variable in the selection stage, under the assumption that countries with large populations may be more likely to be selected as aid recipients, if for no other reason than they are harder to ignore. Because the amount of WASH aid received is expressed in per capita terms, population is not included as an independent variable in the level stage of aid allocation.

As a preliminary test of significance, the selection and level stages of WASH aid allocation were estimated independently, using two alternative binary outcome models and two alternative continuous variable treatments. For the selection stage, the two alternative specifications were the probit and the logit models; in these models, the dependent variable is a binary variable equal to one if a country received aid in a given year and zero if it did not. The level stage of aid allocation is modeled using an OLS regression and a fixed effects panel regression. In these models, only those countries that were selected as recipients are included. All independent variables are lagged by one year, under the assumption that donors make allocation decisions based on previously available data. The results of these initial tests are shown in Table 4.1 below.

[118] There are several explanations for this phenomenon- including the opening of the formerly communist countries in the 1990s, the breakup of the Soviet Union and other blocs over time, and the generally increasing number of WASH aid donors and funds- none of which are of pressing interest here.

Table 4.1- WASH Aid Responsiveness (Selection and Level Stages)				
Variables	**Probit (Selection)**	**Logit (Selection)**	**OLS (Recipients)**	**F.E. (Recipients)**
Child Mortality	0.173***	0.274***	0.556***	0.746***
	(0.053)	(0.093)	(0.075)	(0.146)
GDP	-0.344***	-0.649***	0.364***	0.620***
	(0.039)	(0.071)	(0.061)	(0.111)
Polity Score	0.011**	0.018**	0.009	-0.002
	(0.004)	(0.008)	(0.007)	(0.010)
Investment	0.015**	0.028**	-0.012*	-0.002
	(0.007)	(0.014)	(0.007)	(0.008)
Trade	0.001	0.002	0.008***	0.007***
	(0.001)	(0.002)	(0.001)	(0.002)
Population	0.192***	0.323***		
	(0.022)	(0.040)		
Time	0.0562***	0.097***		
	(0.003)	(0.006)		
Constant	-2.343***	-3.427***	-5.155***	-7.793***
	(0.688)	(1.226)	(0.703)	(1.182)
Observations	3571	3571	2757	2757
R- Squared	0.231	0.232	0.030	0.027

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

Across each of the models, the coefficient of the child mortality variable was positive and statistically significant, controlling for other factors, suggesting that, intentionally or not, donors do select potential recipients of WASH aid and set the level of aid to commit on the basis of recipient country need. Openness to foreign investment was significant in the selection stage, but was insignificant in the level setting stage, while openness to foreign trade was significant in the level stage, but not in the selection stage. GDP was significant and negative, as expected, in the selection stage, suggesting that donors prefer to give to poorer recipients, but was significant and positive in the level setting stage.

Although interesting, these results should not be taken at face value; because donors may rely on similar factors in choosing recipients and setting the level of aid to commit, the two stages may not be independently determined. This has the potential to introduce selection bias in the estimation of the level stage, an issue that can be corrected for using the Heckman method, which estimates both stages simultaneously. The technique involves estimating selection using a standard probit model and then introducing the inverse Mill's ratio estimated in this stage as an explanatory variable in the least squares

estimation of the level stage. The inverse Mill's ratio is the ratio of the probability density function to the cumulative density function calculated in the selection stage. The equation takes the generalized form:

$$P(Y_{i,t} > 0) = \Phi(\gamma Z_{i,t}) + v_{i,t}$$

$$Y_{i,t} = \beta X_{i,t} + \rho\sigma\phi(\gamma Z_{i,t})/\Phi(\gamma Z_{i,t}) + \mu_{i,t} + v_{i,t}$$

Where $Y_{i,t}$ is the amount of WASH aid received by country i in year t, $Z_{i,t}$ and $X_{i,t}$ are vectors of explanatory variables, γ and β are estimated coefficients, $\mu_{i,t}$ and $v_{i,t}$ are error terms, ρ is the covariance of μ and v, σ is the variance of μ and the term $\phi(\gamma Z_{i,t})/\Phi(\gamma Z_{i,t})$ is the inverse Mill's ratio calculated in the selection stage.[119]

Using this procedure, I estimate two related models of WASH aid allocation. In the first model, the explanatory variable of interest is the child mortality rate. In the second, I use both the water scarcity index and rural population as alternative measures of recipient country need. As discussed in Chapter 2, water scarce countries and those with dispersed, rural populations face unique technical constraints in the WASH sector. If WASH aid is responsive to need, then these variables may be significant predictors in the selection of aid recipients or in setting the commitment level. Table 4.2 shows the results of each of these models across the entire sample of 133 recipient countries.

With regard to the responsiveness of WASH aid, the results of the Heckman procedure were broadly similar to previous trials. Once again, recipient country need was significant and positive in both the selection and level setting stages of WASH aid allocation. GDP and the polity score were each significant in both stages, suggesting that donors tend to favor poorer and more democratic countries. Openness to trade was significant only in the level setting stage, while openness to investment was significant only in the selection stage.[120]

[119] See Berthelemy (2006) for a discussion of the Heckman correction and other selection models in aid allocation.

[120] Because openness to trade and openness to investment are likely to be highly correlated, it may well be asked whether this finding is the result of multicolinearity between the two variables. Additional sensitivity analysis suggested that this is not the case; when FDI is removed from the model, the trade variable remains insignificant in the selection stage and when trade is removed, FDI remains insignificant in the level setting stage. It is unclear how these results can be meaningfully interpreted. For the purposes of this paper, both FDI and trade are included

Table 4.2- WASH Aid Responsiveness (Heckman Selection Model)				
Variables	**Model 1**		**Model 2**	
	Selection	Level	Selection	Level
Child Mortality	0.173***	0.298***		
	(0.053)	(0.082)		
Rural Population			0.007***	0.011***
			(0.002)	(0.003)
Water Scarcity			0.200***	0.458***
			(0.034)	(0.052)
GDP	-0.344***	-0.077	-0.353***	-0.135***
	(0.039)	(0.081)	(0.039)	(0.080)
Polity Score	0.011**	0.0237***	0.009***	0.021***
	(0.004)	(0.008)	(0.004)	(0.008)
FDI	0.015**	0.005	0.002**	0.001
	(0.007)	(0.008)	(0.007)	(0.008)
Trade	0.002	0.006***	$-6.1x10^{-5}$	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
Population	0.192***		0.193***	
	(0.022)		(0.022)	
Time	0.056***		0.054***	
	(0.003)		(0.003)	
Constant	-2.343***	-1.445*	-1.830***	
	(0.688)	(0.853)	(0.563)	
Mills Ratio		1.990***		2.306***
		(0.218)		(0.203)
Observations		3571		3597
Censored Obs.		814		832
Rho		0.815		0.917
Sigma		2.443		2.515

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level
Standard errors in parentheses

Like impact, however, responsiveness does not appear to be a static effect. Rather, the responsiveness of WASH aid to need in recipient countries has varied across the time period examined. This will not be at all surprising to students of international development, as it is well established that the behavior and interests of donors have changed considerably over the past half century. In order to begin to understand this dynamic, I repeat the Heckman procedure in each of the three decades from 1980 through 2009, the results of which are shown in Tables 4.3 and 4.4 below.

primarily as control variables and the implications of their significant and insignificance is beyond the scope of the discussion.

Table 4.3- WASH Aid Responsiveness to Child Mortality Across Time (Heckman Selection Model)						
Variables	**Years 1980-1989**		**Years 1990-1999**		**Years 2000-2009**	
	Selection	Level	Selection	Level	Selection	Level
Child Mortality	-0.017		0.381***	1.008***	0.178*	-0.043
	(0.106)		(0.094)	(0.191)	(0.103)	(0.136)
GDP	-0.648***	-0.355	-0.188***	0.223	-0.226***	-0.307***
	(0.080)	(0.381)	(0.070)	(0.163)	(0.081)	(0.115)
Polity Score	-0.003	-0.020	0.031***	0.040**	0.035***	0.074***
	(0.008)	(0.019)	(0.008)	(0.017)	(0.010)	(0.013)
Investment	0.019	-0.005	0.009	-0.012	0.025*	0.044***
	(0.022)	(0.048)	(0.009)	(0.015)	(0.013)	(0.013)
Trade	0.002	0.013***	-0.002	0.002	-0.002	-0.001
	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)	(0.002)
Population	0.144***		0.192***		0.309***	
	(0.043)		(0.038)		(0.050)	
Time	0.020		0.082***		0.071***	
	(0.019)		(0.018)		(0.023)	
Constant	2.588*		-5.134***	-6.651***	5.634***	1.819
	(1.514)		(1.394)	(1.732)	(1.605)	(1.268)
Mills Ratio		2.876**		2.976***		2.175***
		(1.514)		(0.726)		(0.642)
Observations		826		1093		1151
Censored Obs.		241		206		90

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level
Standard errors in parentheses

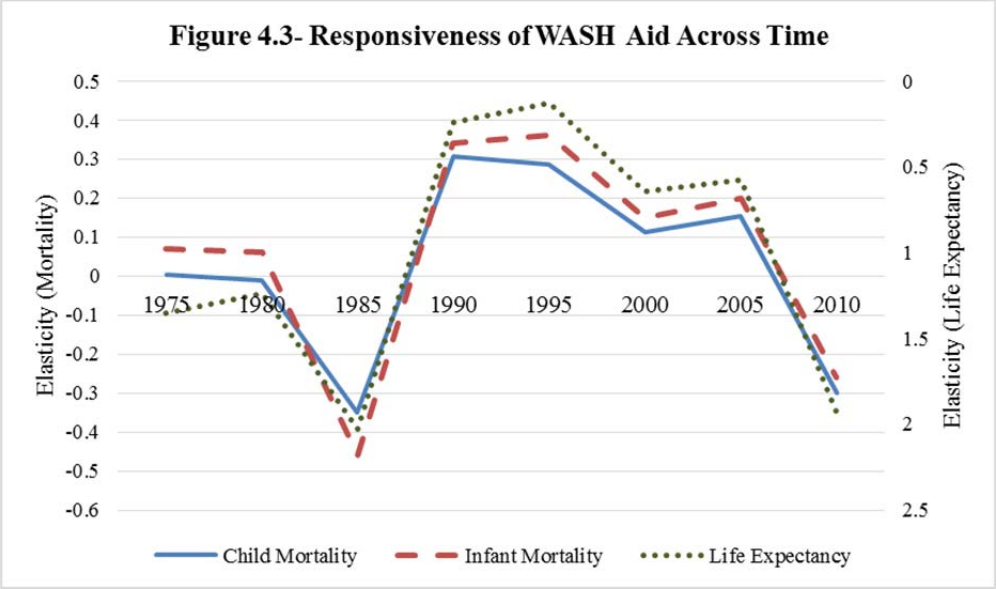
Table 4.4- WASH Aid Responsiveness to Water Scarcity and Rural Population Across Time (Heckman Selection Model)						
Variables	**Years 1980-1989**		**Years 1990-1999**		**Years 2000-2009**	
	Selection	Level	Selection	Level	Selection	Level
Rural Population	0.003	0.003	0.013***	0.012***	0.010**	0.013**
	(0.004)	(0.011)	(0.003)	(0.003)	(0.004)	(0.006)
Water Scarcity	0.371***	0.542***	0.203***	0.365***	0.160**	0.467***
	(0.078)	(0.146)	(0.060)	(0.104)	(0.073)	(0.077)
GDP	-0.615***	-0.711	-0.254***	0.041	-0.216***	-0.062
	(0.085)	(0.460)	(0.066)	(0.188)	(0.078)	(0.108)
Polity Score	0.001	-0.019	0.028***	0.041**	0.024***	0.098***
	(0.008)	(0.021)	(0.008)	(0.020)	(0.010)	(0.014)
Investment	0.020	0.003	0.019	$6.0x10^{-5}$	0.028**	0.051***
	(0.022)	(0.057)	(0.009)	(0.017)	(0.013)	(0.013)
Trade	0.001	0.010**	-0.004***	-0.003	-0.003	-0.002
	(0.002)	(0.004)	(0.001)	(0.004)	(0.002)	(0.002)
Population	0.137***		0.173***		0.304***	
	(0.043)		(0.037)		(0.049)	
Time	0.021		0.075***		0.068***	
	(0.0193)		(0.012)		(0.023)	
Constant	2.209*	3.534	-3.133***	-2.891*	-5.286***	-1.200
	(1.338)	(3.263)	(1.115)	(1.558)	(1.372)	(0.988)
Mills Ratio		3.448***		3.373***		1.978***
		(1.321)		(1.116)		(0.625)
Observations		832		1093		1151
Censored Obs.		243		206		90

* Significant at the 10% level ** Significant at the 5% level *** Significant at the 1% level
Standard errors in parentheses

In the 1980s, need does not appear to have been the primary driver of WASH aid allocation, either in the selection or the level stages of allocation. Although water scarcity was significant in both stages, the child mortality rate and rural population were insignificant. Among the other explanatory variables, GDP was significant in the selection stage, but not in the level setting stage in both models; openness to trade was significant in the level setting stage, but not in the selection stage; and neither FDI nor the polity index were significant in either stage. Taken together, these results suggest that donor behavior during this period was driven by factors not accounted for in the model, including perhaps geopolitical considerations. This is broadly consistent with conventional wisdom surrounding aid allocation during the Cold War period, a phenomenon that will be discussed in more detail in Chapter 6 to follow.

In stark contrast to the previous period, WASH aid in the 1990s appears to have been responsive to recipient need in both the level and the selection stages. All three indicators of need were highly significant in both stages. During this period, countries with higher levels of need were both more likely to be selected as potential recipients and to receive larger amounts of per capita aid. Results from the post 2000 period were mixed, suggesting that WASH aid has again become less responsive to recipient need. Child mortality is significant at the ten percent level in the selection stage, but was insignificant in the level setting stage, while water scarcity was significant in the level setting stage, but insignificant in the selection stage. Rural population was significant at the five percent level or above for both stages. As in the previous period, democratic governance was an important driver of aid allocation in the 2000s, as was openness to foreign investment.

Figure 4.3 shows overall trends in WASH aid responsiveness across time. Here, elasticity is estimated by OLS within individual panels at five-year intervals for three different health indicators- child mortality, infant mortality, and life expectancy- using the set of independent variables described above. The same general pattern is clear; responsiveness is initially low, but increases dramatically in the 1990s before declining again in the post-2000 period.

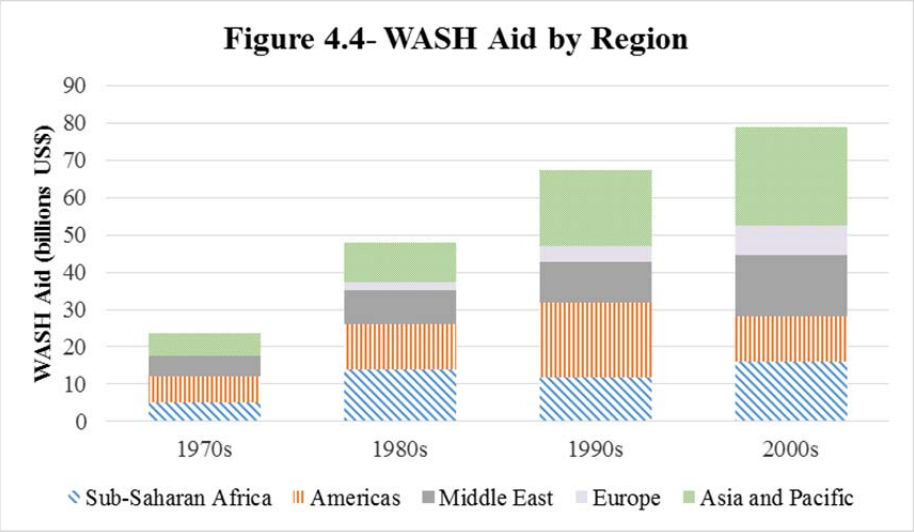


Source: Based on estimates using data from AidData (2013), World Bank (2013a), Marshall et al. (2011)

Accordingly, the answer to the question of whether WASH aid is responsive appears to be a highly qualified yes. More precisely, it seems that WASH aid can be responsive, and has been in the past, although need is clearly not the only or even the primary driver of allocation decisions. However, this preliminary analysis says very little about the behavior of individual donors, who likely respond to these factors in different ways and whose historical, cultural, economic, and political relationships with specific recipients almost certainly play a major role in determine aid allocation. In order to begin to investigate these issues, the following section disaggregates WASH aid flows into specific relationships between individual donors and recipients.

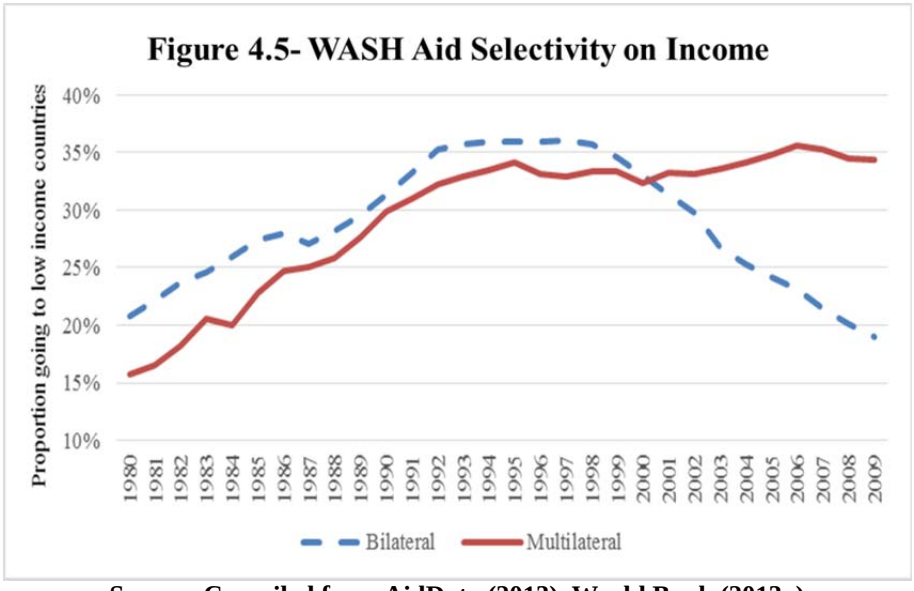
Donor Selectivity

As discussed in Chapter 1, the absolute amount WASH aid from all donors has increased linearly since 1960, although it has fallen over time as a proportion of total aid. As Figure 4.4 illustrates, the relative share WASH aid going to each region of the developing world has remained relatively constant. The exception to this rule has been the growing dominance of Asia as the largest overall recipient, indicative presumably of its rapidly expanding population.



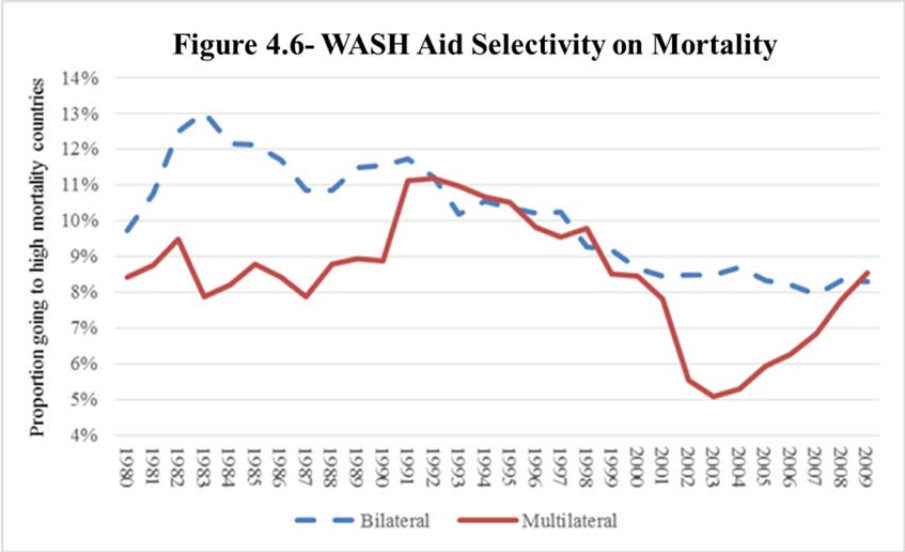
Source: Compiled from AidData (2013) **Amounts in constant U.S. dollars**

Interestingly, Africa, the region with by far the greatest objective need, has received a relatively small proportion of WASH aid overall, although this alone is not evidence of systemic unresponsiveness. In order to examine more closely the behavior of different categories of donors, Figure 4.5 below shows the share of aid going to countries with per capita GDP of less than US$1000 across the time period, separated by bilateral and multilateral donors.



Source: Compiled from AidData (2013), World Bank (2013a)

As an alternative measure, Figure 4.6 shows the proportion of bilateral and multilateral WASH aid allocated to recipients in the top 20 percent of countries for child mortality rate, calculated separately within each year.



Source: Compiled from AidData (2013), World Bank (2013a)

The proportion of WASH aid going to both low income and high mortality countries is surprisingly low, less than 40 percent and 15 percent, respectively; however, otherwise, neither format reveals any immediately identifiable trends. In the first graph, bilateral aid appears to become more selective on poverty in the 1990s and less so in the 2000s, consistent with my previous findings, while multilateral aid has become progressively more selective. In the second graph, however, it is multilateral aid that appears to have become more selective in the 1990s and less selective in the 2000s, whereas bilateral aid exhibits an overall downwards trend across the whole period.

This result can perhaps be better understood when high mortality countries are conceptualized as a subset of low income countries. Broadly, since 1990, multilateral donors appear to have increasingly targeted WASH aid to low income countries, but have tended to favor lower mortality countries within this group; on the other hand, bilateral donors have become generally less selective on both income and mortality over the same period. For both categories of donors, there appears to be two important inflection points during which aid allocation behavior changed, occurring approximately in 1990 and again in approximately 2000.

In order to glean a more nuanced understanding of responsiveness, I adopt an alternative model of responsiveness in which the object of analysis is not the total WASH aid received by each developing country, but rather the amount of aid committed to each recipient by each donor. Following the general approach of Hicks et al., I construct a sample consisting of some 14,667 donor-recipient-year triads, wherein each observation is defined as the aid relationship between an individual donor and recipient in a given year.

In order to partially account for differences in aid budgets across donors, the dependent variable in the model below is defined as the proportion of each donor's total WASH aid commitments that went to a particular recipient in each year. I include as potential explanatory variables all of those that were described above- GDP, openness to trade, population, FDI, the polity score, the child mortality rate, rural population as a percentage of total population, and the water scarcity index. Table 4.6 presents the results of OLS and fixed effects regressions of WASH aid on these variables.

Table 4.5- Donor Selectivity on Recipient Need

	All Donors		Bilateral		Multilateral	
	OLS	F.E.	OLS	F.E.	OLS	F.E.
Child Mortality	0.02***	0.044***	0.012***	0.038***	0.029***	0.012
	(0.003)	(0.005)	(0.003)	(0.009)	(0.008)	(0.024)
Water Scarcity	0.008***	0.023***	0.015***	0.078***	-0.009	0.067*
	(0.004)	(0.008)	(0.003)	(0.019)	(0.010)	(0.038)
Rural Population	0.001***	0.001***	0.001***	0.001**	-1.8×10^{-4}	-0.002
	(1.6×10^{-4})	(2.4×10^{-4})	(1.3×10^{-4})	(0.001)	(3.5×10^{-4})	(0.002)
GDP	0.033***	0.032***	0.026***	0.010**	0.040***	0.013
	(0.003)	(0.004)	(0.003)	(0.005)	(0.008)	(0.013)
Polity 2	-0.002***	-0.002***	-0.002***	5.3×10^{-4}	-0.003***	0.002
	(2.7×10^{-4})	(3.6×10^{-4})	(2.6×10^{-4})	(0.001)	(0.001)	(0.001)
Population	0.009***	-0.001*	0.011***	-0.121***	0.018***	-0.187***
	(0.002)	(0.003)	(0.002)	(0.015)	(0.004)	(0.041)
ODA	0.001	-2.7×10^{-4}	0.009***	0.012***	-0.003	0.001
	(0.002)	(0.002)	(0.002)	(0.003)	(0.005)	(0.007)
FDI	-4.8×10^{-4}	1.6×10^{-5}	-0.001**	-6.0×10^{-6}	-4.4×10^{-4}	0.001
	(3.8×10^{-4})	(3.5×10^{-4})	(4.0×10^{-4})	(4.3×10^{-4})	(8.4×10^{-4})	(0.001)
Trade	-7.8×10^{-5}	-1.0×10^{-4}	3.8×10^{-5}	1.4×10^{-4}	-3.6×10^{-4}**	5.4×10^{-5}
	(6.1×10^{-5})	(8.0×10^{-5})	(5.9×10^{-5})	(1.1×10^{-4})	(1.5×10^{-4})	(2.5×10^{4})
Constant	-0.406***	-0.326***	-0.417***	1.730***	-0.497***	3.175***
	(0.053)	(0.073)	(0.051)	(0.307)	(0.139)	(0.807)
Observations	11367	11367	8554	8554	2813	2813

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

In general, it appears that donors have historically favored countries at higher risk for water-related disease. Across all donors, the water scarcity index, rural population, and the child mortality rate were positive and significant at the five percent level or above. GDP was significant and positive, suggesting that donors tended to allocate a larger percentage of their WASH aid budget to wealthier recipient countries, while the polity score was significant in the OLS model, but not in the fixed effects model. When donor types are examined separately, it appears that much of the responsiveness of WASH sector aid can be explained by the behavior of bilateral donors; all three indicators of need were significant and of the expected sign under both the OLS and the fixed effects model for bilateral donors. The apparent unresponsiveness of multilateral WASH aid to recipient country need can perhaps be partially explained by the behavior of the regional development banks, which are generally constrained within the context of their respective mandates to partner only with a certain set of recipient countries, with the result that they have relatively little latitude to respond to need.

Table 4.7 shows the results of a similar procedure focusing on three individual donors- the United States, the World Bank Group, and the various agencies of the United Nations, including UNICEF, the United Nations Development Program (UNDP), and the United Nations Environmental Programme (UNEP). The United States, perhaps unexpectedly given that country's generally poorer assessment in the existing literature, appears to be relatively responsive to aid as measured by mortality and water scarcity, although it also seems to favor countries with more urbanized populations. The United Nations agencies, although not responsive to need as I have defined it, were the only donors that appear to favor lower income countries. Additional sensitivity analysis indicated that these donors were also the only among those tested to favor African countries; indeed, the World Bank, USAID, and bilateral donors more generally all tended to avoid this region.

Table 4.6- Donor Selectivity on Recipient Need						
	United States		United Nations		World Bank	
	OLS	F.E.	OLS	F.E.	OLS	F.E.
Child Mortality	0.043***	0.185***	$5.1x10^{-4}$	0.034	0.025	0.016
	(0.012)	(0.036)	(0.005)	(0.039)	(0.017)	(0.048)
Water Scarcity	0.140***	0.126**	-0.005	-0.032	0.023	0.064
	(0.009)	(0.057)	(0.006)	(0.027)	(0.020)	(0.071)
Rural Population	-0.001	-0.014***	$3.0x10^{-4}$	-0.006**	$-4.1x10^{-5}$	$-1.3x10^{-5}$
	(0.001)	(0.003)	($2.2x10^{-4}$)	(0.002)	(0.001)	(0.003)
GDP	0.024**	-0.001	-0.006	-0.036***	0.008	-0.051**
	(0.012)	(0.025)	(0.004)	(0.013)	(0.018)	(0.025)
Polity 2	-0.001	0.001	0.001	0.001	0.001	0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.003)
Population	0.015**	-0.252***	0.013***	0.103	0.026***	-0.150*
	(0.006)	(0.070)	(0.002)	(0.068)	(0.008)	(0.087)
ODA	0.025***	0.041***	0.001	-0.004	-0.017	-0.005
	(0.007)	(0.012)	(0.003)	(0.006)	(0.011)	(0.015)
FDI	-0.004***	-0.002	0.001	$3.2x10^{-4}$	0.004	0.001
	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)
Trade	$1.6x10^{-4}$	$4.1x10^{-4}$	$-3.03x10^{-5}$	$-8.1x10^{-5}$	$-4.3x10^{-4}$	$9.1x10^{-5}$
	($2.1x10^{-4}$)	(0.001)	($8.9x10^{-6}$)	($1.8x10^{-4}$)	($3.1x10^{-4}$)	(0.001)
Constant	-0.925***	3.407**	-0.137***	-0.483	-0.409	1.414
	(0.212)	(1.523)	(0.052)	(0.644)	(0.302)	(1.7010)
Observations	469	469	597	597	503	503

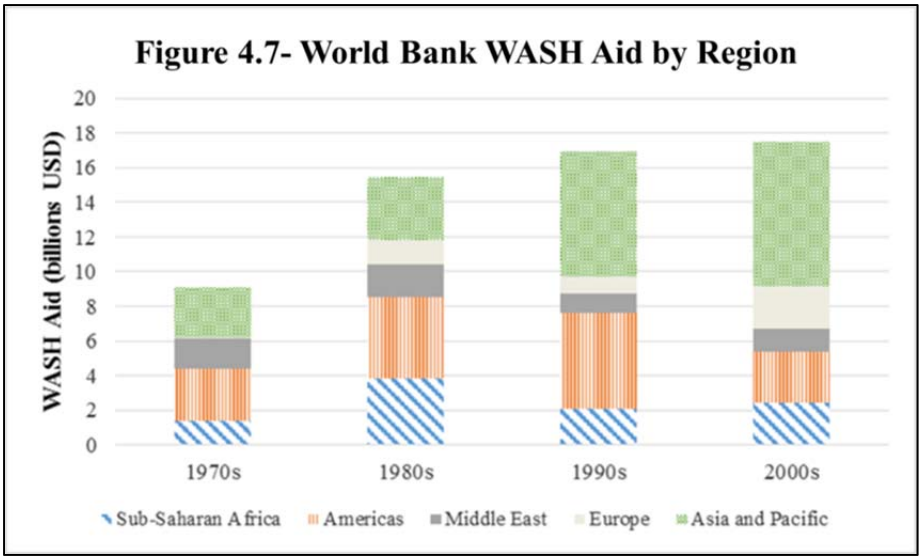
* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

Among all of the donors examined in this study, one remains particularly inscrutable. The World Bank Group, which alone accounts for nearly 30 percent of all WASH sector aid across the period, did not appear to follow any predictable pattern in its allocation behavior. For this reason, the following section examines independently the responsiveness of this donor, focusing on trends within its two most important component agencies- the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA).

WASH Aid at the World Bank

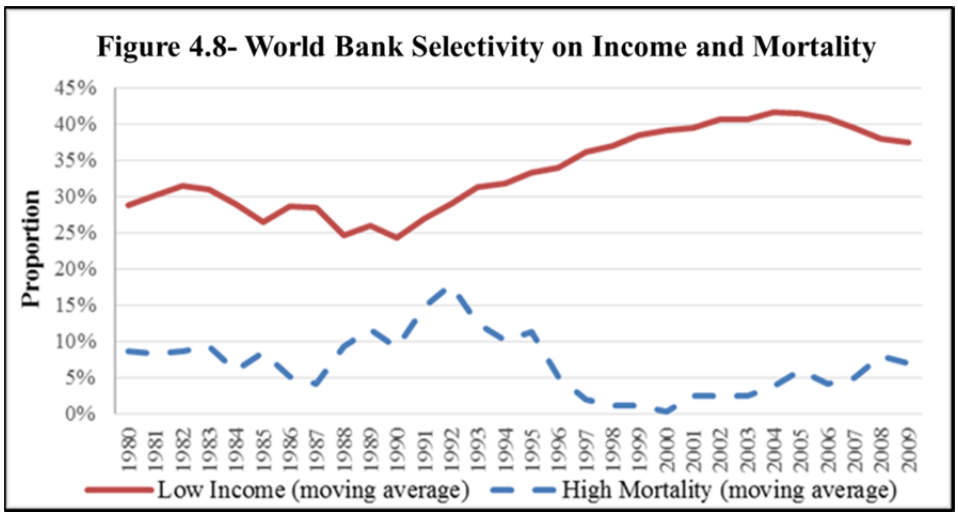
Broadly, World Bank funding for water and sanitation increased rapidly in throughout the 1970s and 1980s, but has stalled in more recent decades, despite an exploding global population. Figure 4.7 breaks down the Bank's WASH aid funding by recipient country region.



Source: Compiled from AidData (2013)

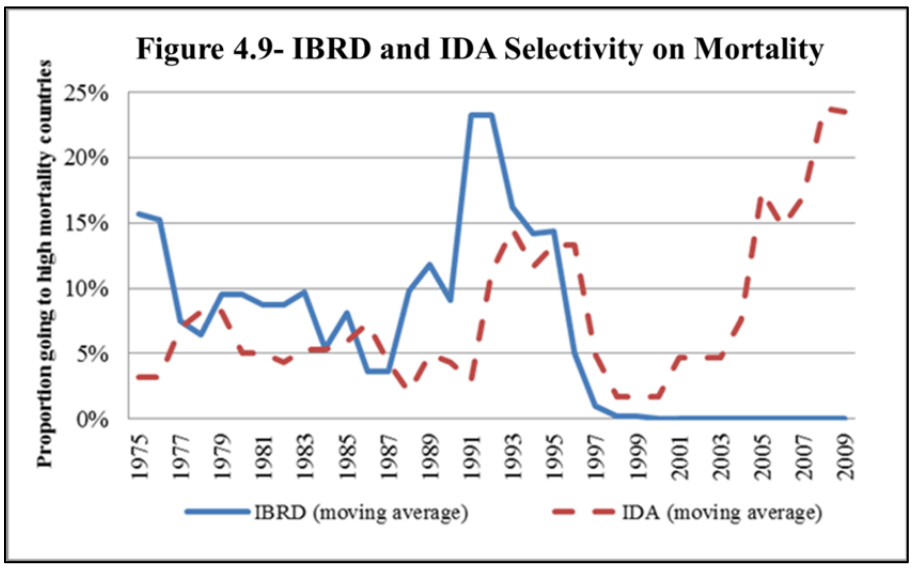
The rise of Asia as the primary recipient region is even more pronounced in World Bank funding than among donors generally. Over the past decade, this region has accounted for nearly half of the Bank's total WASH sector portfolio. Again, this is not unexpected, given that the region also supports more than half of the world's population and a majority of people at risk for water-related disease. What is somewhat surprising is the pronounced decrease in aid to Africa beginning in the 1990s, particularly given the finding in the previous section of generally increasing responsiveness across all donors.

Figure 4.8 tracks the proportion World Bank WASH aid going to low income and high mortality countries across time. Low income countries are defined here as those with a per capita GDP of less than US$1000 in constant (2009) dollars, and high mortality countries are those in the top 20 percent of countries for child mortality, calculated separately within each year of the period.



Source: Compiled from AidData (2013), World Bank (2013a)

In both cases, there is a pronounced rise in the responsiveness of WASH aid beginning in the late 1980s, consistent with the findings of the previous sections. Although responsiveness to income continued to rise into the following decade, responsiveness to mortality declined rapidly in the latter half of the 1990s. There was a more recent rise in responsiveness to mortality in the late 2000s, a trend which, as Figure 4.9 shows, can be largely attributed to the behavior of IDA, the Bank's development arm, which, beginning in the 1960s, has provided highly concessional loans and grants to the poorest countries.



Source: Compiled from AidData (2013), World Bank (2013a)

The same division of labor which was evident across donors is thus also identifiable within a single organization. Beginning in about 2000, the proportion of IDA funding going to high-mortality

countries (those with under-five mortality rate in the highest 10 percent for a given year), begins to rise dramatically, even as the share of IBRD funding to those countries falls to essentially zero. Because IBRD is by far the larger agency, some of the recent decrease in aid to Africa, and overall declining cross-country responsiveness of WASH-sector Bank funding, may be explained by the rise of IDA as the primary donor to low-income countries and the movement of IBRD toward middle income countries, particularly in Asia. This should not be taken, however, to mean that IBRD funding, or WASH aid more generally, is necessarily becoming less responsive; to make such a determination, it is necessary to first examine the allocation of WASH aid within countries, rather than between them. Accordingly, the following chapter continues the discussion of the World Bank's WASH sector activities, focusing on its experience in a single recipient country, the Republic of the Philippines, a middle income nation and one of the largest beneficiaries of IBRD WASH sector funds.

CHAPTER 5

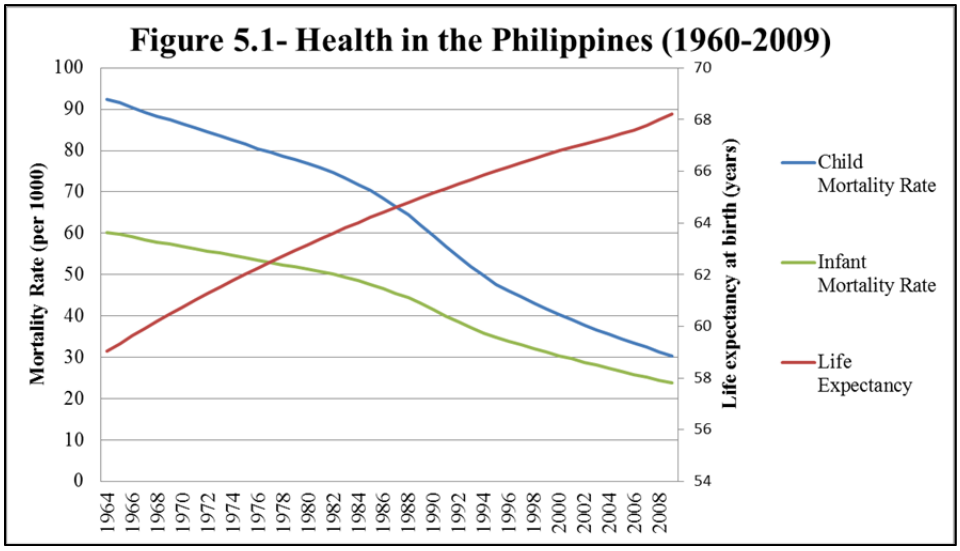
The Local Responsiveness of WASH Aid: Evidence from the Philippines

Where the preceding chapter examined the responsiveness of WASH sector aid at the global level, across all donors and recipients, the current one confines the analysis to a single recipient, the Republic of the Philippines, and a single donor, the World Bank's IBRD. In the following, I examine the distribution of IBRD projects for water and sanitation in the Philippines in order to determine whether WASH aid can be shown to be responsive to need within, rather than between, countries. Using an original dataset compiled from the Philippines Department of Health annual reports, among other sources, I develop a model predicting the relative risk for populations in each of the 188 provinces and major cities of the Philippines. I find strong evidence to suggest that, although Bank funding has not tended to go to areas with high reported levels of water-related disease, there is indeed a statistically significant and important relationship between project location and the predicted level of need based on the results of the model.

Background

The Philippines is a middle income country located in Southeast Asia with a population in 2013 of approximately 92 million and an estimated GDP per capita of around US$2500. Over the past half-century, the country has undergone several intense periods of political and economic upheaval, including more than a decade of military dictatorship under Ferdinand Marcos, and the subsequent People's Power Revolution of 1986. For much of the period, economic growth in the Philippines has lagged behind those of its neighbors, including Indonesia, Thailand, and Malaysia, although the past ten years have seen a rapid increase in per capita income.

Despite this economic turmoil, the Philippines has experienced rapid and relatively stable improvements in health. Figure 5.1 below charts changes in health indicators in the Philippines from 1960 through 2009; over the time period examined, the child mortality rate fell by some 67 percent and the infant mortality rate by 60 percent, while life expectancy at birth increased by more than 10 years.



Source: Compiled from World Bank (2013a)

Nevertheless, water-related diseases remain a pressing problem in the Philippines, especially in rural areas, where access to clean drinking water and sanitation continues to lag behind the cities, and particularly among children. WHO has estimated that as many 1 in 10 children under five die each year as a result of water-related diseases and that such illnesses account for an annual loss of some 365,000 DALYs annually.[121] The World Bank estimates the economic cost of mortality and morbidity resulting from water-related diseases in the Philippines at more than US$134 million annually.[122] Diarrheal diseases account for the vast majority of water-related illness in the Philippines, and alone account for one-quarter of all deaths and one-third of all illnesses among children under five years of age.[123]

At the national level, the National Water Resources Board (NWRB) is the agency with primary responsibility for policy formulation, administration, and enforcement under the authority of the 1976 Water Code of the Philippines.[124] Other national agencies involved in the management of water include the Department of Public Works and Highways (DPWH), which has responsibility for flood control and

[121] WHO (2012)

[122] World Bank (2006)

[123] WHO (2008)

[124] Greenpeace (2007)

drainage, a task which is managed in the National Capital Region (NCR) by the Metro Manila Development Authority; the Department of Health, particularly in the areas of sanitation and hygiene; the Department of Environment and Natural Resources (DENR), which oversees watershed protection and water quality; the Department of Interior and Local Government (DILG), which coordinates the local management of water supply and sanitation systems; the National Power Corporation (NPC), with authority over the construction and operation of hydroelectric dams; the National Irrigation Administration (NIA); and the Bureau of Soils and Water Management (BSWM).[125] At the regional level, the Local Water Utilities Administration (LWUA), in the NCR, the Metropolitan Waterworks and Sewerage System (MWSS) are also important actors.

Historically, international aid agencies have also played a prominent role in the governance of water in the Philippines. Under the Marcos administration, the country was among the first in the developing world to receive structural adjustment loans from the World Bank and IMF, many of which funded the construction of reservoirs and other large infrastructure projects.[126] In the 1980s, the proposed Chico Dam project in central Luzon, funded in part by the World Bank and the Asian Development Bank (ADB), became a poster-child for the backlash against the aid-funded construction of large dams led by a coalition of indigenous groups and environmental activists.[127] And, in the 1990s, following the fall of Marcos, the Philippines again became a sort of developmental test case, this time for nascent neoliberalism, illustrated most poignantly by the 1997 privatization of the MWSS, a project that was explicitly encouraged by the country's creditors.[128]

All told, the Philippines has been the beneficiary of loans and grants totally nearly US$6 billion for WASH sector projects since 1960. Broadly, WASH aid to the Philippines increased rapidly

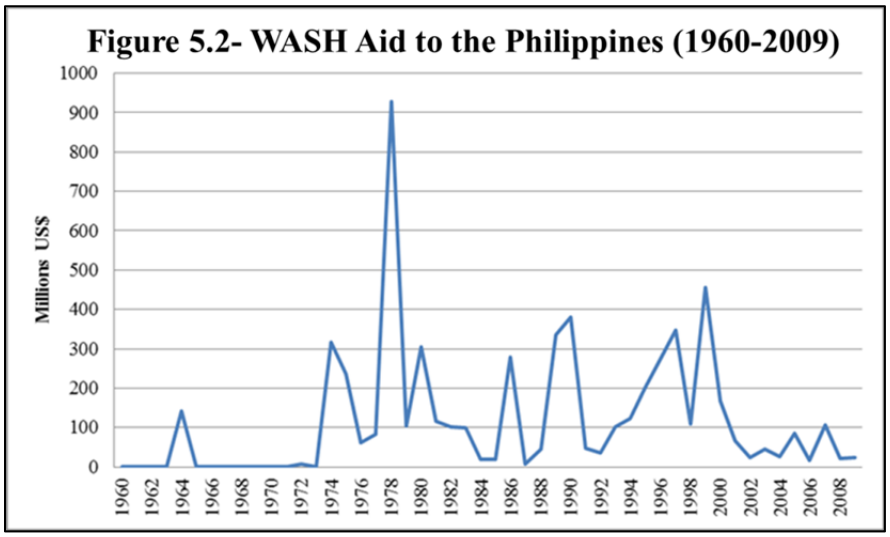
[125] Ibid.

[126] Broad (1990)

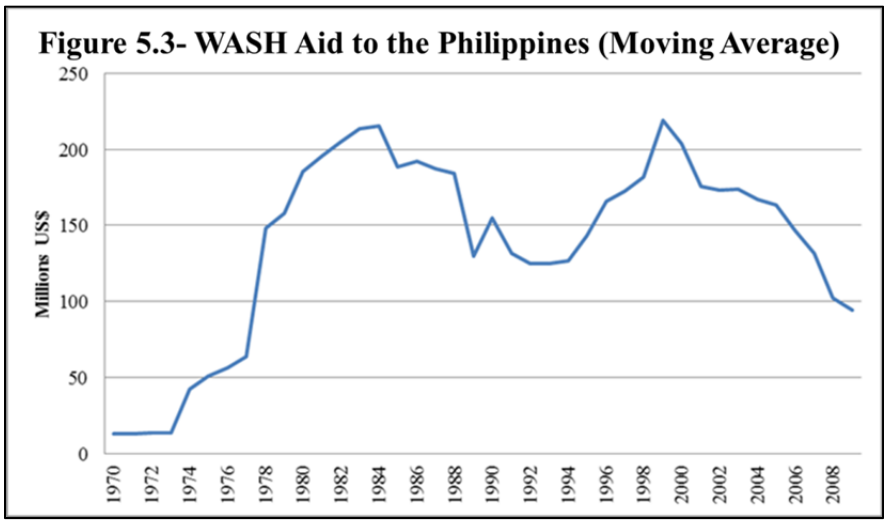
[127] Khagram (2004)

[128] See Bello et al. (2004)

throughout the latter half of the 1970s, and continued rising until the mid-1980s. This is consistent with the pattern of aid generally in this period, during which the Marcos administration embarked on a series of rapid development initiatives in partnership with international donors, particularly the World Bank. The subsequent decline in aid beginning in about 1985 marks the period of political turmoil as the dictatorship began to falter and donors pulled funding in droves.[129] Following the successful revolution of 1986, aid resumed, and continued rising until the about 2000. Figures 5.2 and 5.3 below show these trends in WASH in terms of annual commitments and estimated annual disbursements, respectively.



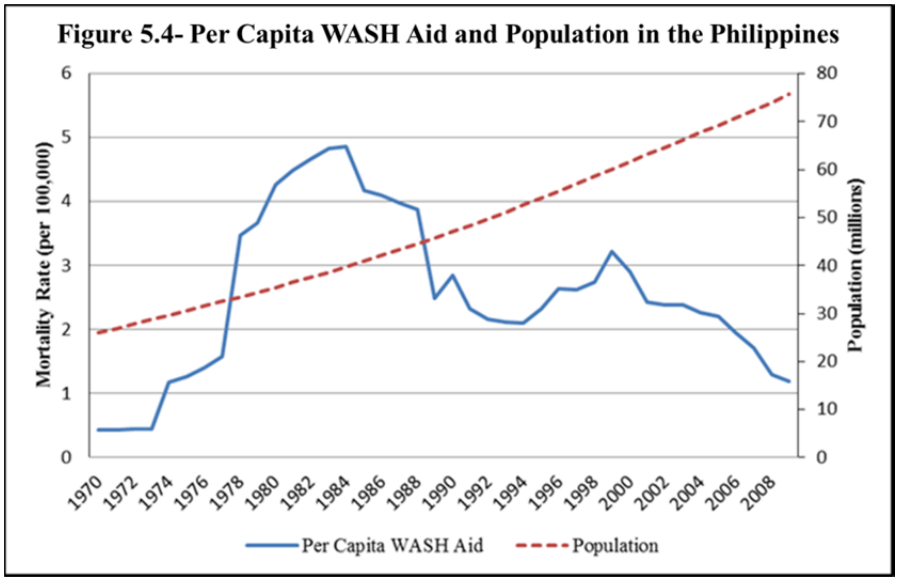
Source: Compiled from AidData (2013)



Source: Compiled from AidData (2013)

[129] See Broad (1990)

The large increase in aid in 1978 is the combined result of two especially large projects that were approved in that year- the World Bank funded Magat River Multipurpose Project (Phase 2) at approximately US$150 million in current (1978) dollars, and the Second Manila Water Supply Project at approximately US$92 million, jointly funded by the World Bank and ADB. Both projects featured the construction of large reservoirs for drinking water supply and other purposes.[130] Figure 5.4 below shows trends in WASH aid in per capita terms; for comparison, population is also shown.

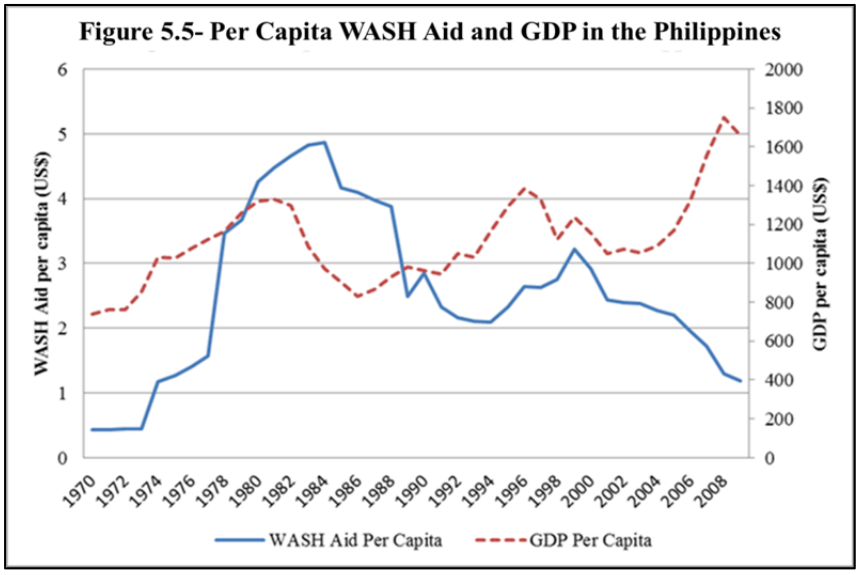


Source: Compiled from AidData (2013)

Although there does not appear to be any clear relationship between population growth and the level of per capita WASH aid received, there may be a relationship between WASH aid and per capita GDP, as shown in Figure 5.5 below. In the figure, it appears as though WASH aid is responding to income, with a few years of lag time. In the first half of the period, per capita GDP peaks in 1981 before falling some 38 percent by 1986; per capita WASH aid does the same a few years later, declining more than 50 percent between 1984 and 1994. Several years after GDP begins to rise once more, WASH aid does as well, the former peaking briefly in 1996 and the latter in 1999. After 2000, however, the pattern

[130] The Magat River project in particular had both energy-generation and irrigation components, as well as an emphasis on flood control. See AidData (2012); World Bank (1978).

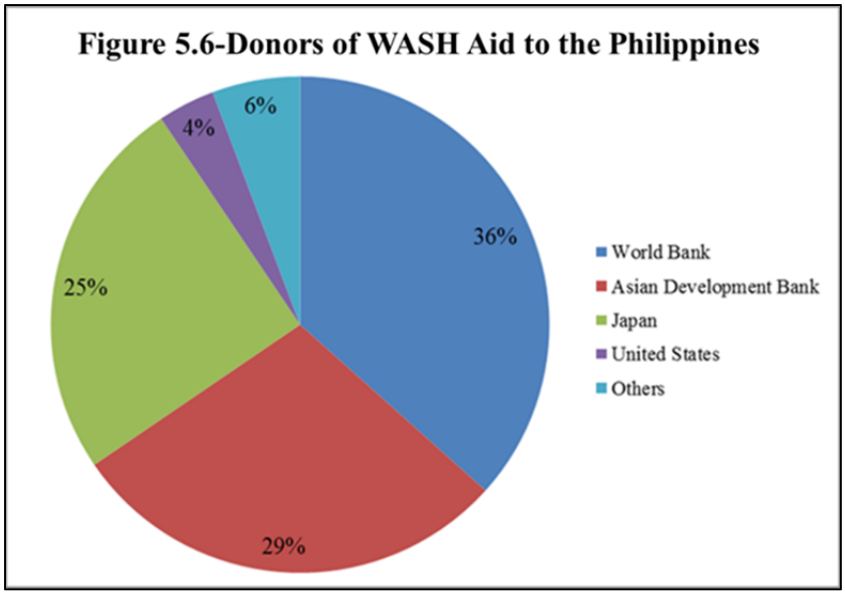
changes abruptly. Even as GDP growth accelerated, WASH aid declined rapidly, reaching a low of just US$1.89 averaged over five years by 2009.



Source: Compiled from AidData (2013), World Bank (2013)

Is this a sign of WASH aid becoming more responsive in the recent period? Certainly it is consistent with the expectation that a country should receive less aid as it develops. However, such figures say nothing about the responsiveness of aid within the Philippines, and it is with this question that the remainder of this chapter is concerned.

In the following, I examine the spatial distribution of World Bank-funded WASH sector projects and compare this distribution to provincial and city level need. The justification for choosing this single donor for analysis can be seen in the donor composition of aid flows to the Philippines shown in Figure 5.6. Between 1960 and 2009, just three donors- the World Bank, ADB, and Japan, constituted some 90 percent of the total WASH aid flows to the Philippines. The United States, surprisingly given the close political and historical relationship between the two countries, accounted for a mere 4 percent, while each of the remaining twenty-one donors each constituted less than 2 percent. Moreover, ADB and the Bank often coordinate their funding within the Philippines, allocating funds to joint projects within the same geographic area. Accordingly, an examination of World Bank funding should lend insight into how a plurality, if not a majority, of WASH aid is allocated within the country.



Source: Compiled from AidData (2013)

The analysis below broadly follows the framework for microbial risk assessment as outlined by the International Life Science Institute and the U.S. Environmental Protection Agency (EPA) Office of Water.[131] The following three sections present a preliminary exposure characterization, human health effects characterization, and risk characterization of water-related disease in the Philippines. The final section compares the reported and predicted instance of disease in each of 188 provinces and incorporated cities to the distribution of IBRD-funded WASH projects.

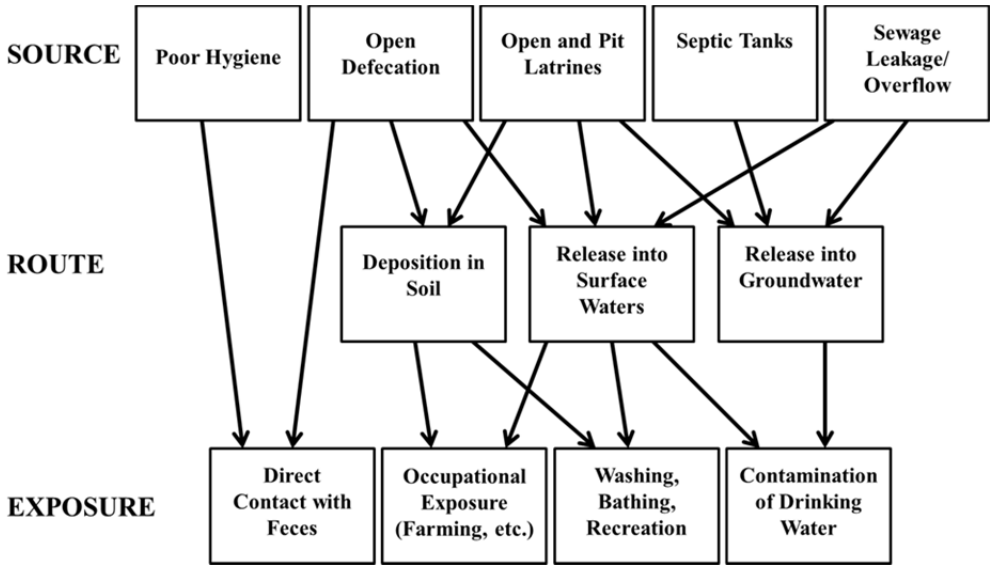
Exposure Characterization

For the purposes of this study, I restrict the analysis of water-related disease in the Philippines to diarrheal diseases, which account for the vast majority of water-related illnesses in that country. WHO estimates that more than 80 percent of diarrhea cases are directly attributable to unsafe drinking water, inadequate sanitation, and poor hygiene; many of the remaining cases can be traced to food contaminated by unsafe water, making water by far the most important contributor to the diarrhea disease burden faced by individuals and communities in the developing world.

[131] See ILSI (2000); Parkin (2007) offers a detailed description of the procedure and challenges of microbial risk assessment.

An estimated 13 million Filipinos lack access to an improved source of drinking water as defined by JMP. Inadequate sanitation constitutes an even more serious problem; some 25 million Filipinos, more than one-quarter of the country's population, live in households without improved sanitation. Compounding this situation is the fact that nearly all of the country's domestic wastewater, even from those household with sanitary toilets, is eventually released untreated into the environment, where it can contaminate surface and groundwater.[132] As displayed in Figure 5.5 below, the transmission route for diarrheal diseases can thus follow any of a number of related pathways, often simultaneously.

Figure 5.7- Transmission Routes of Diarrheal Diseases in the Philippines



Source: Adapted from World Bank (2006)

In households without sanitary toilets, waste is not effectively eliminated from the living space, and can be transmitted directly through physical contact with fecal matter. When untreated waste is released directly into groundwater, it can contaminate wells and thence drinking water. Occupational exposure is also an issue, particularly among farmers, who may come into contact with contaminated irrigation water. In addition, transmission may occur when contaminated surface water is used for

[132] World Bank (2006)

domestic or recreational purposes; women and children, respectively, bear the brunt of these risk factors.[133]

Throughout the country, populations face different risks from microbial infection based on a number of geographic, environmental, demographic, and socio-economic factors. A key consideration is urbanization. On the one hand, cities face additional risks associated with a large population and more limited water resource base. On the other, residents of rural areas are, due to capital costs and other factors, significantly less likely to have access to piped drinking water or municipal sewage infrastructure, and may be subject to a wider range of exposure pathways owing to their reliance on surface water such as rivers and streams for irrigation and hygiene.

Income level is a second important determinant of individual and population risk from water-related disease. Not only are wealthier individuals and communities more likely to have access to improved sources of drinking water and sanitation facilities, they are also more likely to have access to medical treatment in the event that they develop illness. Thus, income is a determinant of both exposure to and hazard from water-related disease.

As is the case with many pollutants, the risks associated with diarrhea also vary according to individual characteristics, especially age. Children, the elderly, and individuals with compromised immune systems face increased risk of morbidity or mortality from all infectious diseases, including diarrhea. Children in particular are at elevated risk of exposure to water-borne pathogens because they may come into contact with contaminated water more often than other age groups, and are less likely to have well developed hygiene habits.[134]

[133] World Bank (2012)

[134] UNICEF/WHO (2009)

Human Health Effects Characterization

Diarrhea is generally defined as the passage of three or more loose or liquid stools per day, or more frequently than normal for an individual.[135] As such, it is neither a precise nor definitive diagnosis, but rather a general symptom of one or more of a wide range of bacterial, viral, and protozoan pathogens. Among children, the group most at risk for developing severe symptoms, the leading cause of diarrhea is rotavirus, which accounts for some 40 percent of hospital admissions for diarrhea globally, and up to 50 percent in the Philippines.[136] Also important are the bacteria *E. coli*, *Shigella*, *Campylobacter*, *Salmonella*, and *V. cholera* during epidemics, as well as the protozoa *Cryptosporidium*. Diarrhea may also be caused by certain parasites, such as the trematode *Schistosoma*, which is endemic only in certain southern regions of the Philippines.[137]

Acute diarrhea can be classified as one of three forms- acute watery diarrhea, acute bloody diarrhea, or dysentery, and persistent, or chronic, diarrhea- each of which can cause mortality or severe morbidity if left untreated.[138] The primary health concern associated with each of these conditions is dehydration resulting from the loss of fluids. Children, particularly those under five years of age, are especially susceptible to severe effects of diarrhea because they require a larger daily intake of water per unit of body weight than do adolescents and adults, and because their kidneys are less able to conserve water.[139] Figure 5.8 outlines the three forms of acute diarrhea, the pathogens with which they are most commonly associated, and their particular health risks.

[135] UNICEF/WHO (2009)

[136] UNICEF/WHO (2009), Carlos and Saniel (1990)

[137] World Bank (2006)

[138] UNICEF/WHO (2009)

[139] UNICEF/WHO (2009)

Figure 5.8- Forms, Causes, and Human Health Effects of Diarrheal Disease in the Philippines

Form	Health Effects	Primary Pathogens
Acute Watery Diarrhea	Associated with significant fluid loss and dehydration lasting for several houses or days	*V. Cholera*, *E. coli*, Rotavirus
Acute Bloody Diarrhea (dysentery)	Associated with visible blood in the stool; may cause intestinal damage and nutrient loss	*Shigella*
Persistent Diarrhea	An episode of diarrhea, with or without blood, lasting at least 14 days; can lead to malnutrition, immune system deficiencies, and other systemic effects	HIV

Source: Adapted from World Bank (2006)

Because most diarrheal diseases follow similar routes of transmission, populations with poor access to clean and adequate sanitation are at risk for infection from multiple pathogens simultaneously, and for serial infections, which, over the long term, can result in chronic malnutrition and other forms of morbidity. Insomuch as these communities are also likely to have limited access to health care, and to exhibit poorer nutrition, the health risk from diarrheal diseases tends to be spatially distributed according to the level of wealth, with children in low-income communities facing the highest risk of any group. As I will discuss in the following section, these trends have implications for the assessment and analysis of risk, as well as for the development of successful intervention.

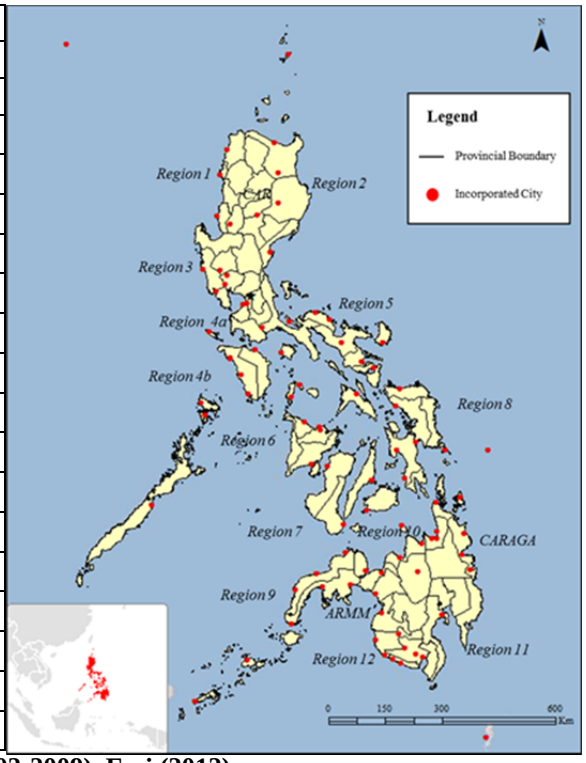
Risk Characterization

The final step of the microbial risk assessment process is risk characterization, which seeks to quantify the relative risk associated with a particular disease in a given population. Although provincial and city level data already exist on the instance of diarrheal disease in the Philippines, my analysis is premised on the belief, well established in the literature, that these data tend to vastly underreport actual occurrence of disease, particularly in those rural and lower-income localities where they are most likely to be of concern. To account for this error, I develop a statistical model relating the reported instance of diarrheal disease with the risk factors identified in the exposure characterization described above. For this exercise, the object of analysis is that of the second-level administrative unit, in this case provinces and

major cities. Figure 5.9 shows the distribution of these units by administrative region, and their location within the Philippines. A full list provinces and cities included in this analysis is available in the Appendix.

Figure 5.9- Provinces and Major Cities of the Philippines

Region	Provinces	Cities
Region 1	4	3
Region 2	6	1
Region 3	8	3
Region 4a	5	3
Region 4b	5	2
Region 5	6	1
Region 6	6	3
Region 7	4	1
Region 8	6	3
Region 9	3	3
Region 10	5	2
Region 11	4	1
Region 12	4	3
Caraga (Region 13)	5	6
Cordillera (CAR)	6	1
Muslim Mindanao (ARMM)	5	2
Metro Manila (NCR)	0	16
Total	82	56



Source: Compiled from World Bank (2013c), FHSIS (2002-2009), Esri (2012)

For each unit, health, population, and mortality data were compiled from the Field Health Service Information System (FHSIS) annual report for the years 2002 through 2006. This report, published by the Philippines Department of Health, details population, mortality, and reported cases of key diseases in each of 188 provinces and incorporated cities in the country.[140] Data on water pollution and water resource potential were obtained from the Philippines Environmental Monitor (PEM) and are aggregated at the regional level.[141] A final source of data was the Philippines National Statistical Coordination Board, which collects and maintains economic and demographic statistics at the national, regional,

[140] FHSIS (2002-2006)

[141] World Bank (2003)

provincial, and city levels.[142] In the model described below, the dependent variable is constructed as the number of reported cases, per 100,000 individuals, of acute diarrhea. The average rate nationwide is approximately 786, although this number ranges widely, from 0 in some locations in some years to more than 2000 in others.

Several independent variables were included as potential drivers of diarrheal disease. As I have discussed in previous chapters, residents of high-income countries, regions, and localities have access to more doctors, better nutrition, and more effective public health infrastructure. In the model, wealth is expressed in terms of Gross Regional Domestic Product (GRDP) calculated at the regional level and expressed in per capita terms. Population density, in terms of individuals per square kilometer, and estimated freshwater potential, in cubic meters per population, are also included.

Biochemical oxygen demand (BOD) serves as a measure of water contamination. BOD measures the amount of oxygen consumed during the decomposition of organic matter in the water column. In estimating the model, BOD is scaled according to the estimated total water resources potential of each region, including both ground and surface water potential. Thus the final variable is expressed in terms of milligrams of BOD per liter of available freshwater for the each region. Because data are not available on either organic waste production or water resource potential at the provincial or city level, all localities within a region are assigned the same value for this pollution variable. An admittedly imprecise measure of pollution, this variable nevertheless helps to control for regional differences in water quality. A list of all variables and data sources is available in Appendix C; summary statistics of the key variables are shown in Table 5.1 below.

[142] NSCB (2012)

Table 5.1- Summary of Key Variables					
Variable	Description	Mean	Std. Dev.	Min.	Max.
Population	Total population in province/city	451,649	465,206.8	15482	2,679,450
Income	Per capita GRDP in region (PHP)	15.142	16.430	3345.66	114,784.20
Density	Persons per hectare in province/city	26.960	71.657	0.119	718.982
Biochemical oxygen demand	Average regional BOD production in milligrams per liter	23.416	19.098	1.253	64.308
Water potential per capita	Regional freshwater resources in cubic meters per person per year	2936.337	3035.894	433.343	22577.78
Diarrhea Rate	Cases of acute diarrhea per 100,000 population	785.537	668.260	0	9414.098
City	=1 if city	0.567	0.496	0	1

Source: Compiled from World Bank (2013c), FHSIS (2002-2009), Greenpeace (2007), World Bank (2006)

As a preliminary test of significance, an OLS regression was estimated of the relationship between reported cases of diarrhea and the explanatory variables described above. As expected, the results of this analysis indicate a potential bias due the under-reporting of disease. In this trial, both access to drinking water and GRDP appear to have a positive relationship with the incidence of diarrheal disease in each locality. This counter-intuitive finding can likely be attributed to better access to health care and more complete reporting of health statistics in high-income communities.

Table 5.2- Impact of Access to Water and Sanitation on Diarrheal Disease			
Variable	**Model 1**	**Model 2**	**Model 3**
Population without water	-0.0014**		
	(0.0005)		
Population without sanitation		-0.0023**	
		(0.0003)	
Population without access to water, sanitation or both			-0.0034*
			(0.0020)
Population Density	0.0126**	0.0126**	0.0125**
	(0.0057)	(0.0058)	(0.0058)
Per capita income	0.1547***	0.1542***	0.1550***
	(0.0417)	(0.0422)	(0.0418)
Pollution	0.0110**	0.0110*	0.0113**
	(0.0056)	(0.0056)	(0.0056)
Intercept	2546.847***	2512.571***	2519.485***
	(5753.029)	(564.849)	(554.745)

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

In order to account for this tendency and estimate a model that predicts actual, rather than reported, cases of diarrheal illness, I estimate a fixed-effects panel model of the form:

$$Y_{i,t} = \beta_0 + \beta_1 X_{i,t} + \alpha_i + \mu_{i,t}$$

Where $Y_{i,t}$ is the expected number of diarrhea cases per 1000 individuals, $X_{i,t}$ is the vector of explanatory variables discussed above, β_0 is the intercept, and $\mu_{i,t}$ is the error term. In this specification, the term α_i is a time-invariant unobserved effect unique to each province or city. If the model is otherwise correctly specified, this term can be conceptualized as access to health care, as well as other geographic and demographic factors affecting the report of disease cases. Thus, by removing α_i, it is possible to obtain an unbiased estimate of the total disease burden associated with diarrhea.

Table 5.3 shows the results of a fixed effects panel regression of the reported rate of diarrheal diseases on four explanatory variables- per capita income, regionally estimated BOD, population density, and fresh water potential. In order to further avoid bias due to under-reporting of disease, the sample was restricted to those provinces and cities in which the reported rate of diarrheal disease was greater than 0.5 percent of the total population, thus removing several outliers in which no or few cases were reported.

Table 5.3- Predictors of Diarrheal Disease (Fixed Effects, Disease Rate >0.5%)

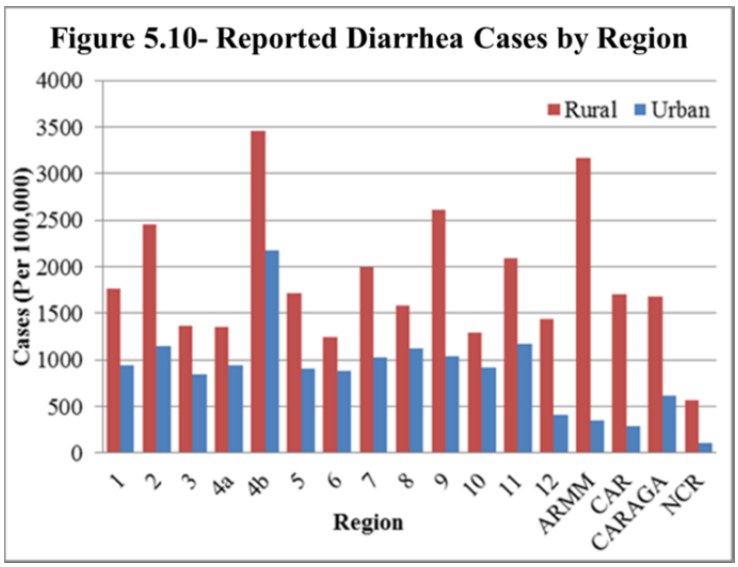
Variable	Coefficient	Std. Error
Income	-0.107***	0.042
BOD	0.325**	0.118
Density	-0.437***	0.056
Water Potential	-0.232**	0.111
Constant	11.111***	1.198
Observations	803	
R^2 (within)	0.123	
R^2 (between)	0.010	
R^2 (overall)	0.014	

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

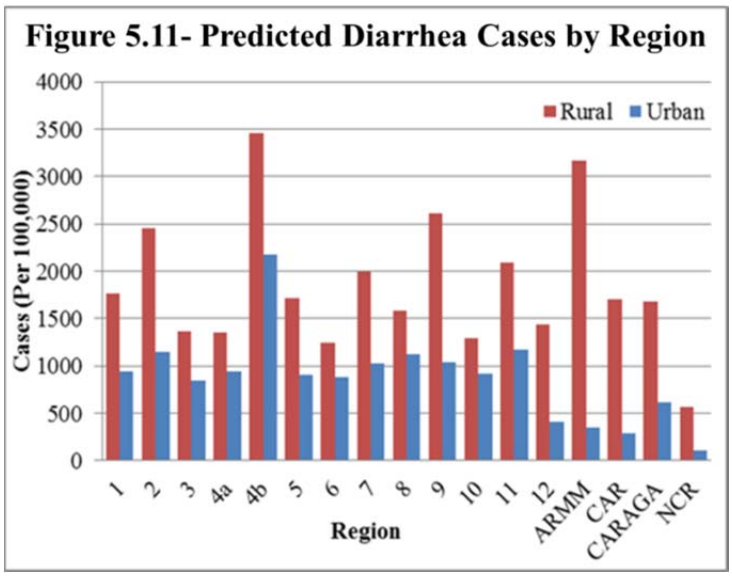
From the results of the fixed effects mode, a value $\hat{Y}_{i,t}$ was estimated for each locality in each year such that:

$$\hat{Y}_{i,t} = \beta_0 + \beta_1 X_{i,t}$$

Where $\hat{Y}_{i,t}$ is the relative risk, the predicted total number of cases of diarrhea per one hundred thousand individuals, including both reported and unreported cases. This relative risk can be used to compare localities in terms of the risk faced by individuals of contracting diarrheal disease irrespective of the total population in the community. It can also be converted into population risk in order to assess the total impact of diarrheal disease in a given locale. Figures 5.7 and 5.8 show the relative and population risk, respectively, estimated for each of the sixteen administrative regions of the Philippines, calculated separately for rural and urban areas.



Source: Compiled from World Bank (2013c), FHSIS (2002-2009)



Source: Compiled from World Bank (2013c), FHSIS (2002-2009)

As expected, the estimates obtained from official health statistics tended to greatly under-report the instance of diarrhea when compared with the predicted estimates using the model above. These results also show that the risk of diarrheal disease is significantly higher in rural than in urban areas, a trend which is well noted in the literature.[143] Using these results, the following section assesses the responsiveness of IBRD WASH aid funding in the Philippines to both reported and predicted diarrheal disease risk.

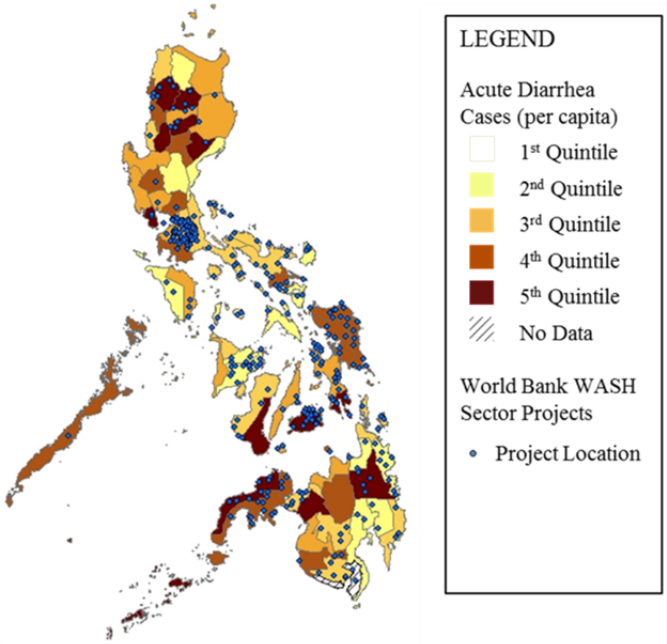
The Responsiveness of World Bank WASH Aid in the Philippines

Based on different potential explanations of donor behavior, I propose three general hypotheses regarding the relationship between the allocation of WASH aid and the reported and predicted levels of disease. If IBRD is primarily concerned with appearing to be responsive to recipient need, as might be the case if it were responding only to its member country preferences and public pressure, then we might expect aid projects to be located in areas with high reported levels of water-related disease. On the other hand, if the agency is sincerely interested in responding to the objective needs of recipient communities, then we would expect aid projects to be located in areas with high levels of predicted risk, although not necessarily those with large numbers of reported cases. Alternatively, if the allocation of WASH aid is driven by factors other than development, then neither reported nor predicted cases of diarrheal disease should be significant predictors of project distribution.

In order to test these broad hypotheses, I perform a series of bivariate and multivariate regressions using geo-coded aid data from the World Bank's 'Mapping for Results' online platform. The dependent variable in each of the models below is a binary indicator that is equal to 1 if the province or city received WASH sector aid during the period 2002 through 2006, and 0 otherwise. Localities in which more than one project was implemented were also coded as 1.

[143] See for instance: UN (2006), World Bank (2007), UNICEF/WHO (2009), WHO (2012), UNICEF/WHO (2012), UN (2012)

Figure 5.12- Location of World Bank WASH Aid Projects in the Philippines



Four alternative measures of need were included as independent variables. These are the reported and predicted relative risk in each city or province from diarrheal disease, respectively, and the proportion of the population using improved sources of drinking water and improved sanitation facilities, as reported in the FHSIS. These explanatory variables correspond to the year 2002 in order to avoid any misinterpretation of the direction of causality. The results of an initial bivariate regression are shown in Table 5.4 below.

Table 5.4- Responsiveness of World Bank WASH Aid in the Philippines (Probit Model)

Variable	Reported Risk	Predicted Risk	Water Access	Sanitation Access
Coefficient	0.108	0.367***	-0.863	-0.592
	(0.124)	(0.118)	(0.542)	(0.453)
Constant	-0.840	-2.454***	0.614	0.327
	(0.835)	(0.118)	(0.462)	(0.345)
Observations	174	175	177	177
Pseudo R^2	0.003	0.042	0.010	0.007

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

Among the indicators of need, only the predicted number of cases was significant at traditionally accepted levels of significance, suggesting that IBRD is responsive to predicted, rather than reported

levels of need. This finding is consistent under alternative specifications of the model, as shown in Table 5.5. In these tests, additional explanatory variables are included to control from income, population, population density, and region. In the table, population refers to the total population of the province or city and income class to a one (wealthier) to six (poorer) scale based on the size of the local economy. The urbanization variable is a binary indicator equal to one if the locality is a 'highly urbanized city,' defined by the NSO as an incorporated city with a population of at least two hundred thousand inhabitants and an annual income of at least PHP50,000,000, and zero otherwise. Two additional binary variables indicate whether the province or city is located in either Metropolitan Manila (NCR) or Caraga (Region 13), the wealthiest and poorest administrative regions of the Philippines, respectively.

Table 5.5- Responsiveness of World Bank WASH Aid in the Philippines (Sensitivity Analysis)

Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Toilet Access	-0.567				-0.218			
	(0.513)				(0.516)			
Water Access		-0.817				-0.515		
		(0.581)				(0.600)		
Reported Risk			0.196				0.148	
			(0.139)				(0.142)	
Predicted Risk				0.387***				0.533**
				(0.124)				(0.216)
Population	0.619***	0.634***	0.665***	0.617***	0.642***	0.645***	0.657***	0.606***
	(0.137)	(0.136)	(0.137)	(0.137)	(0.140)	(0.140)	(0.141)	(0.139)
Income Class	0.115	0.118	0.107	0.062	0.009	0.018	0.014	0.056
	(0.111)	(0.111)	(0.111)	(0.112)	(0.119)	(0.120)	(0.120)	(0.122)
Urbanized					-0.788**	-0.773**	-0.837**	-0.407
					(0.349)	(0.348)	(0.371)	(0.376)
NCR					0.176	0.022	0.088	0.976*
					(0.449)	(0.450)	(0.464)	(0.592)
CARAGA					1.462**	1.465**	1.477**	1.550**
					(0.726)	(0.735)	(0.733)	(0.695)
Constant	-7.73***	-7.65***	-9.99***	-10.5***	-7.93***	-7.72***	-9.29***	-11.3***
	(1.957)	(1.926)	(2.171)	(1.988)	(1.995)	(1.986)	(2.237)	(2.335)
Observations	169	171	171	173	174	174	171	173
Pseudo R^2	0.139	0.141	0.144	0.178	0.192	0.195	0.198	0.217

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

Standard errors in parentheses

In each of the tests above, the predicted relative risk associated with diarrheal disease in each province or city is a significant predictor of having been the beneficiary of an IBRD-funded WASH project. Neither the reported relative risk nor the reported level of access to improved sources of drinking water and sanitation are significant in any of the tests. In other words, IBRD appears to be responsive to

the level of expected need, rather than reported need, among communities. This suggests that, to the extent that the agency exerts control over the location of projects, it is interested not only in showing responsiveness to need, but also in practicing it.

If the IBRD does indeed respond to need, as these results imply, then what can explain this phenomenon? Nielson and Tierney develop a model of international organization (IO) behavior based on principal-agent theory, in which the Bank is conceptualized as the agent of its member states, empowered to pursue the goals of these principals with broad, although not complete, autonomy.[144] As these authors explain, under this framework, "we should observe significant institutional reform and intervention by member governments if and only if the IO strays from its principals' mandated objectives or the preferences of member governments change in concert."[145] Although their analysis focuses on the adoption of environmental policies, the same framework is easily transferable to selectivity processes, and many authors have done just that.

Matthew Winters, for instance, is surprised to find that governance does not explain the lending behavior of the World Bank. He argues that, insomuch as donors face incentives to see their programs succeed, programmatic aid should be targeted to countries that demonstrate the set of 'good' policies, while poorly-governed countries should receive aid that is less discretionary. He finds that, although good governance is generally correlated with World Bank lending flows overall, and that well governed countries were more likely to receive funding for national rather than local projects, IDA tended to provide a larger share of programmatic loans to poorly governed countries. Winters speculates that this discrepancy may be due to political pressure applied on IDA by its bilateral donors, who may be more concerned with geopolitical considerations than with development outcomes.[146]

---

[144] Nielson and Tierney (2003)

[145] Ibid: p. 245

[146] Winters (2010)

I suspect that the reason for this apparent paradox may be far simpler- that poor countries tend to be poorly governed. IDA, with an explicit mandate to fund the poorest of the poor, has little choice within the context of its mission other than to work in countries where corruption and authoritarianism are rife. Under a principal-agent framework, donor organization should be expected to exhibit major operational changes only in instances when the preferences of its principals converge on new sets of objectives. It seems reasonable to propose that the adoption of the MDGs by the 193 members of the United Nations, including all 188 member nations of the World Bank, constitutes just such a convergence. The acceptance of these goals, with their dual emphasis on aid impact and responsiveness, represents a powerful statement on behalf of the Bank's principals regarding their preferences on what development looks like and how it should be achieved. A host of new reforms in the years following the adoption of the MDGs are testament to the desire of the Bank to internalize the principles of development enshrined therein. That its funding appears to have become more responsive to beneficiary need in the years since is therefore evidence for, not against, the conclusion that such efforts can have a demonstrable impact on practice as well as policy.

The principal-agent model of Bank behavior falls short, however, in that it assumes largely independent decision-making authority on the part of the principals, in this case member nations. Critically, the World Bank is not merely an implementing agency, but also a politically powerful entity in its own right; the more than 10,000 employees of this massive organization comprise their own epistemic community of development experts, with access to, and indeed control over, much of the existing data on development practice and progress.[147] The critical part the Bank played in designing the MDGs is evidence of its complicated role in the international development sphere.

A more accurate conceptualization of the relationship between the Bank and its member nations should therefore acknowledge the role of feedback loops, by which development practice both shapes and is shaped by development policy. Indeed, as I will argue in the following chapter, all donor agencies

[147] For example, the vast majority of studies of aid effectiveness, including the present one, rely at least in part on World Bank data, most notably the World Development Indicators.

exhibit complex behavior that cannot be fully explained in terms of their funders' political and economic agendas. Central to understanding this behavior is the relationship between the two component parts of aid effectiveness- impact and responsiveness- and how donors perceive and prioritize these objectives.

CHAPTER 6

Understanding Effectiveness

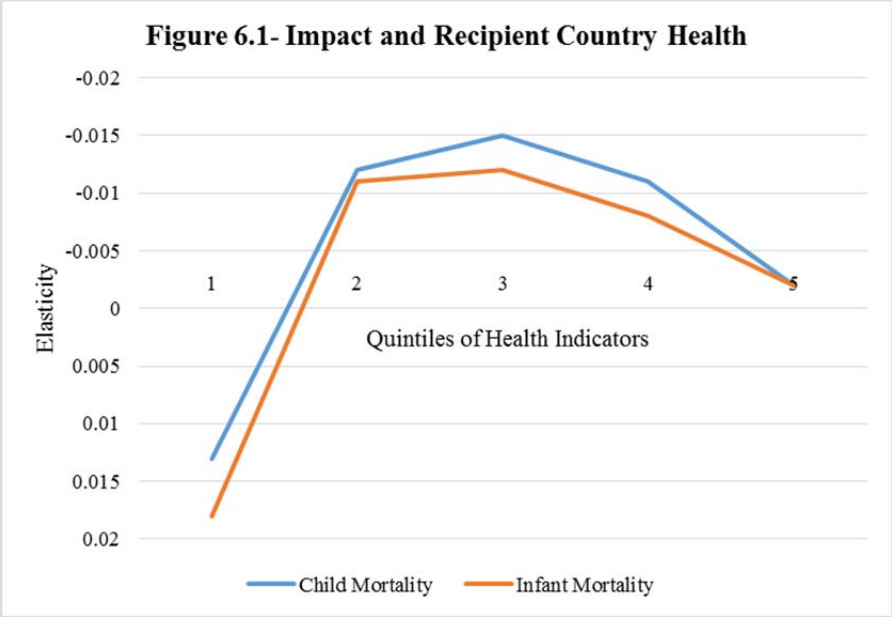
What then can be said about the effectiveness of aid in the WASH sector? The previous chapters have presented evidence that WASH aid, on aggregate, has been both impactful and responsive, but also that both impact and responsiveness have varied across donors, recipients, and time. In this chapter, I present a conceptual model of the relationship between aid impact and responsiveness. Drawing from the findings of each of the previous chapters, I argue that there are certain trade-offs to be made between these two components of effectiveness, and that aid can only be considered to be truly effective when both are addressed. I examine two competing approaches to aid and show why, when applied independently, each fails to promote effectiveness as I have conceptualized it. And I demonstrate how, when applied to recent trends in aid allocation and implementation, my framework provides a model for understanding donor behavior and recipient response. I conclude that WASH aid is indeed becoming more effective, but for very different reasons than have been offered in the past.

Responsiveness and Impact

It has become a mantra of sorts in the aid effectiveness literature that, to be effective, aid should go to where it is most need and where it will do the most good. Statements to this effect are to be found in the Paris Declaration, the Accra Accord, the policy documents of the World Bank and IMF, and throughout the academic literature.[148] The fundamental problem with this goal is that countries that most need aid and countries in which it is likely to have the greatest impact are rarely the same countries. Taken together, the results presented in the previous chapters present a sort of paradox; although WASH aid appears overall to have been both responsive and impactful, it is rarely both at the same time and the same place. Indeed, as Chapters 2 and 3 discuss, the impact of aid is greatest precisely when it is not allocated to those who need it the most. Figures 6.1 below illustrates this point graphically, using the

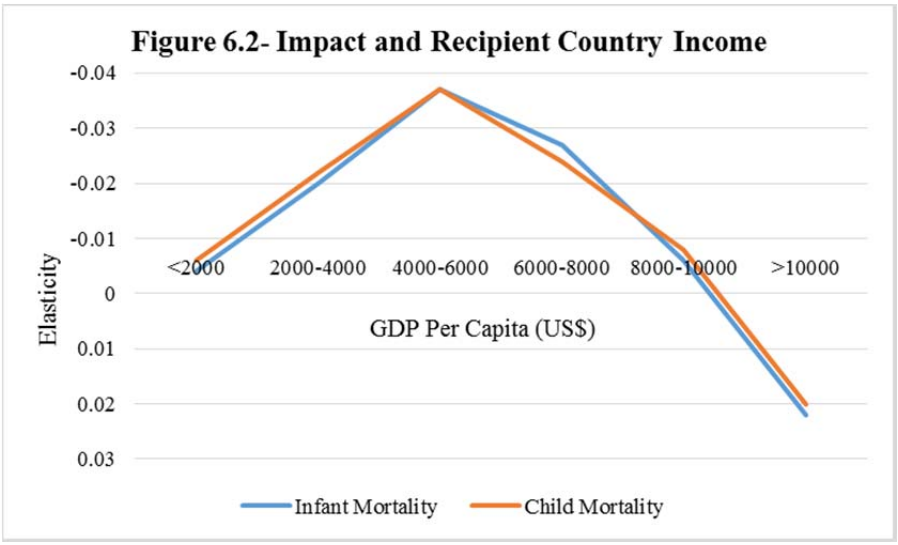
[148] See, for instance OECD (2005), OECD (2008), IMF/World Bank (2005), Easterly (2011), Burnside and Dollar (2000)

dataset described in Chapters 2 and 4. The horizontal axis ranks countries by quintiles according to health indicators, calculated separately within each year of the panel. The vertical axis shows the estimated elasticity of a ten-year moving sum of WASH aid on child and infant mortality for countries in each quintile using the DPM method described in Chapter 2.



Source: Compiled from AidData (2013), World Bank (2013a), Marshall et al. (2011)

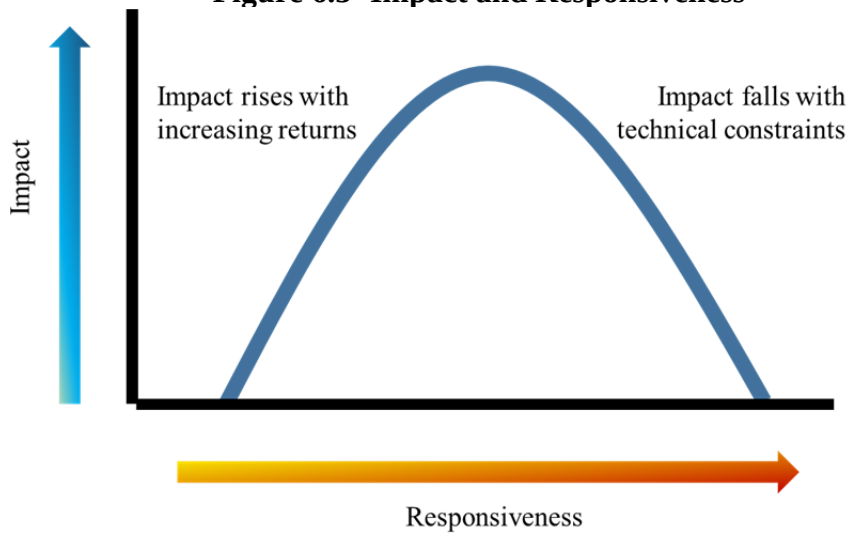
The relationship between the need for WASH aid and its impact follows a parabolic trajectory whereby the estimated elasticity rises and then falls with an increasing mortality rate. This pattern is also evident, unsurprisingly, when countries are grouped according to income level, as shown in Figure 6.2.



Source: Compiled from AidData (2013), World Bank (2013a), Marshall et al. (2011)

Figure 6.3 presents the conceptual model relating impact and responsiveness. The explanation for this relationship depends on (1) the decreasing returns to aid in areas where need is lowest, and (2) the presence of technical constraints on aid impact in areas where need is greatest.

Figure 6.3- Impact and Responsiveness

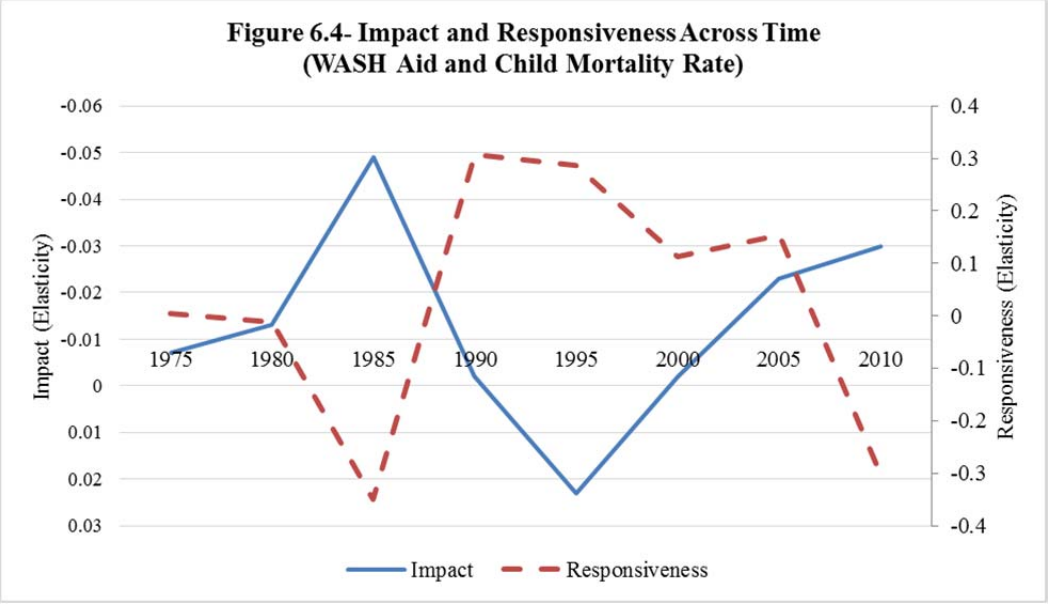


To the first point, the impact of aid, as the results in Chapters 2 and 3 suggest, is asymptotic; as the mortality rate approaches zero, more aid is required to produce the same proportional results as in countries with higher levels. In developed countries, where the child mortality rate is low, generally below ten per one thousand births, the probability of contracting a water-related illness, while not zero, is extremely low; reducing it further requires ever more expensive investments in water quality. The second point is more controversial. There are many potential explanations as to why impact should fall with increasing need. Some observers have pointed to institutional capacity for the absorption and management of aid as the critical prerequisite of aid effectiveness. Others have made the case that political and economic conditions are the crucial limiting factors.

However, my results suggest that the most important constraints on the impact of WASH aid are technical. From a planning and engineering perspective, such a conclusion is hardly surprising. Environmental conditions, such as the availability of renewable freshwater resources, and demographic factors, including the density of the target population, determine the types of interventions that can be pursued and the costs associated with these projects. It is interesting, nonetheless, that the academic

literature on aid effectiveness so often overlooks the technical aspects of aid in its search for political, economic, and institutional explanations. A key point of my framework is that, unlike other models linking effectiveness to exogenous economic and political conditions, the relationship between responsiveness and impact is definitional. High need countries use aid less effectively because they face technical constraints; and the evidence for these constraints is precisely that they have high need. Countries cannot simultaneously exhibit both high need and low constraints, because the presence of constraints necessarily increases need.

Additional evidence for the inverse parabolic relationship between impact and response can be found in a close reading of the history of aid in the WASH sector. In Chapter 2, I showed that aid had the greatest impact in the 1980s, but that this impact declined rapidly in the 1990s. In Chapter 4, I presented evidence that aid was most responsive in the 1990s, and considerably less so in the 1980s. In other words, aid is impactful when it is not responsive and responsive when it is not impactful. Figure 6.4 illustrates this point by showing trends in both responsiveness and impact from 1975 through 2009.[149]



Source: Compiled from AidData (2013), World Bank (2013a), Marshall et al. (2011)

[149] Importantly, the elasticities represented in Figure 6.4 are calculated differently, and are thus not definitionally related. Impact is the estimated effect of a ten-year moving sum of WASH aid received on the child mortality rate, while responsiveness is the estimated effect of child mortality lagged over one year on current WASH aid received. The models also control for a different set of independent variables. For details, see Chapter 2 and Chapter 4.

From these results, a narrative begins to emerge linking the history of foreign aid, as conveyed in the literature and by conventional wisdom, with the model of effectiveness that I have developed here. In the 1980s, it is generally held, aid was largely a geopolitical tool, funneled by the superpowers to 'buy' the loyalty of various governments in what was at the time known as the Third World. Empirical studies have found that nations bordering communist countries during this period were significantly more likely to receive aid from the United States and its allies, regardless of their income level; and it is well established that both the U.S. and the U.S.S.R. transferred massive sums to middle income nations that adopted their respective political and economic philosophies.[150]

Responsiveness to recipient need plays little role in such a system; the neediest of countries were largely ignored in favor of those with more robust economies and stable political systems, for whose allegiance the free market democracies of the West and the socialist states of the East were competing. This has led many observers to conclude that aid in the 1970s and 1980s was a disastrous failure that "obstructed rather than facilitated human development."[151] Indeed many now credit the perceived ineffectiveness of aid during the Cold War as the impetus for the subsequent rise of the aid effectiveness movement.[152]

In stark contrast to this view, my results suggest that WASH aid during the 1980s (and 1970s) had the greatest impact on development of any period.[153] My framework addresses this inconsistency by implying that aid during the Cold War years was impactful precisely because it was ill-targeted. Development assistance flowed to middle income nations for which funding, rather than environmental conditions or technical capacity, was indeed the primary limiting factor for improvement. At a macro-scale, this framework partially explains how, during the 1980s, even as the poorest nations became even

[150] See, for instance, Meernik et al. (1998), Radelet (2006)

[151] Woods (2005): 408

[152] Ibid.

[153] Nor am I the only one to find this; Wilson's (2012) results suggest that aid in the health sector was also more impactful in the 1980s than in subsequent periods, although he dismisses this finding as insignificant.

poorer, many middle income countries emerged from the ruins of the Cold War with empowered populations, stable political systems, and explosively dynamic economies.[154]

With the fall of communism in the early 1990s, a new paradigm emerged. Donors reaffirmed their commitment to development and to the spirit of serving the neediest, exemplified by a series of high-level meeting and declarations in the years immediately thereafter. Among these were such landmark agreements as the 1990 World Declaration on the Survival, Protection and Development of Children; the 1992 Rio Declaration on Environment and Development; the 1993 Vienna Declaration and Program of Action on Human Rights, and the 1994 Cairo Declaration on Population and Development. In response, the proportion of aid going to the poorest countries skyrocketed during this period, as the share going the wealthiest of middle incomes nations declined.[155] Political and economic considerations also took on a more important role in determining which countries were selected to receive assistance; while undemocratic countries received the majority of aid in the 1970s and 1980s, democratic nations took the lead beginning in the early 1990s.[156]

And yet, many point to the 1990s as another example of aid ineffectiveness, largely in terms of good intentions gone awry.[157] Although the neediest countries were now receiving a larger share of aid, aid overall was on the decline, and under increasing scrutiny, as evidenced by a flurry of influential academic and policy papers on the subject of aid effectiveness. By 2000, the paradigm had shifted once again, based on the concept of aid effectiveness and guided by the principle of selectivity. Donor agencies, facing mounting pressure to show results, increasingly tried to target aid to countries where it would have the greatest impact. This emerging model was codified in the principles of the MDGs, the

[154] Among them the so-called Asian Tiger countries of South Korea, Taiwan, Singapore, and Hong Kong, all major recipients of foreign aid during much of the Cold War and all of which experienced unprecedented growth and development throughout the period.

[155] Meernik et al. (1998)

[156] Meernik et al. (1998); much of this effect may be explained by the democratization of the developing world during this period, and particularly among certain leading aid recipients such as Turkey.

[157] See Radelet (2006)

2002 Monterrey Consensus, the 2005 Paris Declaration, and the 2008 Accra Accord, and enabled by an exploding academic literature on the topic.

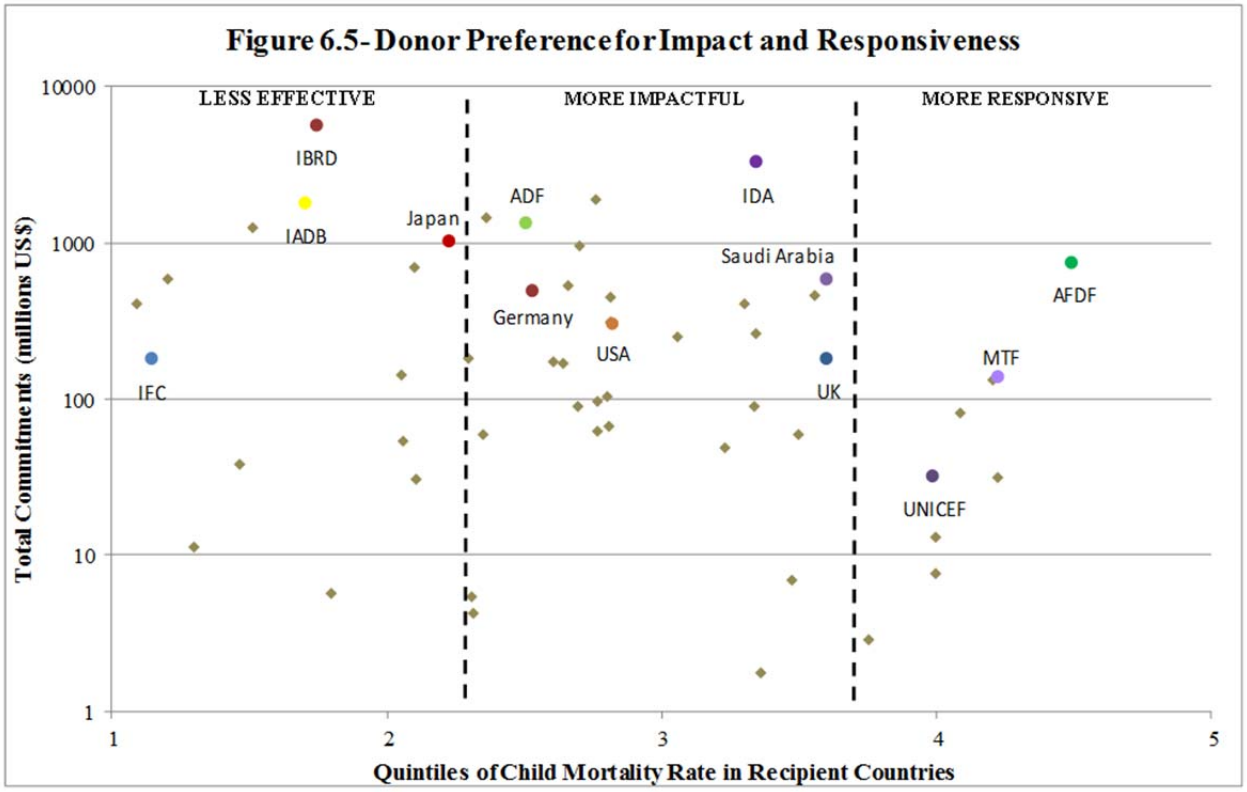
This trend is hardly limited to the WASH sector. Fleck and Kilby, for instance, examine the allocation of bilateral U.S. aid from the end of the Cold War through the current period and find that, beginning in the late 1990s and continuing into the 2000s, the importance of need as a criterion for aid eligibility fell, even as the expected amount of aid received per country continued to increase across all countries.[158] Among those countries that always receive U.S. aid, the weight given to need as a determinant of the amount of aid received has decreased substantially, reversing a decades-long trend of increasing importance of need. Although these authors attribute the shift to the rise during the administration of George W. Bush of new security concerns related to the War on Terror, its precise timing coincides better with the increasing prominence of aid effectiveness considerations. Facing mounting pressure from governments and citizens of developed countries to 'show results,' the overriding prerogative of aid agencies shifted from responsiveness to impact.

Comparing Apples to Apples

By recognizing that there is indeed a tradeoff between responsiveness and impact, my framework allows for a more comprehensive understanding of the behavior of individual donors. Figure 6.5 below charts the relative responsiveness of WASH sector aid from each of 62 individual donor agencies between 2000 and 2009. For each donor, the horizontal axis represents the weighted average of the level of child mortality in each recipient country that received WASH aid from that donor, while the vertical axis shows the value of the donor's total commitments. I have grouped these donors into three broad categories, based on their relative preference for recipients with higher or lower levels of need. Responsive donors tended to favor recipients with relatively high levels of child mortality. Donors in the impactful zone are those that tended to favor recipients with median levels of mortality and where WASH aid is likely to have the greatest impact. A third group of donors tended to favor countries with low mortality rates,

[158] Fleck and Kilby (2010)

where WASH aid is neither responsive nor likely to have the largest impact; it may be the case that these donors have priorities other than aid effectiveness- such as regional preferences, financial considerations or political agendas- that drive allocation decisions.



Source: Compiled from AidData (2013), World Bank (2013a), Marshall et al. (2011)

Broadly, bilateral donors tended to cluster in the impact-driven region, suggesting that these donors prioritize the impact of WASH aid rather than its responsiveness. UN agencies, on the other hand, tended to fall in the needs-driven category. Unsurprisingly, the preferences of the regional development banks depended largely on the prevailing mortality rates among their member countries; the African Development Fund, for instance, is in the need-driven categories, while the Asian Development Fund falls in the impact-driven zone. Among World Bank institutions, IDA appears to have been largely impact-driven, while IBRD and International Finance Corporation (IFC) were neither impact nor needs driven; Bank-managed trust funds (MTF), however, were highly responsive to recipient need. The key point to this exercise is that, for donors in either the responsive or the impactful zones, effectiveness may still be the over-riding goal; where they differ is in how they weight the two components of effectiveness.

Because the impact of WASH aid varies according to recipient country need, donors in each of the three categories should expect to see different levels of results than those in other groups. Rather than comparing the performance of all donors, as is usually the practice, I therefore recommend examining the performance of donors within each broadly defined category. This 'apples-to-apples' approach allows each donor to be evaluated on its own terms, and according to its implicit definition of effectiveness. As a first step, I use AidData's online platform to conduct a search of WASH sector projects by donor. Generally speaking, donors in different categories did indeed tend to fund different types of activities; while more responsive donors favored information-gathering, capacity-building, and small-scale interventions, impact-driven donors preferred large-scale infrastructure projects. Figure 6.6 offers a partial list of project categories according to the type of donor that tended to fund them.

Table 6.1- Impactful and Responsive Project Categories

Impact-Driven Project Activities		Responsive Project Activities	
Activity	Code	Activity	Code
Water supply and sanitation-large systems	14020.01	Water resources policy and administrative management	14010.01
Water desalination plants	14020.02	Water sector polity, planning and programs	14010.02
Sewerage	14020.03	Institution capacity building	14010.03
Intakes, storage, pumping stations, conveyance and distribution systems	14020.04	Water conservation	14015.03
		Prevention of water contamination	14015.04
Domestic and industrial waste water treatment plants	14020.05	Water supply assessments and studies	14020.06
		Water supply and sanitation, low-cost technologies	14030.03
		Small system sewerage	14030.03
Integrated river basin projects	14040.02	Composting and reuse	14050.05
River flow control	14040.03	Water supply and sanitation education/training activities	14081.01
Dams and reservoirs	14040.04	Water research activities	14082.01
Municipal and industrial solid water management	14050.02	Hydrogeology	14082.02
Landfill areas	14050.04		

Source: Adapted from AidData (2013)

Broadly, therefore, impact-driven and responsive donors differ not only in terms of the recipient countries they favor, but also in the type of projects they fund. They also tend to make use of different

modalities, with impact-driven donors presenting funding projects with larger loan components, and responsive donors funding those with larger grant components. And, as Figure 6.5 illustrates, there is a strong relationship between the size of the donor, in terms of its WASH aid portfolio, and its responsiveness to need; among all of the donors that contributed more than US$1 billion for WASH sector project, not one of them fell into the need-driven category as I have defined it.

This points a troubling potential outcome of the international preoccupation with aid effectiveness- that, in an effort to show results, donors may tend to deemphasize the responsiveness component of effectiveness. In the following two sections, I offer some thoughts on two broad and aspirational approaches to foreign aid, one driven by impact, the other by need. I relate each to specific and emerging modalities of aid distribution and implementation, with particular emphasis on their applicability to the WASH sector. I show how each approach raises certain political and ethical implications that tend to undermine their own implicit justification. And, I conclude that, while there is no necessarily 'right' way to balance the competing objectives of impact and responsiveness, the most effective approach to foreign aid is one that if informed by each and beholden to neither.

The Impact-Based Approach

It seems that there is a strong, almost compulsive, desire among aid effectiveness scholars and practitioners to deconstruct development and isolate the underlying factors that cause it. It is, I feel, a vain endeavor. While technical and environmental constraints do appear to be important determinants of aid's impact, I have been unable to find a discernible relationship between impact and the political or economic conditions in countries that receive aid. It may be the case that aid succeeds or fails in different countries and in different periods for vastly different reasons- political, cultural, economic, and environmental. What appear to be 'good' institutions may, in one set of circumstances, increase the impact of aid, while decreasing it in another.

It is well established that eating fast food is a risk factor for developing heart disease, but it would be a fallacy to conclude that everyone who eats fast food will develop heat disease, or that everyone with heart disease eats fast food. And yet, such is the logic underpinning many studies in the aid effectiveness

literature. Many observers use, in place of impact, proxy measures of aid effectiveness to explain the behaviors and motivations of donors. For some, the key variable is democracy; for others it is property rights, economic openness, political stability, or low levels of corruption. Nearly all such studies conclude that, because aid agencies do not appear to allocate aid according to their own chosen metrics, that donors are self-interested and indifferent to the goal of promoting development.[159]

Where all such arguments fall short is in equating good governance with successful implementation, yet another example of putting the cart before the horse. After all, while many studies have indeed found a relationship between various institutional and policy factors and aid impact, as many again, including the current one, have found no evidence for such a relationship. Insomuch as the connection between governance and aid effectiveness is at best tenuous, it seems unlikely that donors, even those with incentive and drive to maximize aid's impact, would base allocation decisions on such a metric. From the point of view of donor agencies and organizations, a much more powerful and tangible predictor of successful aid is past experience. Regardless of the political environment, corruption levels, and economic policy, donors perceive that aid is likely to succeed where it has done so before.

In his study of aid effectiveness in the health sector, Sven Wilson concludes, "[health aid] appears to be *following* success, rather than *causing* it."[160] Based on my own results, I submit that aid in the WASH sector appears to be *both* following success *and* causing it. Donors learn from their past experiences, and adjust accordingly, funding more projects in areas where success has occurred in the past, and thus is more likely to occur in the future. This interpretation is borne out in conversations, my own and in the literature, with aid agency officials, who, despite the econometrician's tendency to reduce them to mechanistic forces, are often as cognizant of their own behavior as any external observer.

[159] See, for instance, Easterly and Williamson (2011), Dollar and Levin (2006), Winters (2010). Some authors go so far as to base the arguments on the premise that donors are inherently disinterested in development and will promote it only to the extent that they are compelled to by their principals; see, for example, Knack and Smets (2012).

[160] Wilson (2011): 1

Dietrich, for instance, quotes one senior German government official as saying, "We always look at corruption and governance but their role is not necessarily critical in making allocation decisions. Most of all, we are interested in trends. If we see positive signals in terms of behavior then we want to intervene more. If there are negative signals then we need to re-evaluate our commitment. We favor spending our foreign aid in countries that show positive trends in spite of weak governance ratings."[161] Another explained, "If we detect a tendency, which is not sufficient to reach our objectives but at least shows movement in the right direction, we want to strengthen it. Consider the water sector: if government makes sure that women and the poor can benefit from newly constructed water wells we look at this as a positive signal and will likely continue our support."[162]

Such remarks, variations of which are commonplace in statements by aid agency officials, suggest that the key factor by which donors assess the likelihood of future success is not economic or political policy, but past performance. This principle is evident also in the donor agency policies; among the many agencies that have instituted explicitly performance-based allocation systems in recent years are the United Kingdom's Department for International Development (DfID), the International Fund for Agricultural Development (IFAD), ADB, the Caribbean Development Bank (CDB), and the Global Environmental Facility (GEF), as well as both the IBRD and IDA.[163] And there are signs that such practices are likely to become even more widespread.

One emerging modality of aid delivery that overtly embraces the impact-driven approach is so-called Cash On Delivery (COD) aid. This strategy adopts the principle, common in the private sector and, increasingly, in such domestic regulatory schemes as the United States' No Child Left Behind program, that the continuation of funding should be directly contingent on performance. As Tina Rosenberg of *The*

[161] Dietrich (2011): 56

[162] Ibid: 57

[163] Hicks et al. (2008)

New York Times succinctly describes it, "instead of rich countries paying for all the little pieces that go *into* a poor country's program, they pay only when something good comes *out*."[164]

Unlike traditional methods of monitoring and evaluation, which assess projects on the basis of inputs and outputs, COD aid focuses instead on outcomes. For instance, a project seeking to expand access to municipal drinking water would be judged not by the amount of money disbursed, or by the number of household connections installed, but by its impact on macro-level indicators, such as the proportion of the national population with access to clean water. Project funding would only continue as long as progress towards certain benchmarks was achieved.[165]

The explicit aim of COD aid, and of the impact-based approach more generally, is that aid should go to those regions, countries, and communities where it will have the greatest impact. The flip side to this argument, which is often left unspoken, is that aid should not go to places where its impact is likely to be smaller. The guiding principle of this approach is therefore efficiency, getting the most 'bang for the buck' in terms of expanded access, reduced mortality, and improved overall health. On its face, it is politically neutral, requiring only that aid flows to those places where it will do the most good, regardless of donor self-interest or notions of favoritism. This is an especially appealing argument in the WASH sector, where the ultimate objective is saving lives, a seemingly unassailable choice of common denominator by which to compare outcomes.

Yet, a constructivist reading reveals the underlying political basis of this apparently straightforward approach. Goals, benchmarks, and indicators, the concepts by which aid agencies justify their activities under the impact-based approach, are not created in a vacuum. They are, rather, set by organizations, which are in turn staffed by human beings, not one of whom is without his own personal set of preferences, opinions, preferences, and ambitions. Which outcomes are chosen as important and

[164] Rosenburg (2010)

[165] Birdsall and Savedoff (2010)

how they are measured matter because they ultimately determine which countries and communities do and do not receive aid.

An example can perhaps illustrate the point. Suppose a hypothetical donor agency finds itself with a budget surplus of some $10 million, with which it wishes undertake a drinking water supply and sanitation project in a developing country. Suppose further that the agency faces the choice between operating in the Philippines, a middle income country with a favorable environment and where aid is thought to be relatively impactful, and Malawi, a low-income nation facing numerous environmental constraints and where many development projects fail. Drawing from the results reported above, assume that the predicted impact elasticity in the Philippines, with a per capita GDP of around $2368, is approximately -0.03, while in Malawi, where per capita GDP is only $380, it is only about -0.01. To which country does the agency send its aid? Under the impact-based approach, the obvious choice seems to be the Philippines, where the elasticity of impact is three times that of Malawi. However, the impact in each country depends entirely on how one decides to measure it.

In the Philippines, with a population of approximately 95 million, a $10 million project would amount to approximately $0.11 per capita in new WASH aid, an increase of about 15 percent over the current annual average of around $0.75 per capita. By contrast, the same project would increase per capita WASH aid by $0.67 per capita in Malawi, an increase of a full 50 percent from its average of $1.35 for each of its 15 million citizens. If impact is defined in terms of increasing per capita aid, then Malawi is now the better choice.

Using estimated elasticity, the agency might then predict that the child mortality rate in Philippines would decline by about 0.5 percent, but only by about 0.25 percent in Malawi. Thus, if the target is a proportional decrease in the mortality rate, then the Philippines is the better investment. Because the mortality rate in Malawi is initially much higher than in the Philippines, however, any proportional decrease will be larger in the former than in the latter; in fact, on average the agency might estimate that the project would save as many as 25 lives per 100,000 in the Malawi, compared with only 5

in the Philippines. Thus, if impact is defined as a direct reduction of the mortality rate, Malawi is the better option.

Yet the story does not end here. Because the population of the Philippines is more than four time that of Malawi, this decrease in mortality corresponds to an expected 4275 child deaths averted per year, as opposed to 2339 in Malawi. From a utilitarian perspective, therefore, the Philippines is again the better choice. And the Philippines also wins out in terms of cost efficiency. Assuming the benefits from any completed project are measurable for 10 years (a pessimistic assumption), this amounts to some $267 per life in Malawi, compared to only $234 in the Philippines.[166]

This then is the fundamental paradox of the impact-based framework for aid allocation: although it is supposedly driven by politically blind and objective notions of efficiency, the fulfillment of this approach relies inevitably on a series of discrete, consequential, and political decisions. The MDGs offer a case in point; as Easterly describes in a 2009 working paper, these targets are expressed, whether by accident or design, in such a way as to make attainment disproportionally difficult for African countries. With regard to child mortality rates, the key indicator used in this paper and the subject of MDG 4, the choice of a proportional measure makes reaching the objective of a two-thirds reduction in child mortality more difficult to achieve for countries with high initial rates. As he explains:

> Although there is relative divergence of child mortality rates, there is *absolute* convergence of these same rates…It all depends on how you state the goal- a goal of proportional reduction is more likely to be met by initially low mortality countries, while a goal of absolute reduction in the child mortality rate would be more likely to be met in the initially high mortality countries. Since the goal was stated in proportional terms and Africa was the highest mortality region, the goal as stated was less likely to be met in Africa.[167]

The same process is at work in Goal 7, which calls for a reduction by half of the proportion of the population without access to clean water. In this case, the choice of a reduction by a proportional amount

[166] These estimates are provided as an illustration only and by no means represent an accurate portrait of the costs associated with averting water-related deaths. As I will discuss, because these are national rather than local indicators, the actual costs are likely much smaller.

[167] Easterly (2009): 16

of a negative indicator makes attainment more difficult for countries with initially poor levels of access. Had this target been expressed in terms of the proportion of the population with access, rather than without, then Africa would appear to be converging with the rest of the world, rather than diverging.[168]

There is no readily apparent justification as to why these MDGs, as well as a number of others that also tend to under represent progress in Africa, were expressed in such a way. Easterly speculates that, if it was intentional, the design may have been "motivated by the desire to draw more attention to Africa, raise more foreign aid resources, and spur other actions to solve Africa's problems."[169] If so, then this was an unfortunate ploy. My framework suggests that, because they are under strong and increasing pressure to show success, donors face incentives that lead them to avoid countries in which success is less likely to be achieved. That, in the wake of the release of the MDGs, WASH aid has become significantly less responsive to need may be evidence of this phenomenon. It would indeed be a tragic irony if, in spite of the remarkable progress that is being made in African countries, the very goals that were designed to increase their share of WASH aid should be culpable in scaring it away.

The Responsive Approach

The alternative extreme scenario to the impact-based approach is one that is wholly responsive, in which the levels of aid a country receives is based solely on its objective need. In the analysis presented in Chapter 4, I find that, overall, donors are indeed sensitive to the level of need in recipient countries; however, this responsiveness varies considerably over time and across donors. In the current period, the majority of bilateral donors appear to be driven more by impact than by need, whereas UN agencies and certain multilateral donors tend to be more responsive. Unsurprisingly, many of these most responsive donors, including the African Development Bank (AFDB) and the Arab Bank for Economic Development in Africa (ABEDA), are those that work primarily or exclusively in African countries, where need is the highest of any region.

---

[168] Ibid.

[169] Ibid: 20

If the impact-driven approach is based on the logic of efficiency, then the responsive approach is based on equality; all countries have an equal claim to aid, according only to their need for it. However, the constructivist argument against the impact-based approach cuts both ways and need, like impact, depends largely on how it is defined and measured. The MDGs do so in terms of access to improved sources of water and improved sanitation facilities; yet herein again there lie issues of semantics, for even the JMP definitions of improved sanitation and improved water source are inevitably arbitrary. The literature contains relatively little regarding the risk associated with the use of various sanitation facilities and sources of drinking water, most likely because the relationship between source and risk depends largely on a host of context specific environmental, technical, and behavioral conditions. While it is well established that certain sources of drinking water and sanitary facilities are generally better than others, the relative risk associated with each is often a function of circumstance.

In recognition of these complexities, the JMP now recommends a 'ladder' model for drinking water and sanitation in which different sources are conceptualized as rungs on a ladder. In the case of drinking water, the bottom rung consists of unimproved sources such as surface water, unprotected wells and springs, and tanker truck water; the second rung includes public taps and standpipes, tube wells and boreholes, rainwater collection, and protected springs and dug wells; and the third and highest rung comprises piped water. The sanitation ladder comprises open defecation at the bottom, followed by traditional latrines, improved latrines, and flush toilets. While still overly general, this model does offer an improvement over the traditional improved and unimproved definitions. For the purposes of setting and benchmarking targets, however, the latter remains the dominant paradigm, with troubling implications. As the Morella et al. explain with regard to sanitation:

> The Joint Monitoring Program counts the top two rungs of the ladder as improved sanitation for purposes of measuring progress toward the MDG target. But, in practice, drawing a line between improved and unimproved forms of sanitation is not easy, owing to the wide variety of installations bundled together under these basic labels. Classification of traditional latrines is particularly difficult. A key issue is the extent to which a traditional latrine can or, with some modification, could provide improved sanitary protection. In addition, the boundary between traditional and improved latrines is

> somewhat porous, because the extent to which latrines deliver the intended health benefits depends on the way they are used.[170]

The categorization of latrines is a particularly important issue in Sub-Saharan Africa, where they are, according to some estimates, the primary sanitation facility for more than 60 percent of the population.[171] The decision of which types of latrine fall on which side of the improved/unimproved divide can, therefore, drastically affect community, national, and regional statistics, and the perceived need for intervention. Because there is no hard and fast rule as to what constitutes an improved versus unimproved latrine, it often falls to individuals, households, and communities to self-identify their sanitation facilities, which leads to a great deal of variation in how these indicators are assessed and, ultimately, which areas appear more or less deserving of aid.

Of course, access is an instrumental objective; the underlying goal is the reduction of the water-related disease burden. In previous chapters, I have conceptualized need in terms of mortality rates, particularly the child mortality rate, but even this seemingly straightforward indicator is subject to a great deal of interpretation. As a proportional measure, the mortality rate does not say anything about the absolute level of need in a country or community; and, while it is generally thought to be a fairly reliable measure, the completeness and accuracy of mortality data still varies widely across regions. More importantly, however, the allocation of aid on the basis of the child mortality rate raises ethical implications because it inevitably involves the implicit valuation of human lives.

Consider the case of the hypothetical donor agency discussed in the previous section. Under the responsive approach, the obvious choice of beneficiary is Malawi, which has a much higher child mortality rate, a much lower rate of access to improved drinking water and sanitation, and widespread water scarcity. On its face, this appears to be a justifiable choice; from an equity standpoint, those with the least ought to receive more. However, our agency now must defend its decision to spend some 10 percent more money per life saved than would have been spent in the Philippines. The implicit message

[170] Morella et al. (2008): iv

[171] Morella et al. (2008)

is that Malawian children are worth spending more money on than are Filipino children and that they are therefore more valuable. This then is the fundamental paradox of the responsive approach: although premised on a principle of equality, this framework leads inevitably to the implicit valuation of human lives such that some are more equal than others.

Human rights present a special case of the responsive approach, and one which is of increasing relevance to the provision of water and sanitation. A number of prominent WASH aid donors have embraced a rights-based approach to aid allocation, most notably the UNDP and the UK-based NGO WaterAid. These donors embrace a strategy based on empowering individuals and communities to exercise their right to clean water and demand its fulfillment from the state, the entity with primary responsibility for the preservation of human rights. The recognition of human rights confers three general obligations for aid donors- to respect, protect, and fulfill. In the WASH sector this implies that aid projects should be designed, allocated, and implemented in ways that (1) do not infringe upon the rights of recipient communities to clean water and adequate sanitation, (2) provide incentives to recipient country governments to protect these rights for their people, and (3) increase the capacity of governments, communities, and individuals to ensure that the rights of all people are met.[172]

The key characteristic of the rights-based approach differentiating it from a strictly responsive approach is thus that it recognizes the role of politics in determining the distribution and management of water resources. In many cases, say advocates of the rights-based approach, individuals and communities are disproportionately, and indeed systematically, denied access to basic drinking water and sanitation facilities on the basis of personal or cultural characteristics such as poverty, race, ethnicity, gender, and religion. This implies a degree of agency, in the form of intentional or inadvertent discrimination, on the part of governments and development institutions alike, in creating or exacerbating inequalities in access to water and sanitation. An example, cited by the UN special rapporteur on water and sanitation, is that of traditionally nomadic minorities, such as the Roma people in Eastern Europe. These individuals, she

[172] See Marchoione and Messer. (2010)

argues, are often not provided with access to public showers or drinking fountains, with both makes them more vulnerable to water-related disease and may lead to stigmatization, which in turn undermines their ability to exercise other basic human rights.[173]

As intuitively appealing as it seems, however, a rights-based approach falls victim to the ambiguity of definitions and assumptions that plague the impact-driven and purely responsive approaches to aid allocation. To the extent that they are sensitive to human rights, donors may respond in one of two ways; they may tend to favor communities where rights have been violated, with the goal of empowering them to demand redress or they may discriminate against countries with a record of violations, in order to create incentives for better behavior. In either case, the fundamental question driving donor behavior involves how rights are defined and when they are perceived to have been violated.

The most commonly cited explanations of a human right to water discuss it in terms of some volume amount of water, such as 20 liters per capita per day (lpcd) recommended by USAID, WHO and the World Bank.[174] Peter Gleick recommends "a basic water requirement of 25 lpcd to meet the most basic of human needs with an additional 15 lpcd for bathing and 10 lpcd for cooking." As he later acknowledges, however, water quantity is a fairly worthless metric in the absence of some measure of quality. Indeed, for the vast majority of people affected by water-related diseases, it is the poor quality of their water, not its quantity, which poses a threat to their health and wellbeing. Yet, very little in the literature has offered much in the way of a standard for water quality, presumably because quality is a much more difficult indicator than quantity to assess.

Does a human right to water then guarantee a right to a certain purity of water in a certain quantity such that the probability of mortality due to water-related disease does not exceed some prescribed threshold? Does this then apply to all classes of water-related diseases, or only to the water-borne, water-based, or water-washed varieties? Or is it rather that they have a human right not to be exposed to water-borne or water-based pathogens at all, a technologically impossible proposition? Or is it

[173] UN (2012b)

[174] Gleick (1998): 496

a right not to live in a community in which the mortality (or child mortality, or infant mortality) rate due to water-related disease is lower than some rate, based perhaps on the prevailing rate in countries perceived not to be in violation of the human right to water, at which point the reasoning becomes fully circular? Gleick contends that, "the specific number is less important than the principle of setting a goal and implementing actions to reach that goal;" in other words, we must set objectives in order that we may meet them.[175] In this view, the choice of indicators and the method by which they are measured are incidental. I argue, at the risk of appearing repetitive, that the choice of targets and how they are measured are extremely important considerations, because they determine which projects get funded, who receives the benefits, and who loses out.

A second, and no less troubling, problem with the rights-based approach is that it tends to deemphasize the very real and often overwhelming technical obstacles to the provision of drinking water and sanitation. In the example of traditionally itinerant communities cited above, for instance, it seems clear that, from a technical standpoint, it would be easier for water planners and managers to reach such communities if they adopted permanent residences that could be connected to water infrastructure. Yet, to require them to do so would present a potential violation of their human right to cultural identity.[176] Further, as I show in Chapter 2, countries with naturally low levels of freshwater availability face particular technical challenges to the provision drinking water and sanitation. To hold governments to identical standards in the face of widely disparate environmental and technical constraints thus undermines the very principle of equality on which the responsive approach is built.

A final consideration is the role of risk. The framing of goals in terms of observable objectives- the use of improved facilities, the availability of water, and the like- overlook the underlying purpose of WASH aid, which is to reduce the disease burden from water-related diseases. Disease, as a biological phenomenon, is best understood in terms of risk, as is typically the case in the fields of environmental

[175] Ibid: 496

[176] The construction of reservoirs has historically been a contentious issue for similar reasons; although its purpose may be to meet the human right of some to clean water, it fulfillment requires violating the rights of others through forced relocation.

health and epidemiology. But risk is a tricky concept, couched as it is in the dual languages of probability and uncertainty, and one not well suited to the absolutes of a justice-based policy framework.

As I discussed in Chapter 5, scientists typically conceptualize risk as a function of both hazard and exposure. In the case of water-related diseases, certain factors, such as drinking water with low levels of potentially harmful pathogens, can decrease risk by limiting exposure. Others factors, such as access to antibiotic medications, reduce risk by decreasing hazard, in this case the potential negative effects of getting sick. As the case of the Philippines demonstrates, however, quantifying the risk from microbial contamination of water is a significantly more difficult exercise than estimating the risk from toxic or carcinogenic materials for, unlike these contaminants, pathogens reproduce, such that an even single organism has the ability to cause infection, morbidity, and death. Thus, there is no clear, linear relationship between exposure and risk, and equating the two, as the rights-based approach implicitly does, flies in the face of scientific realities.

By its nature, the human rights approach requires setting standards above which conditions are considered adequate, indeed 'righteous,' and below which they are abominable, intolerable, and an affront to human dignity. Yet, setting this standard is inevitably an arbitrary exercise. All human beings, regardless of income level, are exposed at some point to some level of risk from water-related disease. Calculating this risk is a possible, albeit difficult, scientific undertaking; but setting the limit at which the human right to water has been violated is not. Discussions of human rights tend to steer clear of scientific uncertainties, and for obvious reasons. The claim that 'all people have the inalienable right to clean water' loses its authoritative ring when it is expressed, for example, as 'all people have the inalienable right to between 20 and 50 liters per day, depending on their intended uses, biological and cultural needs, and within the constraints imposed by their specific environmental conditions, of certain purity such that they are exposed to no more than a ten in one thousand probability of contracting one of several potentially fatal pathogens, as calculated among the most vulnerable age groups within their community.' The paradox of the rights-based approach is thus that, although it portends to proclaim standards that are,

in theory, universal, immutable, and self-evident, when applied in practice, these standards necessarily become ambiguous, fluid, and socially-constructed.

Amartya Sen, presents an elegant solution to this paradox by conceptualizing rights not in terms of numbers, but in terms of capabilities and functionings.[177] Referring to the human right to food, he argues that, "capability concentrates on the *opportunity* to be able to have combinations of functionings (including, in this case, the opportunity to be well-nourished), and the person is free to make use of this opportunity or not. A capability reflects the alternative combinations of functionings from which the person can choose on combination." In this sense, the right to water might be conceptualized as the ability of people to participate in water resource planning, development, and management decisions. Few, I think, would find cause to disagree with this sentiment, but capacity, even more than those other metrics described above, is impossible to quantify. This leaves donors once again defining the terms by which need is measured and, by extension, how to respond to it.

Despite its claims of universality and fairness, therefore, the responsive approach, like the impact-based approach, inevitably reduces to a subjective strategy by which donors allocate aid according to their own internal definition of effectiveness. Ultimately, whether aid is driven by donor self-interest or a sincere desire to promote development is therefore a question that no amount of quantitative analysis can answer. Fortunately, however, the socially constructed nature of aid effectiveness is not evidence of its nonexistence, but only of its incommensurability. That progress cannot be proven does not mean that aid has failed, only that its success is largely in the eye of the beholder.

Concluding Remarks: First Things First

This paper has, I believe, challenged prevailing notions of aid effectiveness on several important grounds. In this chapter, I have argued that effectiveness can be conceptualized as the joint function of impact and responsiveness, and that there are important and definitive tradeoffs between these two components. The preceding sections have demonstrated that there is no necessarily 'right' way to balance

[177] Sen (2005): 154

the competing goals of impact and responsiveness, and that different donor agencies have pursued different strategies for doing so. Some donors appear to follow a model that seeks to maximize impact, largely by allocating funds to countries and communities where projects have been successful in the past. Others place greater emphasis on responsiveness, and work in those areas where need is greatest, but success least likely. On aggregate, however, I find WASH sector aid to have been both impactful and responsive, thus passing the test for effectiveness as I have defined it.

My results and conclusions also challenge the prevailing notion of the role of political and economic institutions in determining aid effectiveness. There is growing call within the academic and technical literature to 'bring politics back in' to the study of aid effectiveness.[178] It has been widely argued that conditions such as authoritarianism, instability, and high levels of corruption are detrimental to aid's impact, and the behavior of some donors appears to reflect this consensus. I find no discernible relationship between impact and democracy, corruption control, rule of law, economic openness, or any of the other panaceas that have been offered up as the missing catalyst for aid effectiveness. My results suggest that technical and environmental, rather than political or economic, constraints are the primary limiting factor for increasing the impact that WASH aid can have. In light of this, I believe there is a strong argument to 'take politics back out' and refocus the energies of the development community on enhancing the ability of development projects to overcome the environmental and technical obstacles that hinder them.

In addition, this study offers some insight into recent trends in aid effectiveness. While some may claim that the declining responsiveness of foreign aid since 2000 is proof that aid is becoming less effective, others may point to declining impact as evidence of the same. Under the framework model presented in this chapter, however, the very fact that aid is both less responsive and less impactful than in previous periods may be a sign of success. Insomuch as effectiveness can be defined as a function of both

[178] See Boone (2010)

responsiveness and impact, it follows that the most effective foreign aid regime is one which jointly maximizes impact and responsiveness, rather than emphasizing one at the expense of the other.

Since 2000, aid does indeed appear to be less responsive than aid in the 1990s, and less impactful than aid in the 1980s; at the same time, however, it is more impactful than aid in the 1990s, and more responsive than aid in the 1980s. Whether this is a sign of concerted effort on the part of the international community, or simply a symptom of the historical pendulum swing between impact and responsiveness remains to be seen; however, I believe there are hopeful signs that it is the former. Taken together, the case studies presented in Chapters 3 and 5 conclude that aid in the current period can be shown to be both impactful in a high-need country, and responsive in a lower-need country, suggesting further that the donor agencies are succeeding in achieving a workable balance between the two components of aid effectiveness.

Finally, there are no doubt those who will interpret my results as a statistically significant, but numerically meaningless relationship between aid and development. Aid may be effective, but its impact is miniscule, a veritable drop in the bucket against the surging tide of water-related illness and death. Indeed, at first glance, the estimated elasticity of WASH aid to mortality does appear small, generally on the order of 1 to 5 hundredths of a percent. It should be recalled, however, that the impact is one of local projects on national health statistics. Although I have described aid largely in terms of dollars per capita across the entire population, the actual impacts are much less diffuse and much more impressive.

The National Water Development Project in Malawi serves as an example of this concept. According to the completion report, this project intended to reach some 1.5 million people, or approximately 15 percent of Malawi's population at the time. With a total project budget of approximately $100 million (in 2009 U.S. dollars), an elasticity of 0.01 would imply a mere 1.44 percent decrease in the national child mortality rate. Because only 15 percent of the total population benefited, however, this constitutes an approximately 10 percent decrease in the child mortality rate *among the target population*. Assuming an under-five population of approximately 30 percent and an initial child mortality rate of 200 per 1000, this decrease is equivalent to some 10,000 averted child deaths per year.

Further, because the benefits of WASH aid are cumulative, this intervention not only provides a foundation on which futures projects may build, but, according to my framework of aid effectiveness, actually magnifies their expected impact.

Whether the initial investment is worth the lives of so many is not a question that can be quantitatively answered. Employing the crude and callus calculus of economic valuation, it is theoretically possible to monetize the average contribution of each life to GDP and thence to perform a cost-benefit analysis to determine whether intervention is indeed worthwhile, but such is a road I do not wish to travel. I maintain, as I have throughout this paper, that the preservation of life is a primary and self-evident rationale for development assistance, regardless of any ancillary impact on economic growth. And, while it is true that my analysis is limited to the WASH sector, I have premised my arguments on the proposition that this sector is not only a proxy for aid more generally, but is itself an independently sufficient measure of development and of the initiatives that promote it.

I do not pretend that the results and reasoning presented above are sufficiently earth-shattering to change anyone's opinion regarding the utility of aid in the WASH or any other sector. Even were the evidence for its efficacy overwhelming, however, there are those who will remain forever skeptical of aid as a tool for development. Broadly, I place these critics in one of two camps. The first comprises those who denounce aid on principle for fostering or supporting corrupt and authoritarian regimes; I count also among these those who argue that aid should never be allocated to countries with such governments, even those in which it is demonstrably effective. The second group is, in some ways, the philosophical counterpoint to the first. It includes those who contend that aid is inevitably a tool of donor agencies and their principals to impose their own economic and political agendas and is therefore by its nature an oppressive force that ought to be abolished.

In response to these arguments, I return finally to the quote with which this paper opened- the often repeated final line of W.H. Auden's poem "First Things First." Thousands have indeed lived without love, as well as without freedom, without wealth, and without dignity. Billions more continue to do so. This is a tragedy, and one which demands remedying. And yet, for one to enjoy these things in

life, one must first live. Accordingly, to the extent that WASH aid is indeed effective, the inevitable conclusion is that there ought to be more of it. In particular, there is a need for a renewed emphasis on responsiveness, in order to begin to address the challenges of the neediest countries and communities. This will require some courage on the part of donors in the face of growing demands for demonstrable results; however, as the previous sections have shown, much might be accomplished toward this end simply by revisiting the way in which targets and benchmarks are defined and measured.

Given the unique characteristics of the WASH sector, the argument for increased funding becomes not only a logical conclusion, but a moral imperative. As I have discussed throughout this paper, the primary beneficiaries of WASH aid are children, who are most vulnerable to water-related disease of all categories. This distinction makes WASH aid different from other sectors, and subject to a different set of rules, because children themselves are different- biologically, mentally, and certainly politically. It is for this reason that children are not generally permitted to vote, to hold public office, to sign legal contracts, or determine their own medical, financial, or educational priorities. Such is also the justification for interventions when the welfare of children is perceived to be at risk. In countries such as the United States, children in abusive households are removed, indigent parents are provided with subsidies, and all children, with very limited exceptions, are required to receive health care and a basic level of schooling.

Throughout human history and across all cultures, the welfare of children has demanded a degree of consideration beyond that afforded to adults. The desire to protect one's children, and indeed all children, is as much instinctual as it is cultural, and extends well beyond the human species. It is this primeval drive to care for the next generation that calls societies to intercede in the rearing of children in a host of what would otherwise be considered violations of personal liberty were not the beneficiaries of a certain age. There is a universal, if often unspoken, recognition that the wellbeing of children does not stop with the immediate family, but is rather the purview of society as a whole.

Why then should this responsibility stop at international borders? The governments of developing countries, democratic or otherwise, are accountable to their citizens to widely varying degrees.

Even among wealthy democracies, the extent to which people are able to exercise political voice varies considerably according to class, race, gender, and religious affiliation. What all governments have in common, however, is that not one of them is directly accountable to children.[179]

If WASH aid works, and I argue that the evidence suggests it does, then it is because it saves the lives of children. The denial of such aid, whether to encourage political change in corrupt, authoritarian, or otherwise undesirable governments, or to preserve the political and economic autonomy of states or local communities, is therefore both cruel and ineffectual. Cruel, because it harms the most vulnerable and powerless segments of the population; and ineffectual because intended beneficiaries are not political actors with either the power to bring about political change or the agency to meaningfully participate in local or national self-determination.

This criticism applies equally to donors and recipients. A donor that uses the denial, or threat of denial, of (effective) WASH aid to reach political ends, holds the welfare of children hostage. By the same token, a recipient, whether a state or a community, that refuses (effective) WASH aid to promote its own political or economic agenda fails in its central responsibility as a governing authority to protect children. The remaining argument, that children may be better off dying than living in an oppressive state, or in one controlled by external actors through economic dependence, is one which bears only this refutation- that it is not our decision to make.

By way of conclusion, therefore, I submit that foreign aid for water and sanitation has been, and continues to be, much more than just a drop in the bucket. On aggregate, WASH aid has both responded to recipient need and demonstrated a measurable impact, thus passing the test of effectiveness that I set forth at the beginning of this paper. Both responsiveness and impact can be shown at the local as well as the global level, and in both past and present periods. This is not to say that every WASH project is effective, and substantial additional research is required in order to evaluate the performance of individual

[179] In some instances, children and, to a greater extent, youth may be involved to greater or lesser degrees in politics (such as through national Youth Parliaments), but few would argue that they are political actors in any real sense of the phrase, particularly those under five-years of age. See Wyness (2001).

donors and their recipient partners. If WASH aid has worked in the past, however, there is reason to believe that it can continue to work in the future, bringing health and hope to millions one drop at a time.

APPENDIX A

Global Dataset Description

Table A1- Description of Indicators Used to Construct Global Dataset				
Indicator	Description	Units	Transformation	Source
WASH Aid	Total value of aid committed to water supply and sanitation activities	Constant (2009) U.S. dollars	Divided by current population	Aid Data (2012) http://www.aiddata.org/content/index/data-search
Child Mortality Rate	Mortality rate for children under five years of age in each county-year	Deaths per 1000 live births	None	World Bank (2012) http://data.worldbank.org/indicator/SH.DYN.MORT
Infant Mortality Rate	Mortality rate for children under one year of age in each country-year	Deaths per 1000 live births	None	World Bank (2012) http://data.worldbank.org/indicator/SP.DYN.IMRT.IN
Life Expectancy at Birth	Average age of death in each country-year	Years	None	World Bank (2012) http://data.worldbank.org/indicator/SP.DYN.LE00.IN
Gross Domestic Product	Calculated for each country-year	Current U.S. dollars	Adjusted to constant (2009) U.S. dollars and divided by current population	World Bank (2012) http://data.worldbank.org/indicator/NY.GDP.PCAP.CD
Imports	Total value of imports in each country-year	Percentage of GDP	Added to exports to calculate Foreign Trade variable	World Bank (2012) http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS
Exports	Total value of exports in each county-year	Percentage of GDP	Added to Imports to calculate Foreign Trade variable	World Bank (2012) http://data.worldbank.org/indicator/NE.IMP.GNFS.ZS
Foreign Direct Investment	Net inflows of investment from foreign investors	Current U.S. dollars	Adjusted to constant (2009) dollars and divided by GDP	World Bank (2012) http://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD
Official Development Assistance	Net value of grants and concessional loans received in each county-year	Current U.S. dollars per capita	Adjusted to constant (2009) dollars	World Bank (2012) http://data.worldbank.org/indicator/DT.ODA.ODAT.PC.ZS
Rural Population	Population in rural areas as	Percentage of total	None	World Bank Development Indicators

	defined by national statistics offices	current population		http://data.worldbank.org/indicator/SP.RUR.TOTL.ZS
Improved Water Source (Rural)	Proportion of population in rural areas with access to an improved source of drinking water	Percentage of total current rural population	Averaged with Improved Water Source (Urban) to calculate Improved Water Access variable	World Bank (2012) http://data.worldbank.org/indicator/SH.H2O.SAFE.RU.ZS
Improved Water Source (Urban)	Proportion of population in urban areas with access to an improved source of drinking water	Percentage of total current urban population	Averaged with Improved Water Source (Rural) to calculate Improved Water Access variable	World Bank (2012) http://data.worldbank.org/indicator/SH.H2O.SAFE.UR.ZS
Freshwater Resources	Annual renewable freshwater resources by country	Billions of cubic meters	Divided by current population to calculate Water Availability variable	World Bank (2012) http://data.worldbank.org/indicator/ER.H2O.INTR.PC
Polity IV Index	Governing regimes scored as relatively democratic or autocratic	-10 to 10 scale	None	Marshall et al. (2011) http://www.systemicpeace.org/inscr/inscr.htm
Political Stability	Governing regimes scored according to perceived political stability	Approx. -2.5 to 2.5	None	World Bank (2012b) http://info.worldbank.org/governance/wgi/index.asp
Government Effectiveness	Governing regimes scored according to perceived government effectiveness	Approx. -2.5 to 2.5	None	World Bank (2012b) http://info.worldbank.org/governance/wgi/index.asp
Corruption Control	Governing regimes scored according to percieved efforts at controlling corruption	Approx. -2.5 to 2.5	None	World Bank (2012b) http://info.worldbank.org/governance/wgi/index.asp

Table A2- Countries Included in Global Dataset			
Country	Years Included	Country	Years Included
Afghanistan	1960-2009	Laos	1984-2009
Angola	1985-2009	Latvia	1987-2009
Albania	1984-2009	Lebanon	1988-2009
Algeria	1960-2009	Lesotho	1960-2009
Argentina	1962-2009	Liberia	1960-2009
Armenia	1990-2009	Libya	1990-2009
Azerbaijan	1990-2009	Lithuania	1990-2009
Burundi	1960-2009	Macedonia	1990-2009
Benin	1960-2009	Madagascar	1960-2009
Burkina Faso	1960-2009	Malawi	1960-2009
Bangladesh	1960-2009	Malaysia	1960-2009
Bulgaria	1980-2009	Mali	1966-2009
Bahrain	1986-2009	Mauritania	1960-2009
Bosnia and Herzegovina	1994-2009	Mauritius	1976-2009
Belarus	1990-2009	Mexico	1960-2009
Belize	1960-2009	Moldova	1990-2009
Bolivia	1960-2009	Mongolia	1980-2009
Brazil	1960-2009	Montenegro	2000-2009
Brunei	1965-1973	Morocco	1960-2009
Bhutan	1980-2009	Mozambique	1980-2009
Botswana	1960-2009	Namibia	1980-2009
Cape Verde	1986-2009	Nepal	1960-2009
Central African Republic	1960-2009	Nicaragua	1960-2009
Chile	1960-2009	Niger	1960-2009
China	1960-2009	Nigeria	1960-2009
Cote d'Ivoire	1960-2009	Oman	1960-2009
Cameroon	1960-2009	Pakistan	1960-2009
Congo, Democratic Republic	1960-2009	Panama	1960-2009
Congo, Republic	1960-2009	Papua New Guinea	1960-2009
Colombia	1960-2009	Paraguay	1965-2009
Comoros	1980-2009	Peru	1960-2009
Costa Rica	1961-2009	Philippines	1960-2009
Cuba	1970-2009	Poland	1985-2009
Cyprus	1975-2009	Portugal	1960-1990
Czech Republic	1990-2009	Romania	1987-2009
Djibouti	1985-2009	Russia	1989-2009
Dominica	1977-2009	Rwanda	1960-2009
Dominican Republic	1960-2009	Saudi Arabia	1968-2009
Ecuador	1960-2009	Senegal	1960-2009
Egypt	1960-2009	Serbia	1997-2009
El Salvador	1960-2009	Sierra Leone	1960-2009
Equatorial Guinea	1960-2009	Singapore	1960-1987
Eritrea	1960-2009	Slovak Republic	1993-2005
Estonia	1987-2009	Slovenia	1991-2001
Ethiopia	1981-2009	Somalia	1960-1990
Fiji	1960-2009	South Africa	1960-2009
Gabon	1960-2009	Sri Lanka	1960-2009
Gambia	1966-2009	Sudan	1960-2009
Georgia	1990-2009	Suriname	1960-2009

Ghana	1960-2009	Swaziland	1960-2009
Greece	1960-2009	Syria	1960-2009
Guatemala	1960-2009	Tajikistan	1990-2009
Guinea	1960-2009	Tanzania	1988-2009
Guinea-Bissau	1970-2009	Thailand	1960-2009
Guyana	1960-2009	Timor-Leste	2000-2009
Haiti	1991-2009	Togo	1960-2009
Honduras	1960-2009	Tonga	1975-2009
Hong Kong	1960-1986	Tunisia	1960-2009
Hungary	1968-2009	Turkey	1960-2009
India	1960-2009	Turkmenistan	1990-2009
Indonesia	1967-2009	Uganda	1960-2009
Iran	1965-2009	Ukraine	1990-2009
Iraq	1960-2009	Uruguay	1960-2009
Ireland	1970-1985	Uzbekistan	1990-2009
Israel	1960-1986	Venezuela	1960-2009
Jamaica	1960-2009	Vietnam	1960-2009
Jordan	1970-2009	Palestinian Territories	1970-2009
Kazakhstan	1990-2009	Yemen	1960-2009
Kenya	1960-2009	Yugoslavia	1960-1990
Korea, South	1960-2001	Zambia	1960-2009
Korea, North	1960-2009	Zimbabwe	1960-2009
Kosovo	2000-2009		
Kyrgyz Republic	1990-2009		

APPENDIX B

Malawi Dataset Description

Table B1- Description of Indicators Used to Construct Malawi Dataset				
Indicator	Description	Units	Transformation	Source
WASH Sector Aid	Geo-coded dataset of active and completed aid-funded WASH sector projects in Malawi	U.S. dollars	Divided by number of project locations and estimated beneficiary population	Peratsakis et al. (2012) http://www.aiddata.org/content/index/AidData-Raw/geocoded-data
Drinking Water Source	Self-reported source of household drinking water	Qualitative description	Used to construct Improved Water variable	Malawi NSO (2011) http://microdata.worldbank.org/index.php/catalog/1003
Sanitation Facility	Self-reported source of household sanitation	Qualitative description	Used to construct Improved Sanitation variable	Malawi NSO (2011) http://microdata.worldbank.org/index.php/catalog/1003
Instance of Illness/Injury	Self-reported instance of personal illness or injury within two week period	Number of illnesses or injuries	Used to construct Water-Related Illness variable	Malawi NSO (2011) http://microdata.worldbank.org/index.php/catalog/1003
Salary/Wages	Self-reported	Daily, monthly, or annual income in Malawi Kwacha (MWK)	Used to construct Household Income and Average Household Income variables	Malawi NSO (2011) http://www.nsomalawi.mw/index.php/publications/integrated-household-survey/third-integrated-household-survey-ihs3.html
Gender	Self-reported gender	Male or female	Converted to binary indicator	Malawi NSO (2011) http://www.nsomalawi.mw/index.php/publications/integrated-household-survey/third-integrated-household-survey-ihs3.html
Age	Self-reported age	Years	Used to construct binary Child and Elder variables	Malawi NSO (2011) http://www.nsomalawi.mw/index.php/publications/integrated-household-survey/third-integrated-household-survey-ihs3.html
Annual Rainfall	Average annual precipitation in	Millimeters	Used to construct binary	Malawi NSO (2011) http://www.nsomalawi.mw/

	district, based on global metrological datasets		Arid Climate variable	index.php/publications/integrated-household-survey/third-integrated-household-survey-ihs3.html
Geographic Location	Adjusted GPS coordinates of household location	GPS coordinates	Used to match respondents to location-specific variables	Malawi NSO (2011) http://www.nsomalawi.mw/index.php/publications/integrated-household-survey/third-integrated-household-survey-ihs3.html
Population Density	Estimated population density in district	People per square kilometer	None	Malawi NSO (2008) http://unstats.un.org/unsd/demographic/sources/census/2010_phc/Malawi/Malawi_Report.pdf

APPENDIX C

Philippines Dataset Description

Table C1- Description of Indicators Used to Construct Philippines Dataset				
Indicator	Description	Units	Transformation	Source
Instance of diarrheal disease	Total number of reported cases of diarrhea in province or city	Number of cases	Adjusted by population to obtain relative risk	Philippines DOH (2002-2006) http://www.doh.gov.ph/publication.html
Population	Total population in province or city	Number of people	None	Philippines DOH (2000-2009) http://www.doh.gov.ph/publication.html
Population Density	Average population density in province or city	Persons per square kilometer	None	Philippines NSO (2002-2006)
Gross Regional Product	Aggregate gross value added of all resident producers in region	Philippine pesos (PHP)	Divided by regional population	Philippines NSCB (2002-2006) http://www.nscb.gov.ph/grdp/
Water Pollution	Regional estimated biochemical oxygen demand	Thousands of metric tons per year	None	World Bank (2003) http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2004/05/24/000012009_20040524135608/Rendered/PDF/282970PH0Environment0monitor.pdf
Freshwater Resources	Groundwater availability by region	Millions of cubic meters	Divided by regional population	World Bank (2003) http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2004/05/24/000012009_20040524135608/Rendered/PDF/282970PH0Environment0monitor.pdf

Table C2- Provinces and Cities of the Philippines				
Region	**Provinces**		**Cities**	
	Name	Years Included	Name	Years Included
Region 1	Ilocos Norte	2002-2006	Alaminos City	2004-2006
	Ilocos Sur	2002-2006	Candon City	2003-2006
	La Union	2002-2006	Dagupan City	2002-2006
	Pangasinan	2002-2006	Laoag City	2002-2006
			San Carlos City	2002-2006
			San Fernando City	2002-2006
			Urdaneta City	2002-2006
			Vigan City	2002-2006
Region 2	Batanes	2002-2006	Cauyan City	2002-2006
	Cagayan	2002-2006	Santiago City	2002-2006
	Isabela	2002-2006	Tuguegarao City	2002-2006
	Nueva Vizcaya	2002-2006		
	Quirino	2002-2006		
Region 3	Aurora	2002-2006	Angeles City	2002-2006
	Bataan	2002-2006	Balanga City	2003-2006
	Bulacan	2002-2006	Cabanatuan City	2002-2006
	Nueva Ecija	2002-2006	Gapan City	2003-2006
	Pampanga	2002-2006	Malolos City	2004-2006
	Tarlac	2002-2006	Munoz City	2002-2006
	Zambales	2002-2006	Ologapo City	2002-2006
			Palayan City	2002-2006
			San Fernando City	2004-2006
			San Jose City	2002-2006
			San Jose Del Monte City	2006-2006
			Tarlac City	2004-2006
Region 4 A	Batangas	2002-2006	Antipolo City	2002-2006
	Cavite	2002-2006	Batangas City	2002-2006
	Laguna	2002-2006	Calamba City	2002-2006
	Quezon	2002-2006	Cavite City	2002-2006
	Rizal	2002-2006	Lipa City	2002-2006
			Lucena City	2002-2006
			San Pablo City	2002-2006
			Santa Rosa City	2005-2006
			Tagaytay City	2002-2006
			Tanauan City	2002-2006
			Trece Martires City	2002-2006
Region 4 B	Marinduque	2002-2006	Calapan City	2002-2006
	Mindoro Occidental	2002-2006	Puerto Princesa City	2002-2006
	Mindoro Oriental	2002-2006		
	Palawan	2002-2006		
	Romblon	2002-2006		

Region 5	Albay	2002-2006	Iriga City	2002-2006
	Camarines Norte	2002-2006	Legaspi City	2002-2006
	Camarines Sur	2002-2006	Naga City	2002-2006
	Catanduanes	2002-2006		
	Masbate	2002-2006		
	Sorsogon	2002-2006		
Region 6	Aklan	2002-2006	Bacolod City	2002-2006
	Antique	2002-2006	Bago City	2002-2006
	Capiz	2002-2006	Cadiz City	2002-2006
	Guimaras	2002-2006	Escalante City	2002-2006
	Iloilo	2002-2006	Himamaylan City	2002-2006
	Negros Occidental	2002-2006	Iloilo City	2002-2006
			Kabankalan City	2002-2006
			La Carlota City	2002-2006
			Passi City	2002-2006
			Roxas City	2002-2006
			Sagay City	2002-2006
			San Carlos City	2002-2006
			Silay City	2002-2006
			Sipalay City	2002-2006
			Talisay City	2002-2006
			Victorias City	2002-2006
Region 7	Bohol	2002-2006	Bais City	2002-2006
	Cebu	2002-2006	Bayawan City	2002-2006
	Negros Oriental	2002-2006	Canlaon City	2002-2006
	Siquijor	2002-2006	Cebu City	2002-2006
			Danao City	2002-2006
			Dumaguete City	2002-2006
			Lapu-lapu City	2002-2006
			Mandawe City	2002-2006
			Tagbilaran City	2002-2006
			Talisay City	2002-2006
			Tanjay City	2002-2006
			Toledo City	2002-2006
Region 8	Biliran	2002-2006	Calbayog City	2002-2006
	Eastern Samar	2002-2006	Maasin City	2003-2006
	Northern Leyte	2002-2006	Ormoc City	2002-2006
	Northern Samar	2002-2006	Tacloban City	2002-2006
	Southern Leyte	2002-2006		
	Western Samar	2002-2006		
Region 9	Zamboanga Del Norte	2002-2006	Dapitan City	2002-2006
	Zamboanga Del Sur	2002-2006	Dipolog City	2002-2006
	Zamboanga Sibugay	2002-2006	Isabela City	2002-2006
			Pagadian City	2002-2006
			Zamboanga City	2002-2006

Region 10	Bukidnon	2002-2006	Cagayan De Oro City	2002-2006
	Camiguin	2004-2006	Gingoog City	2002-2006
	Lanao Del Norte	2002-2006	Iligan City	2002-2006
	Misamis Occidental	2002-2006	Malaybalay City	2002-2006
	Misamis Oriental	2002-2006	Oroquieta City	2002-2006
			Ozamis City	2002-2006
			Tangub City	2002-2006
			Valencia City	2002-2006
Region 11	Compostela Valley	2002-2006	Davao City	2002-2003
	Davao Del Norte	2002-2006		
	Davao Del Sur	2002-2006		
	Davao Oriental	2002-2006		
Region 12	North Cotabato	2002-2006	Cotabato City	2002-2006
	Sarangani	2002-2006	General Santos City	2002-2006
	South Cotabato	2002-2006	Kidapawan City	2002-2005
	Sultan Kudarat	2002-2006		
NCR			Caloocan City	2002-2006
			Las Pinas City	2002-2006
			Makati City	2002-2006
			Malabon	2002-2006
			Mandaluyong City	2002-2006
			Manila City	2002-2006
			Marikina City	2002-2006
			Muntinlupa City	2002-2006
			Navotas	2003-2006
			Paranaque City	2002-2006
			Pasay City	2002-2006
			Pasig City	2002-2006
			Pateros	2002-2006
			Quezon City	2002-2006
			San Juan	2002-2006
			Taguig	2002-2006
			Valenzuela City	20022006
CAR	Abra	2002-2006	Baguio City	2002-2006
	Apayao	2002-2006		
	Benguet	2002-2006		
	Ifugao	2002-2006		
	Kalinga	2002-2006		
	Mt. Province	2002-2006		
ARMM	Basilan	2002-2006	Marawi City	2002-2006
	Lanao Del Sur	2002-2006		
	Maguindanao	2002-2006		
	Sulu	2002-2006		
	Tawi-tawi	2002-2006		
CARAGA	Agusan Del Norte	2002-2006	Bislig City	2002-2006

	Agusan Del Sur Surigao Del Norte Surigao Del Sur	2002-2006 2002-2006 2002-2006	Butuan City Surigao City	2002-2006 2002-2006

REFERENCES

AidData. (2012). AidData 2.0 Database. <http://www.aiddata.org>.

Ahmad, Omar, Alan Lopez, and Mie Inoue. (2000). "The decline in child mortality: a reappraisal." *Bulletin of the World Health Organization* 78: 1175-1191.

Alesina, Alberto and Beatrice Weder. (2002). "Do corrupt governments receive less foreign aid?" *American Economic Review* 92(4): 1126-1137.

Arndt, Channing, Sam Jones, and Finn Tarp. (2009). "Aid and Growth: Have We Come Full Circle?" *United Nations University World Institute for Economic Research*, Discussion Paper No. 5.

Asra, Abuzar, Gemma Estrada, Yangseon Kim, and M.G. Quibria. (2005). *Poverty and foreign aid: evidence from recent cross-county data*. Manila, Philippines: Economics and Research Department, Asian Development Bank.

Bauer, Peter. (1972). *Dissent on Development*. Cambridge, Massachusetts: Harvard University Press.

Bean, J.M.W. (1963). "Plague, Population and Economic Decline in England in the Later Middle Ages." *The Economic History Review* 15(3): 423-437.

Beck, Nathaniel and Jonathan N. Katz. (2007). "Random coefficient models for time-series-cross-section data: Monte Carlo experiments." *Political Analysis* 15(2):182-195.

Bello, Walden, Herbert Docena, Marissa de Guzman, and Marylou Malig. (2004). *The Anti-Development State: The Political Economy of Permanent Crisis in the Philippines.* London: Zed Books.

Bia, Michela and Alessandra Mattei. (2008). "A Stata package for the estimation of the dose-response function through adjustment for the generalized propensity score." *The Stata Journal* 8(3): 354-373.

Birdsall, Nance and William Savedoff. (2010). *Cash On Delivery: A new approach to foreign aid*. Washington, DC: Center for Global Development.

Black, Maggie. (1998). "Learning What Works: A 20 Year Retrospective View on International Water and Sanitation Cooperation." UNDP-World Bank Water and Sanitation Programme.

Boone, Peter. (1996). "Politics and the Effectiveness of Foreign Aid." *European Economic Review* 40(2): 289-329.

Booth, David. (2011). "Aid Effectiveness: Bringing Country Ownership (and Politics) Back In." London: ODI Working Paper 336.

Botting, Marianne, Edoye Porbeni, Michel Joffres, Bradley Johnston, Robert Black, Edward Mills. (2010). "Water and sanitation infrastructure for health: The impact of foreign aid." *Globalization and Health* 6: 12.

Bourguignon, François and Mark Sundberg. (2007). "Aid Effectiveness: Opening the Black Box." *The American Economic Review* 97(2):316-321.

Broad, Robin. (1990). *Unequal Alliance: The World Bank, the International Monetary Fund and the Philippines*. Berkley, California: University of California Press.

Burside, Craig and David Dollar. (2004). "Aid, policies, and growth." *The American Economic Review* 94(3):781-784.

Cairncross, Sandy. (1992). "Sanitation and Water Supply: Practical Lessons from the Decade." Washington, DC: World Bank.

Carlos, Celia C. and Mediadora C. Saniel. (1990). "Etiology and Epidemiology of Diarrhea." *Philippine Journal of Microbiology of Infectious Diseases* 19(2): 51-53.

Cash, Richard and Vacant Narasimhan. (2000). "Impredíments to global surveillance of infectious diseases: consequences of open reporting in a global economy." *Bulletin of the World Health Organization* 78:1358-1367.

Christmas, Joseph and Carel de Rooy. (1991). "The Decade and Beyond: At a Glance." *Water International* 16(3): 127-134.

Clemens, Michael, Steven Radelet, Rikhil Bhavani, and Samuel Bazzi. (2004). "Counting Chickens When They Hatch: Timing and the Effects of Aid on Growth." Center for Global Development Working Paper 44. <http://www.cgdev.org/files/2744_file_CountingChickens FINAL3.pdf>.

Collier, Paul and David Dollar. (2002). "Aid Allocation and Poverty Reduction." *European Economic Review* 46(8): 1475-5000.

Conca, Ken. (2006). "*Governing Water: Contentious Transnational Politics and Global Institution Building*." MIT Press.

Cordella, Tito and Giovanni Dell'Ariccia. (2003). "Budget Support versus Project Aid." IMP Working Paper No. 3/88.

Dalgaard, Carl-Johan, Henrik Hansen and Finn Tarp. (2004). "On the Empirics of Foreign Aid and Growth." *The Economic Journal* 114(496): F191-F216.

Demirci, Ali and Anya Butt. (2001). "Historical Overview and Current Trends in Istanbul's Water Supply Development." Globalization and Water Resources Management: The Changing Value of Water, International Specialty Conference, August 6-8, Awra/IwIri-University of Dundee.

Dietrich, Simone. (2011). "The Politics of Public Health Aid: Why Corrupt Governments Have Incentives to Implement Aid Effectively." *World Development* 39(1):55-63.

Doucouliagos, Hristos and Martin Paldam. (2009). "The Aid Effectiveness Literature: The Sad Results Of 40 Years Of Research." *Journal of Economic Surveys* 23(3): 433-461.

Douliagos, Hristos and Martin Paldam. (2010). "Conditional aid effectiveness: A meta-study." *Journal of International Development* 22(4): 391-410.

Doucouliagos, Hristos and Martin Paldam. (2011). "The ineffectiveness of development aid on growth." European Journal of Political Economy 27(2): 399-404.

Dreher, Axel, Peter Nunnenkamp, and Rainer Thiele. (2006). "Does Aid for Education Educate Children? Evidence from Panel Data." Kiel Institute for the World Economy. Working Paper No. 1290.

Durbarry, Ramesh, Norman Gemmell, and David Greenaway. (1998). "New Evidence on the Impact of Foreign Aid," CREDIT Research Paper No. 8. Center for Research in Economic Development and International Trade, University of Nottingham.

Easterly, William. (2001). *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics*. Cambridge, MA: MIT Press.

Easterly, William. (2003). "Can Foreign Aid Buy Growth?" *The Journal of Economic Perspectives* 17(3): 23-48.

Easterly, William. (2006). *The White Man's Burden: Why The West's Efforts To Aid The Rest Have Done So Much Ill And So Little Good.* New York, NY: Oxford University Press.

Easterly, William and D. Roodman. (2004). "New Data, New Doubts: A Comment on Burnside and Dollar's Aid, Policies, and Growth (2000)." *American Economic Review* 94(3): 774-780.

Easterly, William and Claudia Williamson. (2011). "Rhetoric *versus* Reality: The Best of Worst of Aid Agency Practices." *World Development* 39(11):1930-1949.

Esri. (2012). World Countries Geospatial Dataset. DeLorme Publishing, Inc.

Eyben, Rosalind. (2010). "Hiding Relations: The Irony of 'Effective Aid.'" European Journal of Development Research 22: 382-397

Falkenmark, M. J. Lundquist and C. Widstrand. (1989). "Macro-scale Water Scarcity Requires Micro-scale Approaches: Aspects of Vulnerability in Semi-arid Development." *Natural Resources Forum* 13(4): 258-267.

Feyzioglu, Tarhan, Vinaya Swaroop, and Min Zhu. (1998). "A Panel Data Analysis of the Fungibility of Foreign Aid." *World Bank Economic Review* 12(1): 29-58.

Friedman, Milton. (1958). "Foreign Economic Aid." *Yale Review* 47(4):500-516.

Gebhard, Nathaniel, Katherine Kitterman, Ashley Anne Mitchell, Daniel Neilson, and Sven Wilson. (2008). "Healthy Aid? Preliminary Results on Health Aid Effectiveness." Paper presented at the annual meeting of the APSA Annual Meeting, Hynes Convention Center, Boston, Massachusetts.

Gelman, Andrew. (2008). "Scaling regression inputs by dividing by two standard deviations." *Statistics in Medicine* 27: 2965-2873.

Gleick, Peter. (1998). "The human right to water." *Water Policy* 1: 487-503.

Gleick, Peter. (2002). "Dirty Water: Estimated Deaths from Water-Related Disease 2000-2020." Pacific Institute Research Report. <http://www.pacinst.org/reports/water_related_deaths/water_related_deaths_report.pdf>.

GMA News. (2008). “Diarrhea kills 10,000 Pinoy kids every year- WHO.” <http://www.gmanetwork.com/news/story/119921/news/nation/diarrhea-kills-10-000-pinoy-kids-every-year-who>.

Greenpeace. (2007). “The State of Water Resources in the Philippines.” Quezon City, Philippines: Greenpeace Southeast Asia.

Griffin, Keith and J. Enos. (1970). “Foreign Assistance, Objectives and Consequences.” *Economic Development and Cultural Change* 18(3): 313-327.

Gutierrez, Eric. (2007). “Delivering pro-poor water and sanitation services: The technical and political challenges in Malawi and Zambia.” *Geoforum* 38 (5): 886-900.

Gyimah-Brempong, Kwabena, Jeffrey Racine, and Anthony Gyapong. (2010). “Aid and Economic Growth: Sensitivity Analysis.” *Journal of International Development* 24: 17-33.

Hansen, Henrik and Finn Tarp. (2000). “Aid Effectiveness Disputed.” *Journal of International Development* 12(2): 375-398.

Hansen, Henrik and Finn Tarp. (2001). “Aid and Growth Regressions.” *Journal of Development Economics* 64(2): 547-570.

Heckman, J., H. Ichimura, J.A. Smith and P.E. Todd. (1998). “Characterizing selection bias using experimental data.” *Econometrica* 66(5): 1017-1098.

Hecker, Justus. (1859). *The Epidemics of the Middle Ages.* London: Trubner and Co.

Hendon, Juila and Rosemary Joyce. (2004) *Mesoamerican Archaeology*. Oxford: Blackwell Publishing.

Hicks, Robert L., Bradley C. Parks, J. Timmons Roberts, and Michael J. Tierney. (2008). *Greening Aid: Understanding the Environmental Impact of Development Assistance*. New York, NY: Oxford University Press.

Hirano, K. and G.W. Imbens. (2004). “The propensity score with continuous treatments.” In *Applied Bayesian Modeling and Causal Inference from Incomplete-Data Perspective*, A. Gelman and X.L. Meng (eds.).

Hudson, John and Paul Mosley. (2001). “Aid, Policies, and Growth: In Search of the Holy Grail.” *Journal of International Development* 13:1023-38.

Hulme, David. (2009). "Global Poverty Reduction and the Millennium Development Goals: A Short History of the World's Biggest Promise." Brooks World Poverty Institute Working Paper 100.

International Life Sciences Institute Pathogen Risk Assessment Working Group. (1996). "A Conceptual Framework for Assessing the Risks of Human Disease Following Exposure to Waterborne Pathogens." *Risk Analysis* 16: 841-848.

International Life Sciences Institute. (2000). *Revised Framework for Microbial Risk Assessment*. Washington, DC: ILSI Press.

Irandoust, Manuchehr and Johan Ericsson. (2005). "Foreign Aid, Domestic Savings, and Growth in LDCs: An Application of Likelihood-Based Panel Cointegration." *Economic Modelling* 22(4): 616-627.

Islam, Mohammad Nazrul. (2003). "Political Regimes and the Effects of Foreign Aid on Economic Growth." *The Journal of Developing Areas* 37(1):35-53.

Kenny, Charles. (2006). "What is Effective Aid? How Would Donors Allocate it?" World Bank Polity Research Working Paper 4005: 3.

Khilji, Nasir and Ernest Zampelli. (1994). "The Fungibility of U.S. Military and Non-Military Assistance and the Impacts on Expenditures of Major Aid Recipients." *Journal of Development Economics* 43(2):345-362.

Lebovic, James H. and Erik Voeten. (2009). "The Cost of Shame: International Organizations and Foreign Aid in the Punishing of Human Rights Violators." *Journal of Peace Research* 46(1): 79-97.

Lensink, Robert and Howard White. (2001). "Are there Negative Returns to Aid?" *Journal of Development Studies* 37(6): 42-65.

Leuven, Edwin, and Barbara Sianesi. (2012). "PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing." Statistical Software Components.

Levy, Victor. (1987). "Does Concessionary Aid Lead to Higher Investment Rates in Low-Income Countries?" *The Review of Economics and Statistics* 69(1):152-156.

Lofrano, Giusy and Jeanette Brown. (2010). "Wastewater management through the ages: A history of mankind." *Science of the Total Environment* 408(22): 5254-5264.

Malawi Environmental Affairs Department. (2010). Malawi State of Environment and Outlook Report: Environment for Sustainable Economic Growth. Government of Malawi, Ministry of Natural Resources, Energy and Environment: Lilongewe.

Malawi National Statistics Office. (2011). Third Integrated Household Survey 2010-2011. World Bank Central Microdata Catalog. <http://microdata.worldbank.org/index.php/ catalog/1003>.

Marchoione, Thomas J. and Ellen Messer. (2010). "Food Aid and the World Hunger Solution: Why the U.S. Should Use a Human Rights Approach." *Food and Foodways* 18:10-27.

Marshall, Monty, Keith Jaggers, and Ted Gurr. (2011). Polity IV Project: Political Regime Characteristics and Transitions, 1800-2010. Dataset Version 2010 (p4v2010 and p4v2010d). <http://www.systemicpeace.org/polity/polity4.htm>.

Matthews, Roger. (2003). *The Archaeology of Mesopotamia: Theories and Approaches*. London: Routledge.

Mavrotas, George. (2009). "Development Aid: Theory, Policies, and Performance." *Review of Development Economics* 13: 373-381.

Meernik, James, Eric L. Krueger, and Steven C. Poe. (1998). "Testing Models of U.S. Foreign Policy: Foreign Aid during and after the Cold War." *The Journal of Politics* 60(1): 63-85.

Melter, Eyal and Eli Schwartz. (2007). "Cholera: A Travel History of the First Modern Pandemic." In *Travel Medicine: Tales Behind the Science*, Annelies Wilder-Smith, Eli Schwartz, and Marc Shaw (Eds.). Oxford: Elsevier.

Michaelowa, Katharina. (2004). "Aid Effectiveness Reconsidered: Panel Data Evidence for the Education Sector." HWWA Discussion Paper No. 264. <http://ssrn.com/abstract=508382>.

Michaelowa, Katharina and Anke Weber. (2006). "Aid Effectiveness in the Education Sector: A Dynamic Panel Analysis." In *Theory and Practice of Foreign Aid (Frontiers of Economics and Globalizations, Volume 1)*, Sajal Lahiri, ed. Emerald Group Publishing Limited.

Miller, Daniel. (2011). "Sachs, Easterly and the Banality of the Aid Effectiveness Debate: Time to Move On." *Mapping Politics* 3: 72-86.

Morella, Elvira, Vivien Foster, and Sudeshna Ghosh Bangerjee. (2008). "Climbing the Ladder: The State of Sanitation in Sub-Saharan Africa." Africa Infrastructure Country Diagnostic Background Paper 13.

Mosley, Paul, John Hudson and Sara Horrell. (1987). "Aid, the Public Sector and the Market in Less Developed Countries." *Economic Journal* 97(387):616-641.

Moyo, Dambisa. (2009). *Dead Aid: Why Aid Is Not Working and How There Is a Better Way for Africa.* New York, NY: Farrar, Straus and Giroux.

Najlis, Pierre and Anthony Edwards. (1991). "The International Drinking Water Supply and Sanitation Decade in Retrospect and Implications for the Future." *Natural Resources Forum* 15(2):110-117.

Nielson, Daniel L. and Michael J. Tierney. (2003). "Delegation to International Organizations: Agency Theory and World Bank Environmental Reform." *International Organization* 57(2): 241-276.

Nkhoma, Bryson Gwiyani (2011). "The Politics, Development and Problems of Small Irrigation Dams in Malawi: Experiences from Mzuzu ADD." *Water Alternatives* 4(3) 383-398.

Organization for Economic Cooperation and Development. (2005). The Paris Declaration on Aid Effectiveness. <http://www.oecd.org/dac/effectiveness/43911948.pdf>.

Organization for Economic Cooperation and Development. (2012). "Financing Water and Sanitation in Developing Countries: The Contribution of External Aid." Report produced for the 6th World Water Forum, March 2012. <http://www.oecd.org/dac/aidstatistics/aidtowaterandsanitation.htm>.

Pack, Howard and Janet Rothenberg Pack. (1993). "Foreign Aid and the Question of Fungibility." *The Review of Economics and Statistics* 75(2):258-265.

Papanek, Gustav. (1973). “Aid, Foreign Private Investment, Savings, and Growth in Less Developed Countries.” *The Journal of Political Economy* 81: 121-130.

Parkin, Rebecca. (2007). “Microbial Risk Assessment.” In *Risk Assessment for Environmental Health*, Robson, Mark and William Toscano (eds.). San Francisco, CA: Wiley and Sons, Inc.

Peratsakis, Christian, Joshua Powell, Michael Findley, and Catherine Weaver. (2012). Geo-coded Activity-Level Data from the Government of Malawi's Aid Management Platform. Washington, DC: AidData and the Robert S. Strauss Center for International Security and Law. <http://open.aiddata.org/content/index/geocoding>.

Philippines Department of Health. (2000-2009). *Field Health Service Information System Annual Report.* Manila: Philippines Department of Health, National Epidemiology Center. <http://www.doh.gov.ph/serial.html>.

Philippines National Statistics Coordination Board. (2012). “Regional Accounts of the Philippines.” Philippines National Statistics Office. <http://www.nscb.gov.ph/grdp/>.

Prüss-Üstün, Annette, Robert Bos, Fiona Gore, and Jaime Bartram. (2008). *Safer water, health: costs, benefits and sustainability of interventions to protect and promote health.* Geneva, Switzerland: The World Health Organization.

Prüss-Üstün, Annette, David Kay, Lorna Fewtrell and Jamie Bartram. (2004). “Unsafe Water, Sanitation, and Hygiene.” In *Comparative Quantification of Health Risks: Global and Regional Burden of Disease Attributable to Selected Major Risk Factors*, Majid Ezzati, Alan Lopez, Anthony Rodgers, and Christopher Murray (Eds.): 1321-1352.

Radelet, Steven. (2004). “Aid Effectiveness and the Millennium Development Goals.” Center for Global Development Working Paper No. 39. <http://dx.doi.org/10.2139/ssrn.1112641>.

Radelet, Steven. (2006). “A Primer on Foreign Aid.” Working Paper Number 92. The Center for Global Development. <http://www.who.int/hac/techguidance/training/analysing_health_systems /a_primer_on_foreign_aid_06.pdf>.

Radelet, Stevens, Michael Clemens, and Rikhil Bhavnani. (2005). "Aid and Growth." *Finance and Development* 42(3): 1-10.

Rajan, Raghuram and Arvind Subramanian. (2008). "Aid and Growth: What does the Cross-Country Evidence Really Show?" *Review of Economics and Statistics* 90(4): 643-465.

Roodman, David. (2003). "The Anarchy of Numbers: Aid, Development, and Cross-Country Empirics," Working Paper 32. Washington, DC: Center for Global Development.

Rosenbaum, P.R. and D.B. Rubin. (1983). "The central role of the propensity score in observational studies for causal effects." *Biometrika* 70: 21-55.

Rosenberg, Tina. (2010). "How to Protect Foreign Aid? Improve it." March 14 blog post. *The New York Times*. < http://opinionator.blogs.nytimes.com/2011/03/14/how-to-protect-foreign-aid-improve-it/>.

Salzman, James. (2012). *Drinking Water: A History*. New York, NY: Overlook Duckworth.

Schnabel, Bastian. (2009). "The microeconomic impacts of diarrhoeal infections on rural and suburban households in Uganda." Master of Science thesis, Universiteit van Amsterdam, Amsterdam.

Sen, Amartya. (2005). "Human Rights and Capabilities." *Journal of Human Development* 6(2): 151-166.

Skytta, Tauno and Jean-Francois Landeau. (1996). "Kenya: Development of Housing, Water Supply, and Sanitation in Nairobi." World Bank Operations Evaluation Department. Report No. 15586.

Soller, J., J. Eisenburg, and A. Oliveri. (1999). *Evaluation of Pathogen Risk Assessment Framework*. Washington, DC: ILSI Research Foundation.

Teunis, P. and A. Havelaar. (1999). "Cryptosporidium in Drinking Water: Evaluation of the ILSI/IRSI Quantitative Risk Assessment Framework." *RIVM Report No. 284 550 006*. Bilthover, Netherlands: National Institute of Public Health and the Environment.

Tierney, Michael, Daniel Nielson, Darren Hawkins, J. Timmons Roberts, Michael Findley, Ryan Powers, Bradley Parks, Sven Wilson, and Robert Hicks. (2011). "More Dollars than Sense: Refining Our Knowledge of Development Finance Using AidData." *World Development* 39 (11): 1891-1906.

United Nations. (2003). Monterrey Consensus of the International Conference on Financing for Development. Monterrey, Mexico: United Nations Department of Economic and Social Affairs.

United Nations. (2012a). *The Millennium Development Goals Report 2012*. New York: UN.

United Nations. (2012b). "Stigma and the realization of the human rights to water and sanitation." Report of the Special Rapporteur on the human right to safe drinking water and sanitation. <http://daccess-dds-ny.un.org/doc/UNDOC/GEN/G12/148/98/PDF/ G1214898.pdf>.

United Nations Development Program. (2006). *Human Development Report 2006*. New York, NY: UNDP. <http://hdr.undp.org/en/media/HDR06-complete.pdf>.

United Nations. (2012). The Millennium Development Goals Report 2012. New York: UN.

United Nations Children's Fund. (2012). Committing to Child Survival: A Promise Renewed. Progress Report. New York: UNICEF. <http://www.unicef.org/videoaudio/PDFs/APR_ Progress_ Report_2012_final.pdf>.

United Nations Children's Fund. (2013). Malawi Statistics. <http://www.unicef.org/infobycountry/ malawi_statistics.html>.

United Nations Children's Fund and the World Health Organization. (2009). *Diarrhoea: why children are still dying and what can be done*. Geneva: WHO; New York: UNICEF. <http://whqlibdoc. who.int/publications/2009/9789241598415_eng.pdf>.

United Nations Children's Fund and the World Health Organization (2012). Progress on Drinking Water and Sanitation, 2012 Update. New York: Unicef; Geneva: WHO. <http://www.unicef.org/ media/files/JMPreport2012.pdf>.

United Nations Development Program. (2006). *Human Development Report 2006*. New York, NY: UNDP. <http://hdr.undp.org/en/media/HDR06-complete.pdf>.

United Nations Environment Program and World Meteorological Organization. (2001). Intergovernmental Panel on Climate Change Third Assessment Report. <http://www.grida.no/ publications/other/ipcc_tar/>.

United States Agency for International Development. (2007). "Malawi Water and Sanitation Profile." USAID. <http://www.wsscc.org/resources/resource-publications/malawi-water-and-sanitation-profile>.

Verhoeven, Jeske, Erma Uytewaal, and Jean de la Harpe. (2011). *Aid Effectiveness in the Water and Sanitation Sector: Policies, Practices and Perspectives*. Thematic Overview Paper 26. The Hague, Netherlands: IRC International Water and Sanitation Centre. <http://www.irc.nl/top26>.

White, Howard. (2009). "Evaluating Aid Impact." In *Development Aid: A Fresh Look*, George Mavrotas and Mark McGillivray, eds. London: Palgrave Macmillan.

Wilson, Sven. (2011). "Chasing Success: Health Sector Aid and Mortality." *World Development* 39(11): 2032-2043.

Winters, Matthew. (2010). "Choosing to Target: What Types of Countries Get Different Types of World Bank Projects." *World Politics* 62(3): 422-458.

Woods, Ngaire. (2005). "The Shifting Politics of Foreign Aid." *International Affairs* 81(2): 393-409.

World Bank. (1978). "Report and Recommendation of the President of the International Bank for Reconstruction and Development to the Executive Directors on a Proposed Loan to the Republic of the Philippines for the Magat River Multipurpose Project: Stage II." Report No. P-2310-PH. <http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2000/10/26/000178830_98101902304675/Rendered/PDF/multi_page.pdf>.

World Bank. (2003). *Philippines Environmental Monitor 2003*. Washington, DC: The World Bank Group.

World Bank. (2004). "Implementation Completion Report (IDA-27530 PPFI-P7630 PPFI-P7631 IDA-27531) on a credit in the amount of SDR 50.3 million (US$ 79.2 million equivalent) and a SDR 2.28 million supplemental (US$ 3.0 million equivalent) to the Republic of Malawi for the National Water Development Project." Report No. 29336. <http://wwwwds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2004/06/22/000012009_20040622131403/Rendered/PDF/29336.pdf>.

World Bank. (2006). *Philippines Environmental Monitor 2006*. Washington, DC: The World Bank Group.

World Bank. (2013a). World Development Indicators Database. <http://data.worldbank.org/data-catalog/world-development-indicators>.

World Bank. (2013b). World Governance Indicators Database. <http://info.worldbank.org/governance /wgi/index.asp>.

World Bank. (2013c). Mapping for Results. Database. < http://maps.worldbank.org/>.

World Health Organization. (2002). *The World Health Report 2002*. Geneva, Switzerland: The World Health Organization.

World Health Organization. (2012). *GLAAS 2012 Report: UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water*. Geneva: WHO. <http://whqlibdoc.who.int/publications/2012/ 9789241503365_eng.pdf>.

World Health Organization. (2013). Global Health Observatory Dataset. <http://apps.who.int/ghodata>.

Wyness, Michael. (2001). *The International Journal of Children's Rights* 9: 193-212.