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Elisabeth Lio Rosvold

Coping with calamity:

Natural disasters, armed conflict and development aid

Doctoral thesis

Elisabeth Lio Rosvold

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Contents

List of Tables

List of Figures

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Elisabeth Lio Rosvold,
Trondheim, May 2019

Chapter 1

The circular interactions between natural disasters, armed conflict and development aid

1.1 Introduction

In 2018, 68.5 million people were affected by 315 climate-related and geophysical disasters worldwide. Out of these, more than 11,800 people lost their lives, and the estimated cost of these disasters was US $132 billion (Centre for Research on the Epidemiology of Disasters (CRED) 2019). Figure 1.1 shows the prevalence of floods, storms and earthquakes across sub-national provinces worldwide between 1960 and 2015.[1] The prevalence of several of these natural disasters, here understood as disasters caused by a natural hazard, is exacerbated by climate change. This means that we can expect the force and prevalence of these disasters to increase in the future (for a summary of the anticipated consequences of a 1.5°C global warming and associated confidence levels, see IPCC 2018). The burden of these events is not shared equally across the globe, and in 2018 44.7% of all events occurred in Asia, and 15% in Africa. In terms of total disaster death tolls, seven of the top ten countries are in Asia, illustrating that in addition to the distribution being skewed, the resulting impacts of the disaster depend on the vulnerability of the affected societies.[2] The more vulnerable the society, the worse the conse-

[1] The figure is based on geocoding of disaster locations done as part of this dissertation which will be explained later in this chapter.

[2] The high death tolls are not only a reflection of low resilience to disasters, but also the number of people living in Asia.

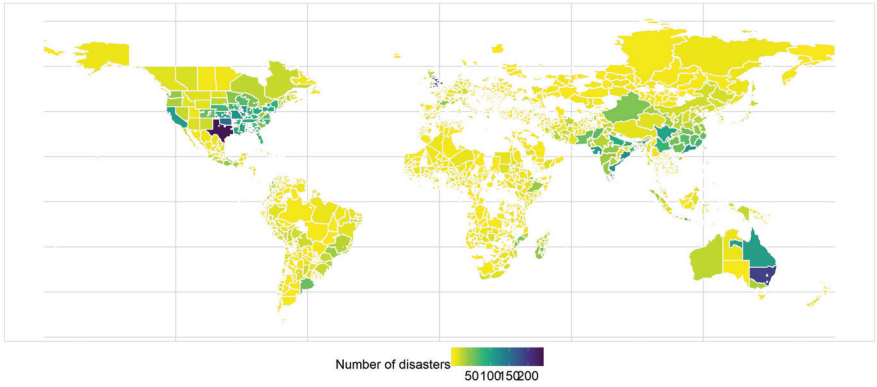

Figure 1.1: Disaster prevalence across first-level administrative units, 1960-2015 (affected provinces only)

quences, both in material and human costs, although economic costs of disasters are often higher in less vulnerable countries because of existing infrastructures. A society's vulnerability to disaster depends on a plethora of factors, but broadly speaking it will be determined by a country's demography, economic situation and institutional capacities.

Another calamity that is prevalent in many of the societies that are most vulnerable to disaster is armed conflict. Half of the ten most disaster-affected countries in 2018 were also experiencing at least one active armed intrastate conflict (India, Indonesia, Philippines, Afghanistan and Myanmar). More than 53,000 people were killed in civil war in 2018 (Pettersson and Öberg 2019). In addition to killing people in combat, armed conflict severely degrades the social, political and economic spheres of the affected countries. Collier et al. (2003) famously termed armed conflict 'development in reverse', something that has later been reiterated by Gates et al. (2012), who find that conflict reduces life expectancies and increases infant mortality, and by Costalli, Moretti and Pischedda (2017), who estimate that armed conflict reduces a country's GDP by more than 17% per year, on average. Looking at the most conflict-affected countries, eight of the top ten in terms of battle-deaths experienced at least one natural disaster in 2018.[3] Figure 1.2 shows the number of natural disasters recorded in the the Emergency Events Database (EM-DAT) provided by the Centre for Research on the Epidemiology of Disasters (CRED), as

[3] Afghanistan, Yemen, Somalia, Nigeria, Turkey, Iraq, Cameroon and India.

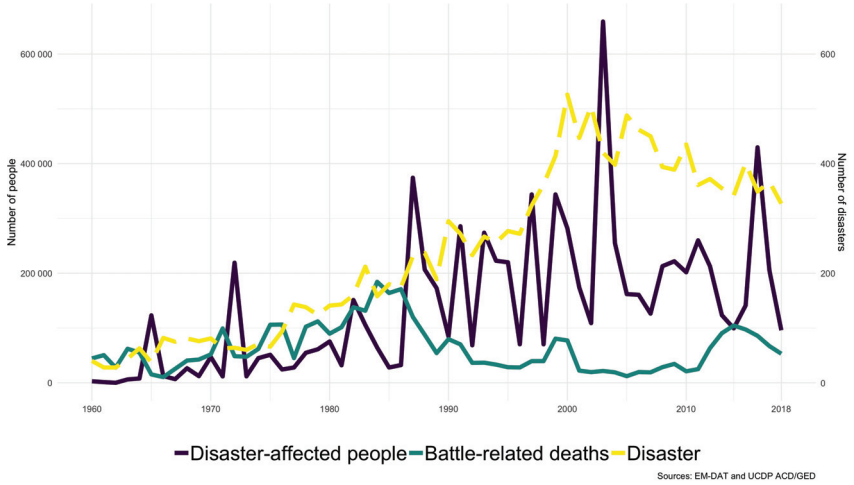

Figure 1.2: Trends in number of people affected by disasters, battle-related deaths and total number of disasters, 1960-2018

well as the total number of people affected by these events.[4] The figure also shows the number of battle-related deaths from armed intrastate conflict recorded in the Uppsala Conflict Data Program's (UCDP) armed conflict database. Unlike battle-related deaths, which had been on the decline until the Arab spring in 2011, there has been an increase in both the number of disasters and the number of people affected by them.

Both armed conflict and disasters are thus significant obstacles to reaching the UN Sustainable Development Goals (SDGs). The most recent *State of Food Security and Nutrition in the World* report echoes this in concluding that conflict and exposure to more complex climate extremes are threatening to erode the progress already made towards the eradication of global hunger (FAO et al. 2018). The available response to these challenges is by and large aid, and development aid is increasingly targeted at disaster resilience and reduction, as well as towards mitigating the consequences of armed conflict.

This dissertation concerns the nexus of disaster, conflict and aid, and seeks to improve our understanding of how these phenomena interact. Two overarching research questions guide the dissertation at large, asking *how do natural disasters, armed conflict and coping capacities interact locally, and how do they shape subsequent response in the form of development aid?* Theoretically, the dissertation

[4] A discussion of the challenges involved in the estimation of these figures will follow in the section concerning measurement challenges.

takes seriously the fact that the causal story is circular; disasters affect ongoing conflicts, but conflict also affects the likelihood of disaster, as well as the distribution of aid, which again affects societies' resilience to future disasters. Even though each paper only concerns one part of this causal chain, coping capacities are pivotal in all contexts.

As potential influences are vast (perhaps even infinite), the dissertation focuses on the potential ways in which disasters – and conflict – influence relevant actors' capacities differently. Governments, insurgents and local populations are different, and this is likely to be reflected in the impacts of a disaster, both in terms of direct damage but also in the subsequent distribution of aid. Methodologically, the dissertation contributes to existing literatures by using highly precise identification strategies. As neither disasters nor conflicts affect whole countries equally, looking at how potential effects vary across space represents an important contribution, made possible by geolocating the sub-national locations of natural disasters in the EM-DAT. Temporally, I utilize the existence of precise information about the timing of disasters, conflict events and aid disbursements, making it possible to set up natural experiments where factors other than the disaster can be held constant. This allows assessing the effects of factors that change within a conflict in a more dynamic fashion than the majority of existing literature. By taking into account the different actors at a growing level of precision, it becomes increasingly possible to understand what is going on at a resolution that corresponds to the objects of study.

The dissertation comprises this introduction and four articles, each of which investigates different aspects of the relationship between disasters, conflict and aid. The first paper, *Development aid, drought, and coping capacity*, assesses the effectiveness of the available response towards the mitigation of armed conflict and natural disasters, namely aid. Looking at child stunting as a health outcome, we find that living close to aid project locations can mitigate negative health consequences after drought across sub-Saharan Africa. As we do not find the same effects in areas that have not seen a drought, the paper illustrates that aid does work when it is distributed to vulnerable populations. The second paper, *Windows of opportunity? Natural disaster and the intensity of armed conflict* moves away from the aid sphere, and looks at the impact of rapid-onset disasters on conflict intensity, depending on the location of the disaster vis-à-vis the conflict zone. The analysis shows that disasters influence the capabilities of actors differently across space, and that the level of violence decreases in the immediate aftermath of a disaster, but predominantly for the disaster-affected provinces. Applying an even stricter spatial identification strategy, the third paper, *Fighting the river: Flood impacts on local conflict dynamics*, looks at how floods influence the level and location of

conflict activity. In this paper, we find that in general conflict activity ceases when its operating areas become flooded, but that this is conditioned by the insurgents' ties to the area. The stronger the ties, the smaller the pacifying effect of inaccessibility. We also find no evidence that the cessation of conflict events is offset by increased levels of violence elsewhere (i.e. diffusion), supporting the notion that effects are highly localized.

Having established that aid has the potential to mitigate adverse effects, and that disasters influence patterns of ongoing conflict when the two concur in space and time, the final paper, *Disaggregated determinants of aid: Development aid projects in the Philippines*, brings the three elements together. This paper looks at the extent to which disasters and armed conflict determine the distribution of development aid projects across Philippine provinces. The paper finds that despite the prevalence of these extreme events exacerbating an area's need for aid, a province's likelihood of receiving new aid projects is predominantly determined by the domestic political alliances. The finding that provinces where the majority belongs to the politically dominant group receive more aid, regardless of need, illustrates that overcoming the political nature of aid will be an essential milestone on the road to reaching the SDGs.

The remainder of this introduction continues with a discussion of the three concepts that are the focus of the dissertation: natural disasters, armed conflict and development aid. Then, the relationships between them are presented in the conceptual framework that guides the dissertation at large. This is also where I situate the dissertation in existing research, before showing how the dissertation addresses shortcomings in the literature by presenting my analytical framework. Because of the nature of disasters as shocks, I argue that disasters offer a way of getting at the dynamic nature of ongoing conflicts within a quantitative empirical set-up. This requires high temporal and spatial resolution, and I continue with discussing measurement challenges and data availability before presenting my own data coding efforts. Finally, I present each paper and their contributions in some detail, before I conclude and discuss avenues for future research.

1.2 Central concepts in the dissertation

> Without concepts, you don't know where to look, what to look for, or how to recognize what you were looking for when you find it.
>
> Becker, 1998:110

The quote from Becker illustrates that any scientific enquiry would be difficult,

if not impossible, without concepts. Although concepts might be developed in close dialogue with empirical data, it is important to avoid treating an indicator of a phenomenon as the phenomenon itself (Becker 1998). This dissertation is no exception, and in the following I describe in some detail the three most important concepts of the dissertation, before I show how they relate to each other.

1.2.1 Natural disasters: Hazard, vulnerability and resilience

The first central concept in the dissertation is natural disasters. According to the United Nations Office for Disaster Risk Reduction (UNISDR) a disaster is a

> *serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts* (UNISDR 2017).

A disaster is thus a function of (at least) three aspects/factors. First, the disruptions must be triggered by a *hazardous event*, which, broadly speaking, can be put into one of four categories: nature as trigger, violence as trigger, technology as trigger, or deterioration (such as environmental degradation) as trigger (Pelling, Özerdem and Barakat 2002). In a disaster situation, a society might be characterized by several of these, but it is often possible to identify one specific trigger. In this dissertation, the trigger of interest is nature, particularly natural hazards that, with the exception of earthquakes, are caused by extreme weather.

Even if the hazard is natural, violence, technology and (social) deterioration all influence the way in which a disaster manifests. The interaction between a (natural) hazard and *vulnerability* is pivotal for the outcome that we call disaster. There are a plethora of definitions and an ongoing debate concerning vulnerability within the literature on environmental change. I follow the IPCC definition provided by McCarthy et al. (2001) of *vulnerability* as a system's susceptibility and (lack of) coping capacity to adverse events. The opposite of vulnerability is therefore *resilience*, which says something about the magnitude of adversities that a system can handle without radically changing (Carpenter et al. 2001, Adger 2006). Adger and O'Riordan (2000) define the *social resilience* of societies to hazards to be made up of economic factors, institutions and demography. The poorer the set of these indicators, the larger the disaster given a natural hazard, which again reduces the adaptive capacities of the affected society towards future hazards.

The interdependence of a hazard and the vulnerability of the affected population prompts the question of whether natural disasters really are natural. The focus on

social-ecological systems within disaster research reflects the fact that "human action and social structures are integral to nature and hence any distinction between social and natural systems is arbitrary" (Adger 2006, p.268).[5] The degree to which the reasons for this are structural or behavioral varies across research traditions (Adger 2006, Cutter, Boruff and Shirley 2003). Within the behavioralist paradigm the focus is on mitigation efforts, as natural disasters are believed to occur mainly because of failure of planning response and rationality. Second, and more likely to refute the idea of *natural* disasters, the political ecology, or structuralist, view suggests that it is deep seated structures in society – such as the global economy and its marginalization of the poorest – that explain who is vulnerable to disasters (Smith 2004). Human decisions create vulnerability to natural events, which results in these events being hazardous to humans.

Regardless of the underlying reasons for the entanglement of environment and society, vulnerability, resilience and hazards are neither evenly nor randomly distributed across the world. The countries that are most exposed to natural hazards are also those that are most vulnerable, with the highest concentration of areas (and populations) at risk in Asia (Pesaresi et al. 2017). Benson, Twigg and Rossetto (2007, p.31) call attention to how difficult it is to get out of this vicious circle:

> *In theory, economic growth and poverty reduction could, of themselves, reduce the vulnerability of the poor to natural hazards, with no explicit risk reduction strategy required. However, this ignores the facts that vulnerability is both a cause and a symptom of poverty, implying that gains in poverty reduction may be unsustainable if disaster risk is not tackled, and also that the development process can influence vulnerability negatively as well as positively.*

Adaptive capacities and resilience to hazards are likely to be adversely affected whenever a country is affected by an armed conflict. By implication, in the relevant universe of cases for this dissertation, the vast majority of hazards will manifest as disasters because the affected areas are already vulnerable. In 2008, cyclone Nargis hit the shores of Myanmar with maximum wind speeds measured at 215 km/h leading to an estimated causality count at 130,000 people (including people missing). In comparison, hurricane Katrina, where measured wind speeds went up to 280 km/h, caused short of 2,000 deaths. Although population density matters, these examples illustrate the importance of a society's coping capacities for the manifestation of a disaster.[6]

[5] A more thorough discussion on this is provided by Wisner et al. (2010).

[6] That being said, hurricane Katrina is estimated to be the second most costly natural disaster

Specifically, this dissertation encompasses the rapid-onset natural disasters floods, storms and earthquakes, but also droughts, which have a slow-onset character. Three out of four – floods, storms and drought – can be categorized as *climate disasters*, which as a consequence of climate change are predicted to become more extreme and recurrent. Earthquakes are geological, and their prevalence depends on movements of tectonic plates, not a changing climate.[7]

1.2.2 Armed conflict

The dissertation's second concept is *armed intrastate conflict*. I follow the Uppsala Conflict Data Program's (UCDP) definiton of state-based armed conflict as "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in one calendar year" (UCDP 2018). As I use the UCDP's geo-referenced data, the inclusion criteria is that 25 battle-deaths is only necessary for the incompatibility to be entered into the database in the first place. After this, all conflict-related events with at least one fatality are recorded (Sundberg and Melander 2013). Adhering to this definition, throughout the dissertation I use the terms *armed conflict*, *civil war*, *violent conflict* and *conflict* interchangeably. There are several types of violence and actors that can be involved within an armed conflict, but as I am concerned only with state-based conflict, two opposing sides are relevant. The first is the *state*, also referred to as the *government*, and second its adversaries, referred to as either *rebels* or *insurgents*.

Despite the relatively straightforward definition of armed conflict as a violent incompatibility between two (or more) actors (of which one is the state), an armed conflict is a complex phenomenon where causes, actors and outcomes are interconnected across space and time. A useful separation, both theoretically and empirically, is that of conflict dynamics versus conflict onset. This dissertation is concerned with how ongoing armed conflicts are influenced – and influence – natural disasters, and the focus is consequently on *conflict dynamics*. *Dynamics* can be defined as the forces or properties which stimulate growth, development, or change within a system or process. Thinking of armed conflict as a process, one way to define conflict dynamics is therefore *the forces or properties that stimulate change within a conflict*. In the quantitative conflict literature, the traditional conceptualization of conflict dynamics tends to be limited to comprise of conflict intensity, conflict location, conflict duration or type of conflict termination. The

in the world with damages at $125 billion (Guha-Sapir, Below and Hoyois 2016), illustrating that economic consequences tend to be highest in developed countries.

[7] A recent report for the European Commissions highlights that the number of people living in seismic areas has increased by more than 90% over the last forty years (Pesaresi et al. 2017).

degree of dynamism in these can be discussed, but they provide useful starting points for empirical analyses and consequent theory development.

1.2.3 Development aid: Blurring the boundaries between development and humanitarian aid

> One *New York Times* article [is] worth more disaster aid dollars than 1,500 fatalities.
>
> Drury, Olson and Belle (2005, p. 470) on U.S. foreign disaster assistance

The third and final concept of the dissertation is development aid, which is a common response to both disasters and armed conflict. Generally speaking, aid is separated into official development assistance (ODA), and humanitarian assistance, usually referred to as emergency aid. It is the OECD Development Aid Committee (DAC) who decides which countries are eligible recipients of ODA, from which the objective is to eliminate poverty and its causes. By definition, ODA is "government aid designed to promote the economic development and welfare of developing countries (...). [It] includes grants, 'soft' loans (where the grant element is at least 25% of the total) and the provision of technical assistance" (OECD 2016). The vast majority of multilateral aid has in recent years been channeled through the regional development banks within the UN Development group and the World Bank (OECD 2018).

This long-term perspective of development assistance stands in contrast to humanitarian assistance, which is both short-term and unconditional, seeking to provide relief to "populations temporarily needing support after natural disasters, technological catastrophes, or conflicts (...)" (Fink and Redaelli 2011, p. 742). In reality, however, this separation is not always straightforward, particularly in protracted crises such as civil war and disasters that are either lengthy in nature or very severe. In instances of massive disaster-related destruction, reconstruction and recovery goes well beyond the immediate provision of emergency aid, and becomes an integral part of the development assistance. In the wake of disasters, developing countries often request additional emergency loans from international financial institutions, without which their low capital reserves would not manage to support the recovery. As disasters and so-called complex humanitarian emergencies increasingly strain the economic stability of many frail countries, the World Bank is taking on a more central role in mitigation and reconstruction (Coppola 2006).

In both papers that concern aid (papers I and IV), the aid projects investigated are World Bank projects, which fall into the development aid category. This means

that these projects are, prima facie, not given in direct response to a natural disaster or an armed conflict. However, the prevalence of disasters and armed conflict increases an area's need for such assistance, and both armed conflict and climate change are prioritized by the World Bank and other multilateral donors in their efforts towards the eradication of extreme poverty. Looking specifically at the different projects funded under the World Bank scheme reveals that they are quite diverse.[8] Some projects concern water supply and sanitation, while others are about education and infrastructure development. Based on the list of projects, a clear separation between humanitarian efforts (in the form of disaster response) and development assistance seems artificial. Several projects concern emergency loans and response to droughts, floods and earthquakes. In addition, adaptation and resilience is prevalent in many projects. In a recent report on the implementation of the Sendai Framework for Disaster Risk Reduction in Asia, Peters (2018) finds that more ODA is spent on responses to than prevention of disasters. Looking at the OECD's reporting between 1997 and 2016, she finds that for the five most fragile states in Asia according to the Fragile States Index (The Fund for Peace (FFP) 2018), Afghanistan, Bangladesh, Myanmar, North Korea and Pakistan, 72% of ODA was spent on emergency response, 20% on reconstruction and rehabilitation and only 4% on (disaster) prevention. Although these figures are not representative globally, they reveal that a clear separation between development and humanitarian aid does not reflect the reality and that development aid is important both for disaster response and for capacity building. In a review of disaster relief efforts in Bangladesh, Paul (2006) argues that emergency relief aid can often be detrimental to development, and that the way to remedy this, and ensure that disaster victims get sufficient help, is for disaster response to be integrated into the development aid efforts. Development aid projects are pivotal for increasing long-term resilience to both disasters and conflict, and this type of aid is therefore a highly relevant response to these emergencies.

1.3 Conceptual framework

Natural disasters, armed conflict and development aid are highly interrelated in the societies in which they occur, and Figure 1.3 illustrates the overarching conceptual framework for the dissertation. Hazards affect armed conflicts, coping capacities/resilience and aid provision, while aid, conflict and coping capacities also affect each other, potentially mitigating or exacerbating the effects of the hazard. The figure illustrates the circular nature of the relations between the three phenomena of interest. As disasters are a function of coping capacity and the hazard, this is

[8] While looking exclusively at World Bank projects does not allow a completely comprehensive assessment of the ODA landscape, patterns of distribution could be applicable to other multilateral donors as well.

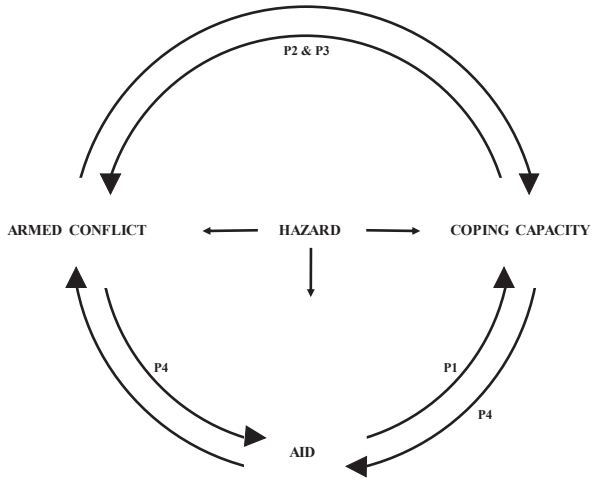

Figure 1.3: The three concepts and their relations

illustrated differently than the two other phenomena. The coping capacity category is broad, and encompasses a society's societal structures, ranging from infrastructure and level of development, to social cohesion. There are myriad ways in which these interact, and this dissertation only begins to fill some of the gaps concerning such interactions. Firstly, I limit the relevant universe for the dissertation to the short term, meaning up to one year after the hazard, making it easier to isolate the direction of the particular relationships studied. Second, all papers focus on how the concepts are interrelated through their influence on the capacities of the relevant actors: either governments, insurgents or (local) populations.[9] Another important delimitation is that I am only concerned with ongoing conflict. Within these limitations, the dissertation is concerned with how aid might increase societies' coping capacities towards future hazards (Paper I); how hazards manifesting as disasters might affect conflict dynamics when the two concur in space (Papers II and III); and to what degree coping capacities and armed conflict predicate the distribution of aid projects (Paper IV). Taking Figure 1.3 as a point of departure, this section will describe how the concepts are connected, as well as identify the gaps in relevant literatures that the dissertation begins to fill.

1.3.1 Armed conflict, coping capacity and hazards

Beginning at the top of Figure 1.3, armed conflict is likely to affect a society's coping capacity towards hazards. It is well established that armed conflict is detrimen-

[9] Assuming that these are unitary actors is of course problematic, particularly over time. However, looking only at relatively short time intervals should alleviate some of this concern.

tal for developmental outcomes, destroying infrastructure, hampering economic growth and depriving the health of affected populations among other things (Collier et al. 2003, Gates et al. 2012, Costalli, Moretti and Pischedda 2017, Alderman, Hoddinott and Kinsey 2006, Urdal and Che 2013). In a recent review, Hegre (2018) takes stock of the literature concerning the impacts of conflict on development, and it is clear that in addition to making affected populations more exposed to future conflict (the conflict trap), armed conflict also makes affected people more vulnerable to other hazards, for instance natural disasters.

However, it is the opposite relation that will be explored in detail in this dissertation. For a hazard to become a disaster depends on the coping capacities of the affected area. Looking at how a disaster affects ongoing conflict is thus one of several potential ways in which a society's coping capacities directly influence the course of a conflict (Papers II and III). There is a growing literature assessing how natural disasters affect armed conflicts, but its main concern has been how disasters affect the risk of conflict onset. The majority of existing studies apply force-based indicators, usually either precipitation or temperature (or a combination of the two), meaning that the objects of study are not necessarily disasters per se, but rather weather anomalies. The climate-conflict literature has been subject to numerous reviews (for a selection, see Theisen, Gleditsch and Buhaug 2013, Buhaug 2015, Ide 2017, Koubi 2019), which show that climate extremes can elevate conflict risk, but that this is most pronounced for communal conflict (Fjelde and von Uexkull 2012, Maystadt and Ecker 2014) and depends a great deal on the specific context in affected areas. Recently, there has been a move towards looking at effects for ongoing conflicts as well, and von Uexkull et al. (2016) identify that for agriculturally dependent and excluded groups, droughts add to existing grievances and consequently make sustained conflict more likely. An exception to the sub-Saharan focus of this literature (Adams et al. 2018) is provided by Eastin (2018), who finds that precipitation shocks and typhoons are associated with higher levels of violence, regardless of who initiates the violence. This is ascribed to increased opportunities for recruitment and support from affected populations for both conflict parties.

Focusing on the conflict actors appears to be pivotal for assessing the effects of disasters on ongoing conflict, and in order to keep a conflict going, involved actors rely on a set of capacities that determine their strategic and tactical choices. These capacities are not fixed, but consist of material capacities such as weapons, transport means and finances, as well as human resources. Each warring actor's total capabilities differ, and it is not necessarily the absolute capacities that matter, but rather the relative capacities between the two parties (Cunningham, Gleditsch and Salehyan 2009, Buhaug, Gates and Lujala 2009). In addition to present endow-

ments, future costs and benefits induced by current action or responses to external factors are also likely to influence the actions of the actors. A disaster will directly impact conflict activity through its effects on the material and human capabilities of the warring actors. Disasters can also indirectly affect governments and insurgents through their impacts on affected populations. This is particularly the case when the responsibility for dealing with the disaster is in the hands of the government and/or insurgents – the latter is usually the case when insurgents provide infrastructure and other public services. The manner in which the government and/or insurgents respond to disaster can have political consequences for their ability to garner future public support. Thus, disasters will also have indirect impacts on the tactical choices of the warring parties. In this way, future (public) support feeds into actor capabilities by placing restraints on current actions. This reflects the "triangular" character of civil wars (Kalyvas 2006), where civilian support can be essential for the outcome of the conflict.

Studies applying consequence-based measures tend to be case-based, looking at either one specific disaster, or several disasters within one country. This allows for going into more detail and assessing the impacts of disasters for the different conflict actors. Looking specifically at the rebel side of the story, Walch (2014) assesses how typhoon Pablo, which hit in the Philippines in 2012, induced one rebel group to obstruct the government's relief efforts, while the other collaborated with government efforts. Because of high levels of pre-disaster hostility, the New People's Army (NPA) refused to cooperate with the government in the aftermath of the disaster, and often called them out for providing poor relief. The Moro Islamic Liberation Front (MILF), on the other hand, assisted the government's relief efforts. Walch ascribes this difference to lower levels of pre-disaster hostility, but also the fact that the social contract between the MILF and the affected population prescribes the group as responsible for the well-being of the population. In a related effort, Walch (2018) looks at the impact of disasters for rebel group recruitment. Looking at two particularly devastating typhoons, Walch finds that the rebels were weakened and that recruitment did not surge in the aftermath of the disasters. This supports the notion that disasters also weaken the capacities of insurgent groups, but goes against the widespread argument that destruction reduces the opportunity costs of joining insurgencies. In a novel quantitative study assessing the importance of actor capacities, Eastin (2016) attributes the prolonged conflict span after disasters to reduced government capacity to suppress insurgencies.

Going beyond armed conflict, several studies investigate the impact of disasters on political unrest/violence. These studies concern escalation processes that should be relevant for armed conflicts as well, and address the (presumptive) responsibility of the government to be prepared for disaster, or at least provide relief in its after-

math. Because of this responsibility, disasters can serve as catalysts for protests and civil unrest (Flores and Smith 2010, Drury and Olson 1998, Nardulli, Peyton and Bajjalieh 2015), and by the same logic they can also escalate repression by the government (Wood and Wright 2016). Expectations about relief and support are also highly relevant in conflict situations. In some instances, the government might be deemed accountable by the local population, while in other instances no one expects the government to do anything, making potential neglect irrelevant.

In the literature so far, while there has been a turn towards the impacts of hazards or disasters for affected actors and groups, existing quantitative studies tend to have a high temporal aggregation, often looking at how disaster impacts conflict on a yearly basis. This makes it difficult to separate immediate impacts from those taking more time to materialize (opportunity costs etc.). In addition to fighting capacities being directly impaired by a disaster, the case-based literature highlights the importance of the actors' responsibilities (or the expectations thereof) towards relief and post-disaster behavior. Such responsibilities add to the incentives to refrain from violence in the aftermath of disaster, and have been found to explain different outcomes across conflicts. Papers II and III are novel in taking these considerations into account in cross-country investigations. Going beyond expectations about relief, incorporating actual mitigating efforts, for instance in the form of development aid, is a discernible next step in this regard.

1.3.2 Coping capacities, aid and hazards

Moving to the lower right part of Figure 1.3, inflow of aid should, prima facie, increase the coping capacities of an area and make it more resilient to future adversities. Literature concerning the effectiveness of aid has predominantly looked at various economic indicators of aid-receiving countries in its evaluation of whether aid works or not. In an extensive meta-study, Doucouliagos and Paldam (2008, p.18) conclude that "the AEL [aid effectiveness literature] has failed to prove that the effect of development aid on growth is statistically significantly larger than zero. We are forced to conclude that aid has not, on average, achieved its stated aims of generating development". Of course, aid projects take many different shapes and forms, and range from general loans to small, concrete projects concerning land cultivation or vaccines. The purpose of these projects is nevertheless to end poverty by increasing recipients' current and future capacities, including their resilience towards future hardships, be it through economic, social or health-related means. Specifically, aid projects might increase the resilience to future climate extremes by providing for instance drought-resistant grains and other agricultural remedies, or by increasing the provision of water, food, and medicines, making people more adept at responding to current and future adversities.

It takes time for these projects to materialize into improved levels of development, and there appears to be a mismatch between the way in which the various targets are operationalized and the way their outcomes are measured beyond single-project evaluations. Instead of country-level growth, aid effectiveness at the local level could mean higher school enrolment, better vaccination coverage or more self-sustained agriculture. Highlighting the importance of the level at which one could expect to see results materialize, Dreher and Lohmann (2015) find that aid can have positive growth effects at the sub-national level. Taking adverse events into consideration provides a forcible way of assessing the degree to which aid efforts are successful, and in Paper I, we look at local health effects of aid across sub-Saharan Africa, and evaluate aid effectiveness by looking specifically at whether coping capacities are improved in the face of post-aid hazards.

Going beyond slow-moving economic growth indicators, much of the recent aid effectiveness literature assesses individual aid projects at the local level (see for example Crost, Felter and Johnston 2014, Gunawardena and Baland 2016), or different aid projects within one country (Kotsadam et al. 2018, Nunnenkamp, Öhler and Andrés 2017). Cross-country studies of this are – with the exception of Briggs (2017; 2018) – still rare , and Paper I begins to fill this gap, looking at health outcomes in particular. Following the notion that, in principle, a society or an area's current coping capacity should predict the inflow of aid to this specific area, and that in turn future coping capacities are enhanced, might not reflect reality. For aid to even have the chance to improve the situation for the recipients, it must reach those who need it, something that is often not the case. This is the topic of the next section, which will bridge the lower parts of the circle in Figure 1.3 by discussing how aid distribution might be affected by the presence of an ongoing conflict.

1.3.3 Aid and armed conflict

The majority of the aid literature concludes that the distribution of aid appears to be driven by the interests of the donor rather than determined by objective need (Neumayer 2003, de Mesquita and Smith 2009, Briggs 2017). Also within countries aid fails to reach the poorest regions (Öhler and Nunnenkamp 2014, Briggs 2018), something that has been ascribed to, for instance, lack of information on the part of the donor (Jablonski 2014). Multilateral development aid is predominantly channeled through national governments, which means that the recipient governments have a certain degree of influence over aid's distribution. The presence of a (state-based) armed conflict will likely reduce the incentives for a government to provide aid in ways that increase the capacities of their enemies (Aldrich 2010,

Paper IV).[10] Aid constitutes new resources flowing into an area, be it in the form of commodities provided as emergency relief, or reconstruction projects or health clinics. This means that it will, all else equal, increase the capacities of the recipients, and indirectly or directly influence the capacities of the conflict actors. Looking at sub-Saharan Africa, Strandow, Findley and Young (2016) find that military fatalities increase in locations where aid concentration is high, potentially reflecting increased capacities, or competition over these.

In addition to direct material enhancements, inflow of aid might also be crucial for attaining or attracting the support of the local population. This is corroborated by Crost and Felter (2015), who find that Philippine municipalities that were just eligible for one particular development aid program saw higher levels of insurgent violence than municipalities that were just below the qualification threshold because the programs threatened insurgents' local support. The same aid program was evaluated by Arcand, Bah and Labonne (2011), who find that different levels of violence across the Philippines could be ascribed to the different ideologies of the two insurgent groups, and that in areas where the aid program was seen as detrimental to the rebel's support, more violence ensued.

To the extent that governments can control the distribution then, their incentives for diverting aid away from areas inhabited by their enemies are high. Even more so if doing this has little consequences for popular support because there is no support for the government in affected areas to begin with. The final paper, Paper IV, concerns this nexus, and looks at the within-country determinants of aid in the Philippines. Tying together all three elements of the dissertation, the paper takes into account the role of extreme events in exacerbating affected areas' need for outside assistance, but also considers the fact that the presence of an armed conflict distorts the motivation for providing aid to areas in need – also if this need is enhanced by events that are external to the conflict situations, such as natural disasters.

1.4 Analytical approach

In the empirical assessments of the conceptual framework, an important contribution of this dissertation is the identification strategies used. This reflects the empiricist epistemological foundation of the dissertation, and the rigorous testing of both statistical models and their assumptions are all attempts to get at possible causal relationships. The problem with causal inference is of course that we can never observe the causality itself, even if we know that the cause occurred before

[10] From a logistical perspective, the presence of an armed conflict could also involve risks for aid workers (Hoelscher, Miklian and Nygård 2017), and the security situation might make it close to impossible to establish aid projects in the area.

its effect, that they occurred with spatial and temporal proximity and that the effect regularly occurs when the cause does (this is Hume's classical complaint; see Humphreys 2001, for an insightful account of it). Even though Sekhon (2009, p.487) argues that "without an experiment, natural experiment (...) or some other strong design, no amount of econometric or statistical modelling can make the move from correlation to causation persuasive", attempts to get at causal inferences are widespread in the quantitative conflict literature. This dissertation does not set out to find the cause with capital letters, but rather to see whether, and how, disasters can add explanatory power to the study of conflict dynamics, as well as how conflict and disasters might in turn influence the distribution of development aid. With this being the *explanandum* – what is to be explained – I then adopt a hypothetico-deductive model of inference seeking to"refute the most plausible [opposite] alternatives and generat[e] novel facts" (Elster 2015, p.20). Rapid-onset disasters are particularly suitable for analyses using difference-in-difference and regression discontinuity designs, where, if set up correctly, causal inferences can be made. In the case of drought, this is more difficult, but using matched wake analysis, Paper I still employs rigorous techniques to make sure that inferences can be soundly made.

1.4.1 The empirical utility of shocks

In addition to the climate-conflict literature, the dissertation also speaks to the conflict dynamics literature in general, which, despite a long research tradition, still exhibits substantial discrepancies between its theoretical and empirical approaches. Contrary to the empirically oriented conception of conflict dynamics which tend to compare changes *across* conflicts, the theoretical conceptions of conflict dynamics focus on changes *within* conflicts. An important foundation for this was laid by Axelrod and Hamilton (1981), who found that the Tit for Tat-strategy (where each player always does the same as the other player did in the previous round) would allow cooperation between self-seeking individuals in repeated games. Because actors are allowed to learn underway during the game, dynamism is inherent in these models, capturing the reactions of the actors to changes in the game (i.e. actions of the other player).

One approach that is apt at capturing dynamics involving changes in actors' behavior, endowments and structural conditions is agent-based modelling (ABM).[11]

[11] Bennett (2008), for instance, simulates the early dynamics of insurgency, arguing that the government's successful counterinsurgency (in the form of avoiding collateral damage in their targeting) in a conflict's beginning stages is crucial for a successful defeat in the long term. His model shows that insurgencies can spread as a result of the government's response to the insurgencies, highlighting the importance of tactics and responses to other actor's behavior (for a corresponding modeling effort, see Epstein 2002). Findley and Rudloff (2012) show that fragmentation is associated with

The appeal of ABM within the conflict dynamics universe is that complex computations make it possible to manipulate a shock or a change, hold everything else constant, and then see what happens. Nevertheless, even if this makes it possible to look at changes within armed conflicts, it is a predominantly theoretical venture because a conflict is an unfolding of events with many different processes going on at the same time. Consequently, defining any moment of change becomes difficult. A way to remedy this, and to empirically assess how an ongoing conflict changes/reacts to change, can therefore be to look at shocks. Shocks provide a defined moment of change, and allow a more empirical assessment of dynamics and change within a conflict than agent-based models.

Theoretically, the focus on shocks is not a new proposition. Weinstein (2007) argues that individual conflicts tend to follow the same trajectory unless they are exposed to a shock. Apart from changes in groups' economic endowments, Weinstein's expectation-altering shocks have not been the subject of widespread (quantitative) assessments. In economics, much research can be found on economic shocks and armed conflict, generally concluding that economic shocks and recessions act as triggers for instability (for a selection, see for example Miguel, Satyanath and Sergenti 2004, Elbadawi and Hegre 2008, Ciccone 2011). Looking at aid shocks specifically, Nielsen et al. (2011) assess how reductions in foreign aid weaken the government and incentivize rebel groups to attack. Similar to the literature on economic shocks/changes in endowments however, they investigate conflict onset rather than dynamics. Also the most recent, disaggregated literature struggles to escape the criticism that it is not really considering how dynamics unfold *within* conflicts, but rather looking at the influence of pre-conflict determinants.[12]

The emerging literature on disasters and conflict dynamics thus has the potential to get at changes within, rather than between, conflicts. Even though the manifestation of a disaster is dependent on the situation on the ground, the hazard occurs externally, and under certain conditions, a hazard can provide us with natural experiments – scenarios where assignment to treated and untreated groups are ap-

shorter wars because it weakens the combatants that split. What these modeling efforts have in common is that they assess changes within conflicts and how the "system" responds to changes, whether it be fragmentation (Findley and Rudloff 2012), government repression (Epstein 2002) or government targeting (Bennett 2008).

[12] A notable empirical study that captures dynamic processes within conflict is Raleigh and Choi (2017). They model actors' responses to other actors' behavior by identifying *spirals of violence*, where violence (against civilians) by one actor leads to successive violence by the other actor. By using vector autoregressive models they are able to capture feedback-loops and look at how violence evolves over time. This requires a disaggregated approach, but also reducing the sample (they look at two conflicts in DR-Congo and Sudan) in order to correctly specify the relevant parameters.

proximately random. In the case of looking at how an external shock might induce change within a conflict, the timing, and to some extent the location, becomes the random element making it possible to compare the situation before the shock (the untreated group) with the situation after the shock (the treatment group) because the only difference between the two is the shock (Paper II). Although the set-up does not qualify as a natural experiment in Paper III, the shock-element is important also here as it defines a time at which we should observe a change. Beyond the two papers concerning conflict dynamics, the notion of disasters as shocks is less temporally disaggregated but nevertheless still crucial in the assessment of whether aid effectively increases coping capacities (Paper I) and to what degree shock-induced needs determine the distribution of aid projects (Paper IV).

1.4.2 Spatial and temporal disaggregation

To be able to utilize a shock for causal inference, spatial and temporal proximity to the event is pivotal. Much existing literature has not been able to establish this in a satisfactory way. As neither disasters nor armed conflicts tend to affect entire countries, spatial disaggregation is necessary. Consequently, the quantitative literature on disasters and conflict is moving from the country-year approach towards single-country/case studies, allowing more information and detail to inform the analyses. This is not to say that the macro-level is not important. To the extent that the government is responsible for disaster response and reconstruction, the government of a country will be affected by a disaster regardless of where in the country it happens. But this is not the case for their adversaries, who are likely only to be affected by disasters that are proximate to their operating areas. Nevertheless, going down on the grid-cell level increases the risk of losing important information about what is going on at a higher level. Reflecting the point made by Sambanis (2004) about civil war as a phenomenon where we need to understand how micro-level motivations interact with macro-level structural conditions, a meso-level approach, looking at actors or geographic provinces appears more viable. Of course, provinces vary in size and type, but they often represent politically relevant entities, and can coincide perfectly with politically relevant groups/local government structures (Fjelde and von Uexkull 2012). Particularly in the absence of precise data on the whereabouts of specific groups, province-level units of analysis are feasible and provide within-country variation reflecting different local impacts. Spatial adjacency is important also in assessments of the effects of aid projects, both for how they might increase local populations' resilience to hardships, and when looking at whether aid projects are distributed according to need.

A high spatial resolution also increases the demands on the temporal scale. Using a yearly framework with lags means that the real time window in reality can be

as large as two years (the first day of the first year and last day of the year after), allowing for a lot of noise and other potential impacts. Particularly when assessing conflict dynamics where things can change rapidly. However, having daily data entails having to define the appropriate temporal window. Even if we only look at disasters that are rapid-onset, a daily resolution appears too short to capture potential effects (as getting an overview of the situation after a disaster even tends to take a couple of days or weeks). Most studies, including this dissertation, therefore adopt an exploratory approach where several different time frames are used. Finally, spatial and temporal considerations are important even if causal inference is not the objective, as the proximity to the events both in time and space can decrease measurement errors.

1.4.3 Data and measurement challenges

Consequence- versus force-based measures of disaster

As already mentioned, I rely on the term 'natural disaster' for disasters that were triggered by a natural hazard. However, there are two different ways of measuring a disaster: either force- or consequence-based indicators. In three of four papers, I rely on consequence-based measures of natural disasters. This means that only hazards hitting populations that were not resilient are considered disasters. This operationalization follows the inclusion criteria in the Emergency Events Database (EM-DAT) provided by the Centre for Research on the Epidemiology of Disasters (CRED). For a disaster to be included in this database – and consequently, for it to be included in the geocoded version of the dataset – one of the following criteria have to be met: either (i) ten or more fatalities are suffered, (ii) one hundred or more people are affected, (iii) a state of emergency is declared, or (iv) a call for emergency is made.

The consequence-based approach enables the inclusion of the social/human aspect of disaster, in line with the idea that a disaster only happens if a hazard hits a vulnerable population.[13] However, there are also challenges associated with this approach. The most important challenge arises when using a consequence-based measure to study outcomes that can potentially be affected by the same factors that translated the hazard into the disaster in the first place. This endogeneity concern must be taken seriously in any study using a consequence-based measure. By using an identification strategy that takes seriously the timing of the events studied, as well avoiding comparisons and generalizations across contexts where the resilience/vulnerability of societies are different, this concern can be mitigated. In all papers that use these measures, I have utilized very precise information on the

[13] It is possible to envisage disasters that do not affect people, but rather animals or ecosystems, but these are not relevant in the context of this dissertation.

timing of the disaster and the conflict activity, and I take great care to ensure that the sequencing is correct. In addition, I only look at the consequences of disasters that hit countries that are already experiencing armed conflict. This means that I am only comparing areas that are already susceptible to a disaster, not comparing for instance peaceful countries with conflict-affected countries.[14]

The other way of measuring a natural disaster, the force-based approach, is used in the first paper. Within this approach, a disaster is measured by the physical manifestations of the hazard, such as wind speed, precipitation and ground movements. This means that the human aspect of the equation is removed, and the measures are consequently independent of the situation on the ground. This allows standardization where deviations are not measured in absolute terms but rather as deviations from the normal (for the particular) area in question, and is consequently advantageous for comparisons across time and space.

However, the force-based approach also entails challenges. First, capturing natural hazards is more complex than it might seem. A flood can have many different or intertwined causes, ranging from precipitation, snow melt, and absorptive capacity of the ground, to terrain. Similarly, a storm depends on temperature, humidity, air wind and the rotation of the earth, making it difficult to identify storms based on wind speeds only. In the event of storms, it is often the associated storm surges that are most devastating, and these again depend on the coastal terrain. Moreover, the prevalence of storms is highly variant in space and time, generating massive amounts of data that make them difficult to capture post-hoc. It is easier to capture phenomena that, although highly variable in space and time, make sense to aggregate over time (days and months for instance). Consequently, rainfall deviation is the most commonly used force-based indicator for drought within the climate-conflict literature.[15] By also taking into account evapotranspiration, the Standardized Precipitation-Evapotranspiration Index (SPEI) enables detection of droughts that can be compared across time and space. Nevertheless, the force-based measures cannot say anything about the resilience to drought in affected areas. This means that they do not contain information about the outcome of the phenomena, whether a disaster materialized or not. Even if the standardization mitigates some concerns regarding this, assuming that the effect of a two-standard deviation reduction in rainfall over a month is uniform across areas might be problematic.

[14] An elaborate discussion of concerns related to measuring disasters this way are thoroughly discussed by Slettebak (2012).

[15] Precipitation levels have recently also been used to measure the prevalence of floods (see Eastin 2018).

Events data and reporting bias

Another data-challenge relates to the precision of the data, which becomes increasingly pertinent with the growing availability of disaggregated data. For instance, that the specific inclusion threshold for the EM-DAT is arbitrary is one thing, but the precision of these figures is perhaps a more serious issue. In a recent editorial, the CRED director discusses the difficulties associated with measuring the number of disaster deaths and affected people, and highlights the politically sensitive nature of death tolls after disasters (Guha-Sapir and Checchi 2018). They contend that this has always been the case in conflict settings as different actors have incentives to over-report the causalities inferred by the opponents, but that in the current day and age, this can also be seen outside conflict-settings. Calling attention to the disagreement over death tolls in Puerto Rico after hurricane Maria in 2017, they show that the traditional conception of natural disasters and their consequences as less susceptible to political controversy is no longer true. This caution is evident across the papers, and in absence of reliable data the severity of the disasters do not play a prominent in the analyses.

In addition to potential political biases in reporting, there is also the issue of accessibility, particularly when the reporting is dependent on media reporting. Both disasters and armed conflict are challenging situations to obtain information in. Eck (2012) and Weidmann (2015) discuss the implications of this for conflict data in particular. In addition to being challenging to reach, some conflicts and situations are deemed more newsworthy than other, making events that fall outside this category likely to be under-reported. Nevertheless, despite uneven reporting in remote areas as well as uncertainty relating to causality counts, both Eck (2012) and Weidmann (2015) conclude that events data is still valuable in empirical research, as long as the caveats are taken seriously.

Geocoding the disaster data

In order to be able to look at the prevalence of disasters on the sub-national level in this dissertation, I have geocoded the locations of just short of 7,500 rapid-onset disasters from EM-DAT. Floods, storms and earthquakes from 1960 to 2015 were extracted from the database, and split according to the different locations listed for each event. These locations were cleaned and matched with data on administrative boundaries provided by the Database of Global Administrative Areas (GADM) (Global Administrative Areas 2018). The GADM provides polygons for all administrative boundaries, and out of more than 30,000 disaster locations, 25,000 locations were matched with an administrative unit on the first, second or third level. This means that the geocoded dataset contains geographic polygons for all known locations of a given disaster. This constitutes an important addition to ex-

isting disaster datasets, and efforts to expand the dataset beyond the disaster types included in this dissertation are underway.

1.5 Presenting the papers

In addition to showing that natural disasters, armed conflict and aid affect each other in a circular and bidirectional manner, Figure 1.3 also points out which arrows are covered by each paper. Table 1.1 compares the four papers across nine different categories: disaster type, conflict dynamic, conflict type, relevant actors, mechanisms, unit of analysis, temporal disaggregation, geographic coverage and temporal coverage. The first paper assesses the relationship between aid and local coping capacity to drought, while the two subsequent papers go into depth concerning the impact of disasters on conflict dynamics. The second paper looks at how disasters influence conflict actors' capacities and their ability and motivation to keep fighting in the aftermath of calamity, while the third paper looks specifically at riverine floods' impact on conflict locations. Finally, the fourth paper takes all three elements into account, exploring the degree to which disasters and conflict determine the distribution of aid projects across the Philippines.

Table 1.1: Overview of the four papers

	Disaster type(s)	Conflict dynamic	Conflict type	Actors	Mechanisms	Unit of analysis	Temporal disaggregation	Geographic coverage	Temporal coverage
Paper I: Coping capacities	Drought	(Conflict incidence)	(Armed intrastate & communal conflict)	World Bank & survey respondents	Aid effectiveness	Children living within 50 km of an aid project	Monthly	sub-Saharan Africa	2001-2006
Paper II: Disasters & conflict intensity	Floods, storms & earthquakes	Conflict intensity	Armed intrastate conflict	Conflict actors	Actor capacities	Provinces (first-level administrative units)	Yearly	Worldwide	1989-2004
Paper III: Fighting the River	Riverine floods	Conflict intensity and diffusion	Armed intrastate conflict	Conflict actors	Inaccessibility	Flooded conflict-zones (various sizes)	Daily	Worldwide	1989-2015
Paper IV: Aid distribution in the Philippines	Floods, storms, landslides & earthquakes	Conflict incidence & excluded groups	Armed intrastate conflict	World Bank & Philippine government	Aid distribution	Provinces (first-level administrative units)	Yearly	Philippines	1996-2012

1.5.1 Paper I: Development aid, drought and coping capacity

Co-authored with Siri Aas Rustad and Halvard Buhaug

In this paper, we assess the short-term health impacts of World Bank development aid projects across sub-Saharan Africa. Specifically, we investigate whether these aid projects make the recipient populations more resilient to future climate extremes by looking at the prevalence of under-5 child wasting. Knowing that wasting, or children's weight-to-height ratio, is a result of acute food deprivation (or illness), we argue that looking at health outcomes represents a viable way of measuring aid effectiveness both across and within recipient countries.

Our first expectation reflects precisely this, namely that development aid projects reduce the local risk of child wasting by increasing welfare and food security for recipient populations. Following this, we also propose that the presence of these projects makes the population more resilient to future drought, meaning that a post-drought wasting should be less in areas where aid projects were implemented compared to areas where this was not the case. Relatedly, we also expect this effect to be stronger when the development aid projects are geared towards the agricultural sector, where disaster and climate resilience has become an integral part of improving agricultural productivity and food security.

We test these propositions using survey data from the Demographic and Health surveys of nearly 150,000 respondents across 16 sub-Saharan African countries in combination with georeferenced World Bank ODA projects and high-resolution weather statistics. In order to maximize the potential for inference, we apply coarsened exact matching, and use local aid allocation as the treatment and drought as post-treatment shock. The matching ensures that the treated and untreated areas we compare are similar on factors that predict inflow of aid. Identifying first the base condition that drought is associated with increased child wasting, the analysis reveals little benefit of development aid on child nutritional status under normal meteorological conditions. However, among children exposed to drought, proximity to preceding development aid projects significantly reduces average weight loss. Aid projects targeting the agricultural sector perform equally well as, but not better than, other aid projects in reducing child health sensitivity to drought.

The paper is novel in its systematic assessment of the implications of official development assistance for recipient populations' environmental coping capacity. While the merit of ODA in facilitating long-term growth is debated, this study finds clear and important effects of development aid on recipient communities' capacity to cope with future climatic extremes.

1.5.2 Paper II: Windows of opportunity? Natural disasters and intensity of armed conflict

This paper looks at how rapid-onset disasters affect the intensity of armed conflict, depending on the location of the conflict vis-à-vis the disasters. When the two are overlapping, the capabilities of both insurgents and governments are negatively affected, while only governments are affected when the disasters happen outside rebel groups' operating areas. Specifically, the paper argues that when disasters and violence coincide, the level of violence will decrease in the immediate aftermath of a disaster, reflecting decreased capabilities to continue to wage war. However, disasters also involve a different type of cost: public support. To the extent that conflict actors are responsible for the provision of public goods, failing to provide disaster relief can incur losses in support. Therefore, the paper also holds that when insurgents are responsible for this, post-disaster violence will go down. The final expectation of the paper concerns the level of violence in areas that were not affected directly by a disaster, and where only one actor, the government, is adversely affected by the disaster. This is argued to provide a window of opportunity for the insurgents to intensify their effort, meaning increased post-disaster levels of violence.

The proposed relationships are tested on floods, storms and earthquakes which occurred in a country experiencing armed conflict between 1989 and 2014. Using a regression discontinuity design, the paper compares the level of violence within a province in the thirty days before and after a disaster has hit the country in question. This means that the situation resembles that of a natural experiment, and any difference between the two periods can be ascribed to the disaster.

The analysis shows that, on average, the intensity of armed conflict is reduced in the immediate aftermath of a disaster when a disaster hits a violent province. This is only statistically significant for territorial conflicts, where insurgents often are the de-facto state and have stronger incentives for refraining from violence than in situations where the affected populations expect the government to provide relief. Contrary to the expectation however, conflict intensity outside disaster-affected areas appears to be more or less unaffected by the disaster, although in many instances the level of violence appears to increase.

The paper illustrates the utility of using disasters in the empirical investigation of conflict dynamics. By looking at (external) interventions that happen *during* conflict, the analysis advances beyond the traditional static approach of existing literature that considers only determinants of conflict dynamics ex ante. In addition, the paper illustrates the importance of spatial disaggregation in showing that the effects of a disaster on conflict activity are not uniform within countries.

1.5.3 Paper III: Fighting the river: Flood impacts on local conflict dynamics

Co-authored with Martin Smidt

In this paper, we look at how one specific disaster type, riverine floods, influences the prevalence and location of conflict activity. By identifying riverine floods that affect active conflict zones, we investigate how disasters influence the spatial strategies of conflict actors. Going beyond existing literature on the topic, this paper evaluates first whether flooded areas see cessations of hostilities, and second whether this is offset by increased conflict activity outside the flood's catchment area. Theoretically, we argue that even though floods make affected areas non-navigable, such logistical constraints are likely to be temporary, and we expect the level of violence to return with time. This resumption, we argue, is also more likely when insurgents have strong ties to flooded areas, both symbolic and material. Following a conflict diffusion logic, we also expect the reduction of violence in flooded areas to be offset by an increase in violence in the remainder of the affected province.

To test these assumptions, we join flood data from the geocoded version of the EM-DAT emergency events database with geographic information on rivers to identify the spatial prevalence of the floods. Information on the flooded areas is then combined with geolocated conflict events from the UCDP-GED database. The analysis covers 15 countries where floods and state-based conflict events overlap in time and space between 1989 and 2015. We take an exploratory approach to the spatial and temporal boundaries of this overlap, using geographical buffer zones between 3 and 10 kilometres around flooded rivers and time-periods from 60 to 150 days before and after the disasters.

The analysis shows that, on average, conflict activity is lower in the 90 days after disaster than it was in the equivalent pre-disaster period. This reduction is also stronger when insurgents have few specific ties to the flooded areas, indicating that the conflict-dampening effect of floods depends on the strategic and symbolic importance of the territories. We do not find that local flooding has low explanatory powers on impacts of conflict activity outside the flooded conflict zones in the period after the flood. Looking at a few, but crucial, cases thus confirms that effects are highly localized, and provides some indication that effects across space are stronger during a flood than after it.

1.5.4 Paper IV: Disaggregated determinants of aid: Development aid projects in the Philippines

The fourth and final paper looks at the case of the Philippines to illustrate how different province characteristics influence the dispersal of aid projects. The paper

argues that extreme events such as natural disasters and armed conflict must be taken into account when estimating an area's need for aid. Both disaster and armed conflict exacerbate the need for aid, ceteris paribus, and targeting of disaster- and conflict-affected areas are explicit donor strategies. Revisiting the classical debate on need versus donor interests as the best predictors of aid, the paper also argues that in the same manner as donor interests predict the distribution of aid across countries, domestic political alliances are a strong predictor of who gets aid within a country. In effect, excluded groups should be less likely recipients of aid projects, even if need predicts the opposite.

To test these propositions the paper looks at World Bank development aid projects to Philippine provinces from 1996 to 2012, and uses a logit random effects model to assess the predictors of aid projects across the country. The analysis shows that low scores on the conventional predictor of aid, the HDI-index, predicates inflow of new aid projects in politically excluded majority provinces. HDI matters less for Christian majority provinces (the politically dominant group), but these provinces are more likely to receive new aid projects, period. Previous disaster exposure increases the likelihood of receiving new aid projects somewhat, but this is not a strong predictor of aid. For conflict exposure, the results show that previous conflict exposure only increases the likelihood of receiving aid projects for the politically dominant areas.

In conclusion, the paper makes a case for including extreme events such as disasters and conflict in the assessment of within-country need for aid. It also shows that, despite good intentions on the part of mulitlateral aid agencies, in this case the World Bank, domestic political alliances, which are closely associated to ongoing armed conflict, are the most important predictor of aid distribution, sometimes at the expense of those areas that have the greatest need for it.

1.6 Concluding remarks and way forward

To better understand civil war, Sambanis (2004, p.272) argues we must get at the "combination of micro-level motives and macro-level structures that is unique to civil war". If we want to understand change within conflicts, looking more closely at those conflicts seems essential. This dissertation finds that natural disasters can (temporarily) reduce violence levels in ongoing conflict. This effect is highly localised however, and also depends on the degree to which the affected populations count on relief from the conflict actors. The dissertation also finds that ongoing conflicts can influence one of the most important tools for responding to disasters, namely aid. While development aid projects can make populations more resilient to subsequent extreme weather, in order for aid projects to increase local coping capacities and resilience, aid must be distributed to those who need it. The disser-

tation suggests that this is in fact not the case, as recipient governments can employ substantial discretion in the domestic distribution of aid projects, using it to reward their own supporters rather than distributing it according to objective need.

The importance of spatial and temporal proximity is illustrated by the apparently contradictory findings in the two papers concerning disaster and conflict dynamics. The first (Paper II) finds that the level of violence in the first month after the onset of a disaster decreases, and significantly so in territorial conflicts. In conflicts where the objective is secession, insurgents are often considered to be responsible for public services – including disaster relief – in the contested area. Failing to provide relief could thus incur losses of public support, adding incentive for the cessation of fighting activity. Contrastingly, the paper that looks at floods only (Paper III) finds that the reduction in violence after a flood is lower when territory is valuable for the insurgents, including when the conflict is territorial. However, this need not necessarily be a discord, as the latter study has a wider time-frame, and higher levels of violence might come after water levels have withdrawn. Floods are not the most severe disaster type, meaning that things might return to 'normal' after a flood faster than after, for instance, an earthquake. That post-disaster conflict dynamics depend on the relationship between the insurgents and the local population confirms earlier findings on rebel group behavior during disasters (Walch 2014; 2018).

Moreover, the dissertation provides a valuable methodological contribution with respect to the applied identification strategies, which make it possible to get very close to the objects of study, even if the statistical significance is not soaring. The first paper relies on matching in order to reduce model dependence at the micro-level, while the second uses a natural experiment set-up. The third paper, which has the most high-precision identification strategy, takes an exploratory approach suited to the low N. The final paper is the least disaggregated, but uses provinces as the unit of analysis, departing from an unlikely assumption concerning within-country uniformity. The dissertation consequently adds to a growing literature applying sub-national spatial units of analysis (see for instance Rustad et al. 2011, De Juan and Pierskalla 2014, Wig and Tollefsen 2016). In terms of geographical coverage, it also avoids the "African bias" that characterizes much of the climate-conflict research (Adams et al. 2018). This dissertation is not the first to use external shocks in order to make inferences about their consequences, but it is novel in applying disasters to the understanding of conflict dynamics. From a policy perspective, if we want to make conflict less prevalent, it is important to understand how what happens during a conflict influences its course – not only knowing what might make it long or short before it breaks out. That being said, the dissertation also shows that local vulnerabilities are important, and that it is detrimental not to

take them into account in efforts to mitigate the adverse impacts of both disasters and armed conflict.

In terms of scope conditions, both papers on the effects of disaster on conflict deal with the relatively rare situation where a disaster happens in the same area as an ongoing armed conflict. This means that the data basis is modest, reducing the potential for generalization of the findings. The limited availability of high-precision data on these phenomena also warrants that future research goes more into depth in relevant cases, in order to improve our understanding of how conflict dynamics are influenced by disasters and other external events. For the papers concerning aid (papers I and IV) inference is limited by the fact that the aid projects included are World Bank development aid projects (specifically from the IBRD and IDA lending lines) only. Consequently the results might not apply to aid projects from any donor. However, to the extent that the projects are funneled through local governments, the findings might be indicative for other types of development aid. The World Bank is one of the most important multilateral aid agencies, and further investigations of the degree to which similar agent-principal dynamics exist also beyond this actor is important.

In addition to its contributions, the dissertation has also sparked many new questions and avenues for future research. One important aspect that has received little attention is the role of local institutions. One thing is the expectations of local populations as to who is responsible for responding to disasters, as well as conflict, but the ability of local institutions to mitigate impacts, for instance, decidedly plays an important role. The lack of data on this has been identified by many, but increasing availability of survey data on the perceived quality of local institutions is making this an emerging research agenda within the quantitative conflict literature. Related to this, looking more in depth at the role of insurgents in providing public services would also offer important insights into how disasters, conflict and aid unfold and affect one another. The conventional quantitative divide between territorial and governmental incompatibilities are hardly sufficient in this respect. Situations where insurgents are a de-facto state are prevalent also in governmental conflicts, and despite notable contributions from comparative case studies (for instance by Walch 2016), knowledge on this across countries is still scarce.

Finally, other types of conflict dynamics could also be explored in this context. For instance, the roles of both disasters and aid distribution for the declaration of ceasefires is still poorly understood. The effects of disasters likely also change as weeks and months pass, and investigating the effects over time is important, particularly from a policy perspective. After disasters, things eventually return to normal, and knowing when, for instance, peace-keeping efforts are most effective should be a priority. Lastly, looking at the degree to which extreme events pre-

dict sub-national distribution of development aid projects outside the Philippines would make it possible to look closer at what determines the amount of discretion domestic governments have in the distribution of (multilateral) development aid across the world. Particularly in the light of the Sustainable Development Goals, such efforts appear critical.

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Chapter 2

Development aid, drought and coping capacity

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Abstract: Climate change is a major threat to sustained economic growth and wellbeing, particularly in the Global South. To what extent does official development assistance (ODA) strengthen recipient communities' capacity to cope with climatic extremes? Here, we investigate whether inflow of development aid mitigates adverse health impacts of subsequent drought among children under 5 years of age, drawing on survey data from nearly 140,000 respondents across 16 sub-Saharan African countries in combination with georeferenced World Bank ODA projects and high-resolution weather statistics. Using matching to improve inference, the analysis reveals little benefit of development aid on child nutritional status under normal meteorological conditions. However, among children exposed to drought, prior aid allocation is associated with significantly reduced weight loss. While the merit of ODA in facilitating long-term growth remains debated, this study finds clear and important effects of development aid on recipient communities' capacity to cope with future climatic extremes.

2.1 Introduction

The first ambitious goal of the recently concluded United Nations Millennium Development Goals project was to eradicate extreme poverty and hunger, including halving the proportion of people worldwide that suffer from hunger by 2015. With a handful of exceptions, all developing countries managed to accomplish the latter target, denoting a remarkable improvement in global food security (UN 2015). However, in the most recent years, the global rate of undernourishment has again been on the rise. The leading cause of growth in hunger is escalating violence in war-torn countries, compounded by climate-related shocks, notably drought (FAO et al. 2017; 2018). Extreme weather events are projected to become more frequent and more severe as a result of global warming (Fischer and Knutti 2015, Stott 2016), directly threatening agricultural productivity and food security in fragile regions of the world. In the absence of conscious adaptation and sustainable development, many societies risk being increasingly exposed to rampant and recurring episodes of acute hunger and malnutrition (Dawson, Perryman and Osborne 2016, Lesk, Rowhani and Ramankutty 2016, Nelson et al. 2014, Springmann et al. 2016).

In this paper, we ask: what are the short-term health impacts of development aid, and to what extent does aid reduce individual vulnerability to future climatic extremes? Official development assistance (ODA) projects come in many forms and their overall success in promoting economic growth is debated (Doucouliagos and Paldam 2008, Easterly 2003, Sumner and Glennie 2015). However, to the extent that development aid leads to general improvements in physical infrastructure, sanitation and health provision, agricultural productivity, female empowerment, and/or educational opportunities, it may also increase communities' pool of skills and resources needed to cope with disaster. In addition, development aid efforts increasingly encompass disaster relief and resilience strategies (Paul 2006). Even if development aid may be formally distinct from emergency relief aid, most ODA projects target populations that are vulnerable to climate-driven food security threats in their efforts to spur economic development.

Focusing on multilateral ODA provided by the World Bank, we investigate the extent to which the inflow of development assistance to an area (i) has a measurable and direct effect on recipients' health conditions, and (ii) results in the recipient population being less adversely affected by subsequent drought. In terms of health outcomes, we study extent of wasting, or low weight-for-height ratio, among children aged 0–5 years. Wasting is a common indicator of acute undernutrition, which often comes as a result of disrupted food access during drought. We adopt an inclusive approach to the research question by first considering the average effect

of all aid projects, since individual health and wellbeing are determined by many factors beyond local food production. We then assess agricultural development projects specifically, which most directly target communities' food production and livelihood systems and therefore should have particularly beneficial consequences for recipients' sensitivity to drought.

In order to maximize the potential for general inference, we draw on data on nearly 140,000 children from 32 household surveys across 16 sub-Saharan African countries since 2001 from the Demographic and Health Surveys (DHS) program, in combination with georeferenced development aid projects and high-resolution meteorological data. Using a research design with matching, which reduces model dependence, we estimate the isolated average treatment effect of receiving development aid on extent of child wasting, accounting for variation in respondents' post-treatment drought exposure. In line with earlier research (e.g. Kumar, Molitor and Vollmer 2016), we find that recent drought exposure has a significant negative impact on child nutritional status. The analysis provides little evidence of a direct health benefit of ODA under normal conditions (see also Williamson 2008, Wilson 2011). However, among children exposed to drought, we find that proximity to a recent development aid project site significantly reduces the observed level of undernutrition. We then zoom in on the subset of aid projects that directly targets local food production systems. Here, results are weaker, although the overall pattern replicates the general results, whereby agricultural aid has a larger mitigating effect on child weight loss among drought-affected respondents. We conclude that even if the macro-economic merit of official development assistance may be uneven, development projects significantly reduce child health risk imposed by future drought in the short to medium term. In the next section, we briefly review the scientific literature on causes of child malnutrition, followed by an outline of how development assistance may curb negative health impacts of drought-related agricultural production shocks. We then present the materials and methods and document the results from the statistical analysis. We end by discussing some implications of our results for future research and policy.

2.2 Drivers of child malnutrition

Wasting, or below-normal weight-for-height ratio, is the standard anthropometric measure of acute malnutrition for children aged 0–5 years (WHO and UNICEF 2009). Unlike other measures of undernutrition, such as stunting (height-for-age), wasting can emerge quickly and is usually the result of recent acute food deprivation or severe illness (Smith and Haddad 2015). Child malnutrition can result in developmental impairment, such as growth failure, delayed motor and cognitive development, diminished immunocompetence, and increased morbidity and mor-

tality (Martorell 1999), and impacts are usually more damaging for the youngest children (Hoddinott and Kinsey 2001, Lentz and Barrett 2013). One study calculates the annual cost of child wasting at 3.1 million lives, or around 45% of all under-5 deaths globally (Black et al. 2013). Most chronically malnourished people are found in Asia, although Africa has the highest density and it is also the continent that has experienced the least improvement in food and nutrition security in recent decades. Moreover, the prevalence of undernutrition exhibits strong subnational variation even in very poor countries (Osgood-Zimmerman et al. 2018). 80% of the hungry are found in the countryside, notably among smallholders, pastoralists, and landless rural poor (Sanchez and Swaminathan 2005).

The estimation of individual weight-for-height score is done in relation to an international reference population of children at the same age and sex, traditionally provided by the US National Center for Health Statistics and adopted by the World Health Organization (WHO). The resulting score is then standardized (the so-called WHZ index) to facilitate comparison across children and child populations. WHO defines moderate wasting as two standard deviations (SD) below the reference median (WHZ $<$ -2), whereas the threshold for severe wasting is set at 3SD below the reference value. In the reference population, 2.3% of children are classified as moderately undernourished while 0.13% are severely underweight. The true global extent of wasting is well above this share, since malnutrition is much more widespread in countries in the Global South than in the reference population.

The violin plots in Figure 2.1A show the distribution of observed WHZ scores among rural children in selected sub-Saharan African countries, based on available DHS survey rounds since 2001 (N=138,103). The plots reveal considerable variation across countries, although most exhibit median WHZ scores well below the WHO reference. Overall, Mali has the largest negative median value (0.69 standard deviation below the reference) but the largest share of severely undernourished children (WHZ $<$ -3) in our data is found in Nigeria (4.3%). Note that these values are sampled across different years, 2001–2016, and only consider rural respondents. According to the latest global statistics, around 51 million children were classified as wasted in 2017 (UNICEF, WHO and The World Bank 2018).

High rates of malnutrition are closely related to armed conflict, which causes massive human and material losses, hampers economic activities, triggers capital flight and forced displacement, and erodes the social fabric required for peaceful interaction. Food crises are often especially acute when conflict overlaps with natural hazards. The Food and Agriculture Organization of the UN (FAO) has concluded that the recent deterioration in global food security is due to the compound effect of escalating conflicts and climate-related shocks (FAO et al. 2017).

Drought and other forms of extreme weather events can severely threaten food security also in the absence of political turmoil (Ebi and Bowen 2016), especially where food provision and income are dependent on local agriculture, where food and trade markets are inefficient, and where road and transportation networks are poorly developed. For example, Mulmi et al. (2016) and Shively (2017) find solid evidence that agroclimatic factors and rainfall variability affect children's height-to-age ratio in Nepal and Uganda. Health impacts further depend on baseline vulnerability, which is determined by a host of individual-, household-, and context-specific factors, including age and gender, mode of livelihood, poverty and other socioeconomic conditions, and political status of the affected population (e.g. Cutter 2017, Grace et al. 2012, Hoddinott and Kinsey 2001, Jankowska et al. 2012). At the same time, much of our current knowledge about climatic drivers of individual-level wasting is derived from single-country studies, and cross-country comparative assessments reveal significant cross-sectional heterogeneity in child malnutrition severity as well as its correlates (Akombi et al. 2017).

To verify that climatic conditions influence child health across contexts, we estimate the average effect of drought severity on WHZ score of children under 5 in a pooled sample of 138,103 DHS-surveyed children, identical to the sample shown in Figure 2.1A, controlling for basic background factors. As revealed in Figure 2.1B, there is a statistically significant association between drought exposure over the past 12 months and child wasting, whereby more severe droughts are linked to lower weight-for-height scores. According to this model, a severe drought, equivalent to 1.5 standard deviations drier than normal meteorological conditions, reduces the predicted WHZ score by around ten percentage points (0.1 standard deviation from the reference median), all else constant. While this effect is hardly trivial, the magnitude of the effect is modest when compared to some of the controls. We also see that child wasting risk peaks around the age of 1–2 years, whereas the youngest children, most of whom benefit from breastfeeding, are the least likely to be undernourished (Alderman, Gentilini and Yemtsov 2018, Black et al. 2013). See Materials and methods section for details on measurements and Table A.4 in the Appendix for complete model output.

2.3 Health benefits of development aid

Few ODA projects have reduction in hunger as the main operational goal. Yet, since food security is closely linked to household wealth and development, there is good reason to anticipate that aid projects that facilitate economic growth also reduce the rates of chronic and acute undernutrition in a population. Thus far, the jury is still out as to the general effectiveness of development aid (Clemens et al. 2012, Dreher and Lohmann 2015, Easterly 2003). Explanations for why foreign

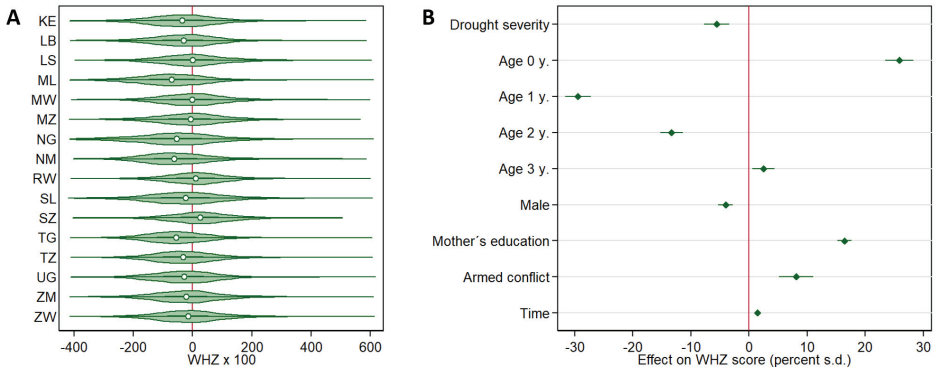

Figure 2.1: Distribution and determinants of under-5 wasting in 16 sub-Saharan African countries. Panel A shows the distribution of weight-for-height (WHZ) score among under-5 children of rural DHS respondents in Kenya (KE); Liberia (LB); Lesotho (LS); Mali (ML); Malawi (MW); Mozambique (MZ); Nigeria (NG); Namibia (NM); Rwanda (RW); Sierra Leone (SL); Swaziland (SL); Togo (TG); Tanzania (TZ); Uganda (UG); Zambia (ZM); and Zimbabwe (ZW). Panel B shows ordinary least squares regression coefficients of determinants of under-5 WHZ score with whiskers representing 95% confidence intervals. The horizontal axis is expressed as percent of a standard-deviation change in WHZ score with a one-unit increase in the independent variable (N = 138,103 children).

development assistance has a modest track record include arguments that recipients are unable to absorb capital flows, that aid attracts corruption and helps keep bad governments in power, that it leads to currency depreciation, and that it reduces incentives to improve productivity, thus adversely affecting the local labor market. The temporal aspect of aid effectiveness is also a source of some controversy (Clemens et al. 2012); how soon should one expect the benefits to materialize? Ultimately, aid effectiveness in terms of fostering long-term economic growth is likely to depend on the quality of governance and institutions in the recipient country and the size and persistence of investments (Asongu and Nwachukwu 2016, Booth 2012, Sumner and Glennie 2015, Tierney et al. 2011).

Macro-economic growth should not be the only yardstick of aid effectiveness, however. Because development projects often target specific sectors, like education, health or infrastructure, expecting these investments to show up in a country's GDP within a couple of years might be naïve, and the failure of such investments to directly boost national economic growth does not necessarily mean that the projects were unsuccessful. Indeed, recent research suggests that household-level socioeconomic status matters much more for child health than aggregate income and inequality measures (Harttgen, Klasen and Vollmer 2013, Reinbold 2011). Several recent efforts to evaluate aid impacts therefore take a more nuanced ap-

proach, considering health outcomes, educational improvements, and changes to the political system (e.g. Bermeo 2011, Christensen, Homer and Nielson 2011, Wilson 2011).

Many ODA programs also have a decidedly local or regional scope, again implying that country-aggregated statistics may be poorly suited to evaluate progress. More nuanced analyses that explore within-country variation in aid impacts provide more encouraging results. For example, Dreher and Lohmann (2015) use remote sensing data on night-time light emissions to track local effects of World Bank projects on economic activity in Malawi. Although the study is unable to demonstrate a causal effect, the authors found a significant positive correlation between aid and luminosity growth at the lowest administrative level. Similarly, a recent micro-level study of child health in Nigeria found that being close to an active aid project is associated with reduced infant mortality rates (Kotsadam et al. 2018).

In summary, acute malnutrition is the main cause of child wasting in poor societies. Low food security, in turn, is determined by adverse socioeconomic and political conditions and market failure, but also by nature- and human-driven disruptions of food provision, such as drought and conflict. To the extent that development aid programs spur local economic activity and improve access to core public goods, they should also increase average welfare in the recipient population. This gives the following basic expectation:

H1: Development aid projects reduce the local risk of child wasting.

Regardless of the direct effect of ODA on child nutritional status, there are good reasons to expect that inflow of human and monetary resources has beneficial consequences for communities' ability to cope with climate-driven food security threats. Looking specifically at food aid across Ethiopia in mid-1990s, Yamano, Alderman and Christiaensen (2005) reported that children exposed to severe crop failure experienced an average height growth loss of 0.9 cm over a six-month period, compared to areas where only half as much of the crop was damaged. The inflow of food aid, on the other hand, was found to increase growth of same-aged children at an average of 1.8 cm over the same period. Relatedly, Quisumbing (2003) found that food aid in Ethiopia has a positive direct impact on drought-affected children's weight-to-height rate. We thus propose:

H2: Development aid projects mitigate the effect of subsequent drought on local child wasting.

Since adverse nutrition-related outcomes, such as wasting and stunting, are tightly

linked with low or highly variable food availability at the local level, aid projects that specifically target the agricultural sector should have immediate implications for food and livelihood security. This link may be especially important in rural sub-Saharan Africa, where rain-fed agriculture constitutes the dominant sector in terms of employment and income (Diao, Hazell and Thurlow 2010, Irz et al. 2001). Consistent with this view, Kaya, Kaya and Gunter (2013) found that agricultural aid projects recorded in the OECD Creditor Reporting System reduced poverty both directly and indirectly through a positive effect on economic growth. Other studies offer more sobering conclusions. For example, Petrikova (2015) reports that agricultural aid is more context sensitive than multilateral and economic aid projects and only likely to improve food security in countries with well-functioning governance systems. A meta-analysis of 23 studies of local agricultural interventions that seek to improve child nutritional status failed to uncover a positive effect "with any level of confidence", although many of the assessed interventions were at a more local scale than conventional aid projects (Masset et al. 2012, 1). The authors judge the discouraging finding to be as much a result of methodological weaknesses and poor data in underlying studies as general evidence of aid failure.

Development projects targeting the agricultural sector often have more than one specific aim. Yet, many agricultural aid projects explicitly address drought risk and seek to build resilience to future drought exposure. This testifies to the fact that disaster/climate resilience has become an important component of projects that aim to improve agricultural productivity and food security. Our third expectation can be formulated as follows:

> *H3: Agricultural aid is especially effective in mitigating drought impacts on local child wasting.*

Of course, the expectations formulated above tacitly assume that development aid succeeds in reaching the most needy in the recipient population. It is entirely possible that aid interventions foster macro-economic growth without benefits reaching the rural poor. An oft-cited example of high productivity in combination with acute crisis is the famine in Ethiopia in 1972–73, which reportedly killed more than 40,000 people in the Wollo region at the same time as the country exported over 200,000 tons of grain (Asserate 2015, de Waal 1991).

Just as access to food can sometimes be a political tool, the domestic distribution of development aid can be influenced by political considerations among donor and recipient governments alike. Ethnic and regional favoritism is prevalent in many parts of Africa, and examples of funds being diverted to the home region or supporters of the incumbent abound (Hodler and Raschky 2014). For example,

Briggs (2014) found that aid to Kenya from both bilateral donors and the African Development Bank is biased towards the president's ethnic base. Similarly, Dreher et al. (2016) concluded that Chinese aid goes disproportionately to African leaders' ethnic groups and home regions. Such concerns have important implications for the analytical design of survey-based assessments of aid impacts, which we discuss below.

2.4 Materials and methods

In order to assess the effect of official development assistance on recipient populations' vulnerability to climatic extremes, we construct a comprehensive georeferenced dataset of individual respondents across sub-Saharan Africa from five main sources of data: (i) survey data on child undernutrition and household characteristics from the Demographic and Health Surveys (DHS); (ii) data on the establishment and location of World Bank-sponsored development aid projects from AidData; (iii) monthly statistics of local drought severity from SPEIbase; (iv) location of armed conflict battle events from the Uppsala Conflict Data Program's Georeferenced Event Dataset (UCDP GED); and (v) various location-specific controls. The unit of analysis is each child, aged 0–5 years, born by women interviewed in the DHS surveys. See Appendix for details.

We limit focus to rural respondents as this is where child malnutrition is most rampant and where development projects have the greatest potential to boost food security, health conditions, and coping capacity. The full dataset contains information on more than 150,000 rural children in 16 Sub-Saharan African countries, surveyed between 2001 and 2016, although missingness on some indicators reduces the valid sample to roughly 138,000 children. To our knowledge, this constitutes the most comprehensive study of its kind and the first systematic, cross-country analysis of development aid effects on local coping capacity using micro-level data.

2.4.1 Dependent variable: Wasting

The dependent variable is extent of wasting of each child under the age of 5 at the time of the interview, born by female respondents in 32 DHS household surveys over the period 2001–2016 (rounds 4–7). As an indicator of wasting, we use the standardized weight-to-height (WHZ) ratio, which is provided by the DHS survey (variable hw11). The WHZ score measures the child's deviation from the normative median weight in an international reference population, given age, sex, and height. To ease interpretation of the regression coefficients, observed values are expressed in percentages of a standard deviation from the median (i.e., WHZ/100). A WHZ score exceeding two standard deviations below the median reference is

classified as wasted, whereas three standard deviations below the normative median is the threshold for severely wasted. In the valid rural sample (N = 138,103 children), 11,365 of the surveyed children – one in twelve – fall into the wasted category, nearly four times the proportion in the international reference population (see also Figure 2.1A). The geographical locations of the observed children are defined by the survey cluster coordinates provided with the DHS data.

2.4.2 Treatment: Proximity to development aid project

The observed treatment in this study is World Bank interventions in the form of local development aid. To this end, we use geocoded data on World Bank-sponsored development aid projects provided by the AidData consortium v. 1.4.2 (AidData 2017, Findley et al. 2011). Ideally, we would have liked to include ODA information from other donors as well, but the World Bank aid dataset is the only one that covers all African countries with subnational coordinates, and thus better permits coupling with the DHS countries. This dataset tracks 5,684 World Bank projects across 61,243 locations globally between 1995 and 2014. The dataset gives information about, inter alia, type of project, when it was established and when it closed, total funding committed and dispersed (the latter indicator has considerable missing data), geographical coordinates of specific project locations (the average project includes 12 unique sites), and the precision of the geocoding. There is considerable variation in project duration, although most last between one and ten years before the operation is terminated or replaced by another project. We do not have information on dates of operation for individual locations within each project, so this is assumed to be identical to the project implementation period.

The treatment variables are constructed by first drawing a 50 km buffer around each DHS cluster centroid and then identifying aid project locations that fall within the buffer zone. To be counted, development projects must have been established between one and four years (13 to 48 months) prior to the date of the survey (see below for further details). We only consider project locations that have a spatial precision code of 3 or better, equivalent to second-level subnational administrative entity (ADM2: district/municipality) or lower, in order to ensure reasonable confidence in treatment exposure and to allow sufficient within-country variation. From this we create two main treatment variables:

i A binary variable (*aid*) coded 1 if the respondent belonged to a DHS cluster located within 50 km of one or more aid projects during the treatment period; and

ii. A binary variable (*ag. aid*) coded 1 if the respondent belonged to a DHS cluster located within 50 km of one or more agricultural aid projects during

the treatment period.

For both variables, the control group is drawn from matched respondents that were not exposed to any aid project during the specified treatment period.

2.4.3 Post-treatment shock: Drought

As a post-treatment shock, we consider the respondents' exposure to drought during the 12 months immediately prior to the date of their survey participation – in other words, after the initiation (and possibly, closure) of the aid treatment. To this end, we use the Standardized Precipitation-Evapotranspiration Index (SPEI) from SPEIbase v. 3.23 (Beguería et al. 2014), which is available as monthly georeferenced raster files at a spatial resolution of 0.5 x 0.5 decimal degrees. We link the SPEI data to the DHS respondents by means of a spatial overlay between the rasters and the survey cluster centroids. Individual children are then assigned the observed weather pattern of the grid cell within which they reside.

The preferred drought indicator is based on the SPEI-12 index, which measures, for every location and every month, the deviation in climatological conditions over the preceding 12-month period from the long-term norm for the given months and location, expressed in standard deviations. SPEI is superior to simpler precipitation-based drought indices as it additionally captures the effect of temperature and potential evapotranspiration anomalies, which exert a powerful influence on agricultural production systems. Importantly, the index is location-standardized, where deviation from median meteorological conditions is expressed in standard deviations, implying that every location has the same probability of experiencing drought of a given magnitude over time such that it can be considered a random post-treatment shock. By using the 12-month version of the SPEI index, we ensure that the drought variable covers the most recent growing season(s) regardless of the date of the DHS interview.

In the main models, the SPEI index is used for specifying weather-specific subsamples, where binary drought is defined as more than one standard deviation drier than normal conditions (SPEI $<$ -1) over the past 12 months (Table 2.1). Normal conditions are conventionally defined as weather within one standard deviation in either direction of the long-term norm. In the interaction models (Table 2.2) and the assessment of wasting determinants (Figure 2.1B), we use a continuous variant (*drought severity*). Consistent with the substantive focus on drought, positive SPEI values, which imply wetter-than-normal conditions, are censored (recoded 0) and the index is then reversed, such that higher values (expressed in standard deviations from long-term norm) denote more severe drought, to ease interpretation. See Table A.2 in the Appendix for descriptive statistics of all variables.

Figure 2.2 visualizes the spatial dimension of core variables across African countries covered in this analysis. While some countries display a relatively even distribution of aid projects across space, other countries vary greatly in local aid provision (Figure 2.2A). Similar intrastate variations can be detected for drought exposure (Figure 2.2B) and average under-5 extent of wasting (Figure 2.2C). These maps are generated from grid cell-aggregated estimates, which in some cases cover multiple survey clusters and ODA sites, sampled across multiple years, thereby masking more local variations.

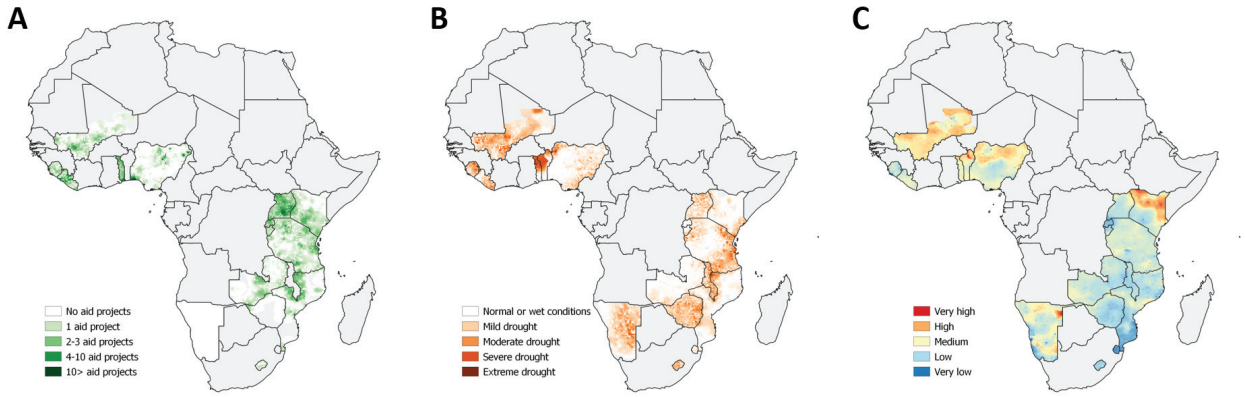

Figure 2.2: Aid treatment, drought exposure, and under-5 undernutrition. Panel A shows the spatial distribution of development aid project sites, summarized by 0.5 x 0.5 decimal degrees grid cell, observed 1–4 years prior to the DHS survey. Panel B shows the spatial extent of SPEI-12 drought, averaged over the same grid, observed during the last 12 months prior to the DHS survey ('normal or wet conditions' refer to SPEI score $>$ -0.5; 'mild drought' $>$ -1; 'moderate drought' $>$ -1.5; 'severe drought' $>$ -2; 'extreme drought' -2). Panel C shows grid-cell average extent of under-5 wasting, derived from the DHS survey ('very low' denotes WHZ x 100 score 0; 'low' $>$ -50; 'medium' $>$ -100; 'high' $>$ -180; 'very high' -180). Color scales are smoothed to facilitate visual interpretation. Gray areas are not covered by the study.

2.4.4 Sequencing, matching, and causal identification

In Figure 2.1B, we documented a statistically significant positive effect of drought severity on child wasting. If development aid projects have a measurable effect on recipient communities' ability to cope with future drought, as we proposed above, these projects must be active prior to the experienced drought. Since drought exposure is measured over the 12-month period immediately prior to the survey (t-12 to t-1 months), we focus on ODA projects that were implemented in the same area during the preceding three years (t-48 to t-13 months). The three-year treatment window represents a pragmatic midpoint between maximizing inclusiveness and maintaining a homogeneous treatment group.

Development aid is not distributed at random, so assessments of aid outcomes based on direct comparisons between aid recipients and a random control group would result in distorted estimates. To estimate unbiased causal effects, we must ensure that the control group matches the treated as closely as possible on covariates that predict aid inflow, such that the actual treatment is the only (or main) right-hand-side factor that differs between the samples. In order to achieve this, we implement coarsened exact matching (CEM). CEM is a powerful monotonic, imbalance-reducing matching method that accounts for potentially confounding influence of pre-treatment factors (Iacus, King and Porro 2012). Informed by past research on aid allocation, we consider five pre-treatment selection variables that are measured uniquely for each survey cluster over the two-year period prior to the earliest implementation of observed aid projects (i.e., t-72 to t-49 months):

a. (log) number of previous aid projects *(aid history*) from AidData (2017), since aid allocation often exhibits a distinct path dependence (e.g. Feeny and McGillivray 2008);

b. local exclusion from participation in national politics (*excluded*) from the Ethnic Power Relations project (Wucherpfennig et al. 2011), since aid distribution is sensitive to ethnopolitical dynamics in the recipient state (e.g. Jablonski 2014);

c. (log) local population size (*population*) from the Gridded Populations of the World v.4, facilitated via PRIO-GRID (Tollefsen, Strand and Buhaug 2012), since population size determines overall potential impact of aid;

d. (log) gross cell product (*GCP*), a local variant of gross domestic product, from G-Econ (Nordhaus 2006) and facilitated via PRIO-GRID, since level of poverty reflects neediness and donor interests (although recent research suggests that pockets of wealth may in fact be more likely to attract aid, see Briggs (2017)); and

c. (log) travel time by road to the nearest major urban center (*periphery*) from Nelson (2008), facilitated via PRIO-GRID, since logistical barriers and quality of infrastructure affect the feasibility of ODA implementation.

In addition, we impose exact matching on country codes (i.e., treated DHS respondents are matched with control respondents within the same country only) in order to account for systematic differences between countries in the likelihood of receiving development assistance. See Table A.4 in the Appendix and its associated section for further details. Figure 2.3 visualizes the sequencing of the empirical variables.

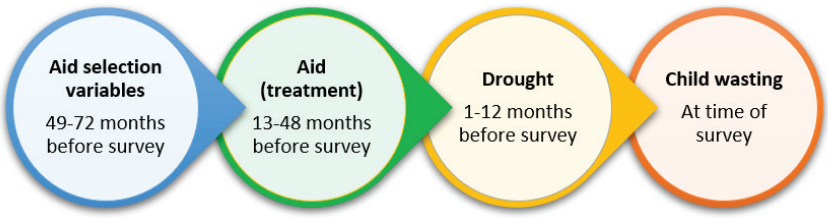

Figure 2.3: Key variables and time of measurement.

When the data have been matched, we use the weights from CEM to estimate the sample average treatment effect on the treated via robust ordinary least squares (OLS) regression. The matching procedure means that considerable shares of non-treated as well as treated survey clusters are excluded due to systematic differences in pre-treatment characteristics. Moreover, although the matching by design accounts for core contextual determinants of undernutrition, the models presented below additionally control for the occurrence of lethal battle events within 50 km of the survey cluster during the past 12 months (*armed conflict*), derived from the UCDP Georeferenced Event Dataset (Sundberg and Melander 2013), as well as basic individual-level characteristics from the DHS survey: age dummies (age 0–3 years; children aged 4 serving as reference category), gender dummy (*male*), and mother's level of education (*mother's education*) on a scale from 0 (no education) to 3 (higher education). In addition, we include a common time trend and fixed effects on the first-order subnational administrative level to account for omitted spatiotemporal determinants of child undernutrition.

Table 2.1: Aid and under-5 WHZ score under various climatic conditions

	All aid projects			Agricultural aid projects		
	(1)	(2)	(3)	(4)	(5)	(6)
Post-treatment weather:	All conditions	Drought SPEI < -1	Normal conditions	All conditions	Drought SPEI < -1	Normal conditions
Aid	-1.239	17.097**	-3.092	-6.616	4.121	-6.103
	(2.824)	(6.104)	(2.899)	(4.208)	(9.447)	(4.572)
Age 0 year	17.200**	-12.513	24.885**	19.435**	-17.005	30.732**
	(4.704)	(10.202)	(4.317)	(7.026)	(13.909)	(6.930)
Age 1 year	-36.703**	-62.162**	-32.361**	-23.175**	-52.920**	-18.347*
	(2.971)	(5.969)	(3.561)	(6.522)	(14.915)	(7.395)
Age 2 years	-16.548**	-21.488**	-15.193**	-17.379**	-30.558*	-14.617**
	(2.849)	(6.654)	(3.386)	(5.899)	(14.862)	(5.464)
Age 3 years	4.239	5.067	2.926	4.729	5.723	3.058
	(2.633)	(5.214)	(3.248)	(4.742)	(7.674)	(5.865)
Male	-2.562	-0.588	-4.517*	-8.000+	7.331	-11.432*
	(2.366)	(4.861)	(2.236)	(4.080)	(8.455)	(4.546)
Mother's educ.	11.879**	12.610**	10.640**	12.124**	7.698	12.170**
	(2.126)	(4.470)	(2.370)	(3.866)	(7.967)	(3.755)
Armed conflict	8.344	28.160*	5.706	12.646	-2.679	13.199
	(5.730)	(11.986)	(7.310)	(9.069)	(25.085)	(9.225)
Time	2.361**	1.055	2.832**	3.483**	2.851**	4.297**
	(0.448)	(1.268)	(0.361)	(0.577)	(0.965)	(0.658)
Constant	-51.795**	-41.017**	-54.656**	-50.359**	-67.394**	-48.008**
	(6.667)	(10.464)	(7.893)	(12.551)	(15.689)	(14.106)
Observations	48,139	6,682	36,347	15,667	3,146	11,692

Note: OLS regression coefficients with standard errors clustered on DHS survey clusters in parentheses;**p<0.01, *p<0.05, + p<0.1.
Constants for admin 1-level regions estimated but not shown. Dependent variable is WHZ index x 100.

2.5 Results and discussion

Table 2.1 presents the main results of the analysis. Model 1 contains all matched child observations, using proximity to any development aid project (1–4 years before the DHS survey) as the treatment. As evidenced by the small and insignificant regression coefficient, aid does not have a measurable, direct impact on child health – contrary to Hypothesis 1 but consistent with recent research that questions the effect of aid on economic growth (e.g. Young and Sheehan 2014) and poverty reduction (e.g. Page and Shimeles 2015).

The controls behave as expected: extent of wasting is generally the lowest for the youngest children whereas one- and two-year olds appear to be most vulnerable to food security threats, compared to the reference category. We also find solid evidence that the household's socioeconomic status, represented by the mother's level of education, greatly affects child nutritional status. A shift from no education to higher education (three steps on the categorical education variable) implies an estimated improvement in WHZ score exceeding one-third of a standard deviation, all else equal. Proximity to armed conflict events is inconsistently associated with weight-to-height ratio and the gender gap is small. Lastly, we see a general improvement in child nutrition over time.

Next, we estimate the same set of variables on matched subsets of children, determined by their exposure to drought: Model 2 only considers respondents that endured at least moderate drought over the past 12 months, whereas Model 3 only

contains respondents that enjoyed normal weather conditions (neither drought nor unusually wet weather). The split sample approach is a convenient way to assess the effect of ODA on coping capacity, as the respondents already are matched on pre-treatment determinants of aid allocation, and the location-standardized drought classification (which is SPEI-based) represents a random shock with equal baseline probability of occurrence across space.

As shown in Model 2, we find statistically significant evidence that past aid has a measurable positive effect on nutritional status among children exposed to drought, even if the magnitude of the effect is modest in comparison with some of the controls. Under normal environmental conditions (Model 3), however, aid treatment does not affect child health in terms of WHZ score. Taken together, these results suggest that development aid does indeed strengthen recipient populations' ability to cope with future weather anomalies. However, before we can conclude in favor of Hypothesis 2, we also need to consider the margins of error around the point estimates. Figure 2.3, panel A, provides a visual comparison of the estimated aid effects in Models 2 and 3. Since there is no overlap in the error bars, we can conclude with 95% confidence that development assistance improves local resilience to drought.

Interestingly, we find that the youngest age group, which normally suffers less from severe undernutrition than their older peers (Model 1), loses the advantage vis-à-vis the four-year-old reference group in times of meteorological extremes. We interpret this result as a consequence of reduced health among breastfeeding women during drought. Finally, Model 2 seems to suggest that armed conflict has a slight positive health impact on children exposed to drought. We do not trust this estimate but rather believe it is an artifact of the very low number of observations residing in the proximity of ongoing armed conflict in the drought subsample (only 4% or 279 children) that makes the coefficient sensitive to outliers.

The remaining models in Table 2.1 follow the same setup, but here the treatment is limited to agricultural aid projects. The results are mostly in agreement with the first set of models. However, comparing the effect of agricultural aid under drought (Model 5) with normal conditions (Model 6), we find a much weaker health benefit of aid and the error bands around the point estimates are wide and overlapping, implying that these effects are not significantly different from each other (Figure 2.4, panel B).

Judging from the results in Table 2.1 and Figure 2.4, it would seem that aid projects targeting the agricultural sector provide no added value in terms of strengthening local coping capacity to future climatic stress over other types of rural development projects. Such a deduction would be hasty and possibly false, however, since re-

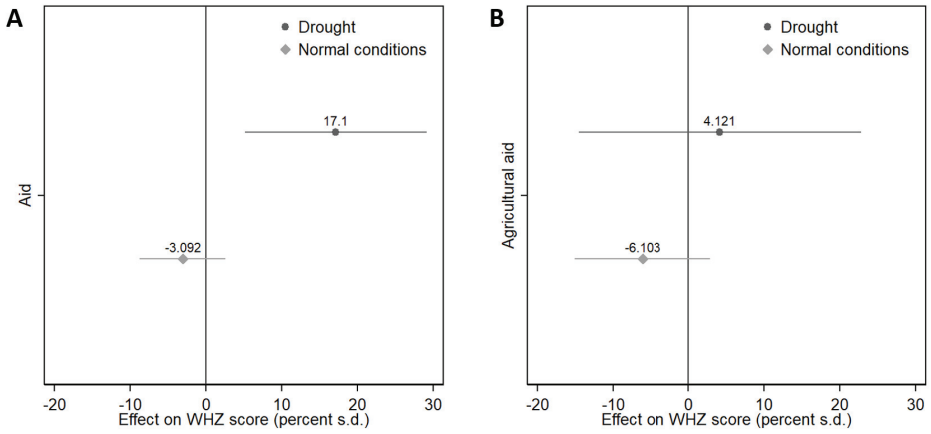

Figure 2.4: Effect of aid on under-5 wasting for matched respondents.The plots show ordinary least squares regression coefficients with whiskers representing 95% confidence intervals, expressed as percent of a standard-deviation change in WHZ score from aid intervention, under drought and normal climatic conditions. Panel A includes all aid projects (Model 2 vs. 3); Panel B represents agricultural aid projects (Model 5 vs. 6).

cipients of agricultural aid differ from hosts of other aid projects (Table A.5 in the Appendix). Among other things, agricultural aid projects tend to be implemented in more peripheral and less densely populated parts of recipient countries, but also more often in areas inhabited by co-ethnics of the ruling coalition. Accordingly, the matched respondents comprising the sample in Models 4–6 also differ systematically from those included in the first models, obstructing direct comparison of effect sizes.

To better assess the empirical merit of Hypothesis 3, we estimate interaction models of the joint effect of aid and drought severity on child wasting, using any aid project and agricultural aid as the treatment, respectively (Table 2.2). Model 7 reveals that drought can have a grave, short-term effect on child health; a severe drought (conventionally defined as 1.5 standard-deviation drop below normal SPEI-12 values) is associated with a 0.15-point drop in WHZ score, holding other factors constant. Development aid, while lessening the burden of future drought, does not fully insulate recipients from negative health externalities of extreme weather events. Among respondents in target areas for agricultural aid (Model 8), a severe drought leads to a dramatic 0.22-point drop in WHZ – counteracting the benefit of shifting from no education to medium education for the child's mother.

The difference in the isolated impact of drought on child health between Models 7

Table 2.2: Interaction effect of aid and drought severity on under-5 WHZ score

	(7)	(8)
Treatment:	All aid	Agricultural aid
Aid	-5.067	-14.646**
	(3.402)	(5.441)
Drought severity	-10.379+	-14.378+
	(5.805)	(8.062)
Aid x drought severity	8.877+	16.999*
	(5.329)	(8.217)
Age 0 year	17.479**	19.028**
	(4.466)	(6.833)
Age 1 year	-36.865**	-24.187**
	(2.977)	(6.434)
Age 2 years	-16.441**	-17.767**
	(2.872)	(5.928)
Age 3 years	4.217	4.160
	(2.633)	(4.672)
Male	-2.688	-8.411*
	(2.279)	(3.964)
Mother's education	11.687**	12.003**
	(2.151)	(3.767)
Armed conflict	8.858	13.388
	(5.760)	(8.964)
Time	2.086**	3.094**
	(0.537)	(0.622)
Constant	-44.262**	-37.915**
	(9.140)	(14.085)
Observations	48,139	15,667

Note: OLS regression coefficients with standard errors clustered on DHS survey clusters in parentheses; **p<0.01, *p<0.05, + p<0.1. Constants for admin 1-level regions estimated but not shown. Dependent variable is WHZ index x 100

and 8 indicates that agricultural aid projects more often are allocated to areas where the local population is especially vulnerable to weather extremes. Although this should mean that the potential gain of development intervention is correspondingly higher, the interaction term in Model 8 suggests that agricultural aid projects in combination with drought barely offsets the negative baseline effect of being an ODA recipient. Hypothesis 3 is not supported.

2.5.1 Sensitivity tests

Ideally, we would have wanted to account for the monetary size of aid projects or in other ways measure project comprehensiveness, but such information is generally limited to aggregate, project-level funding commitments, with unknown actual disbursement across project locations and over time. Nonetheless, in the Appendix (Table A.6), we use the aggregate disbursement size data and limit the treatment variable to aid projects with a total value exceeding 1 million USD, assuming even distribution of funds among aid locations. The results are similar to those reported in Table 2.1, but they also indicate a stronger and more significant direct effect of aid on child health across various meteorological conditions.

In other tests documented in the Appendix, we consider whether the number of

recent development projects matters for local coping capacity building, defining treatment equal to proximity to at least three recent projects (Table A.7). Again, the sensitivity test reinforces the conclusion from the main analysis: while aid has a modest general effect on child nutritional status, children residing in areas with multiple recent ODA projects were measurably better able to endure subsequent drought without severe weight loss.

Third, although agricultural aid, by virtue of targeting local food production systems, was expected to be particularly important in building rural climate resilience, it is clear that other specific types of development assistance also might have significant impacts on communities' ability to cope with drought. In the Appendix, we document the effects of two other aid treatments: health projects and water and sanitation projects (Table A.8). Again, the results are consistent with the general pattern shown in Table 2.1, even though the parameter estimates are generally less statistically significant (at least partly a result of fewer matched observations for these aid categories).

Lastly, we inspect the sensitivity of the main findings to altering the distance threshold for classifying the treated population. Average aid impacts on community health and coping capacity are likely to taper off over distance as diminishing shares of the encircled population will be reached. Despite the encouraging findings reported above, it might be that the chosen 50 km buffer is too generous. In Table A.9 in the Appendix, we estimate the effect of aid based on a 25 km buffer around each survey cluster. Yet again, the robustness test reproduces the same overall pattern. While all six models suggest a positive association between aid treatment and subsequent child health, the average treatment effect is many times larger in the drought subsamples, consistent with aid leading to improved resilience to environmental extremes. That said, the margins of uncertainty around the point estimates are wide across the models, again at least partly due to reduced matching samples and lower shares of treated respondents within the more restrictive spatial buffer.

2.6 Concluding remarks

To our knowledge, this study represents the first attempt to systematically assess implications of official development assistance for recipient populations' environmental coping capacity. Using 16 years of survey data from the Demographic and Health Surveys, in combination with geocoded World Bank development aid project locations and local weather data, we found limited evidence that development aid generates measureable child health gains for recipient populations in general. However, when focusing on the subsample of respondents exposed to recent drought, we found robust statistical evidence that prior aid allocation reduces

the extent of child undernutrition. Contrary to expectations, development assistance earmarked specifically for the local agricultural sector appears to perform less well, although we should interpret this result with some care since agricultural aid projects are more likely to be allocated to areas where local livelihood security and wellbeing are considered especially vulnerable to fluctuating climatic conditions.

While these findings are important in their own right, future research should seek to provide deeper insight into how aid projects improve local coping capacity. The fact that agricultural aid doesn't outclass other types of development assistance in mitigating drought-related food insecurity suggests that important aid-sensitive drivers of malnutrition are found outside food production and provision systems. The results from the sensitivity analysis are consistent with this view. The link between climate resilience and quality of maternal and child health care services should constitute a natural focal point in this endeavour.

A second priority for future research is to expand the scope beyond development aid provided by the World Bank. The need for comprehensive time-series, cross-national, georerefenced aid data to maximize the utility of the DHS data dictated a focus limited to World Bank-commissioned projects here, which potentially moderates the generalizability of our findings. That said, the multi-sector approach of many World Bank projects should be well suited to address the complex origins of rural poverty and household vulnerability, and our finding that agricultural aid does not perform better than other types of development aid in strengthening under-5 nutritional health also supports such an interpretation.

A related limitation is our study's inability, due to data constraints, to account for relevant emergency relief operations. For example, it may be that the control group in some locations includes recent recipients of emergency assistance. If this were a widespread pattern, it would attenuate the estimated treatment effect. On the other hand, past development aid might also facilitate rapid response to emerging crises, such as drought and famine, such that some of the reported treatment effect in fact is a result of emergency assistance made possible through past ODA. While such a dynamic is entirely consistent with the overall conclusion of this article, the underlying explanation and driver of the aid effect is qualitatively different. We defer this research challenge to future work.

The ambitious target of the 2015 Paris agreement on climate change mitigation should help ensure a faster transition to sustainable, carbon-neutral energy consumption, thereby limiting future warming. Even so, reducing human security challenges of increasingly violent extreme weather events will largely depend on sustained local adaptation efforts and future development pathways. As succinctly

summarized in a recent call for more research on the climate-health-security nexus, "poverty, state fragility, poor pre-existing health outcomes, and high susceptibility to climate change converge to amplify the effects of future famines, droughts, and neglected tropical diseases" (Gupta et al. 2017). Official development assistance can be an important response to this challenge (IPCC 2018).

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2.8 Appendix

Table A.1: Variable description

Variable	Description	Source
Wasting	Standardized weight-to-height ratio (WHZ) x 100 for children under 5 years of female respondents	Demographic and Health Surveys (DHS), various rounds
Aid	Implementation of development aid project within 50 km of respondent's survey cluster, 13–48 months prior to survey	Own coding based on AidData v.1.4.2 (AidData 2017)
Ag. aid	Implementation of agricultural development aid project within 50 km of respondent's survey cluster, 13–48 months prior to survey	Own coding based on AidData v.1.4.2 (AidData 2017)
3+ aid	Implementation of three or more development aid projects within 50 km of respondent's survey cluster, 13–48 months prior to survey	Own coding based on AidData v.1.4.2 (AidData 2017)
3+ ag. aid	Implementation of three or more agricultural development aid project within 50 km of respondent's survey cluster, 13–48 months prior to survey	Own coding based on AidData v.1.4.2 (AidData 2017)
Aid history	Log count of number of previous development aid project within 50 km of respondent's survey cluster, 49–72 months prior to survey	Own coding based on AidData v.1.4.2 (AidData 2017)
Drought severity	Standardized negative deviation from long-term normal precipitation-evapotranspiration condition at survey cluster, averaged over 1–12 months prior to survey, using the SPEI-12 index	Own coding based on SPEIbase v.3.23 (Beguería et al. 2014)
Age 0 year	Age dummy, 0–11 months = 1	Own coding based on DHS
Age 1 year	Age dummy, 12–23 months = 1	Own coding based on DHS
Age 2 years	Age dummy, 24–35 months = 1	Own coding based on DHS
Age 3 years	Age dummy, 36–47 months = 1	Own coding based on DHS
Male	Child gender, male = 1	DHS
Mother's education	Mother's education, categorized from 0 = no education to 3 = higher education	DHS
Armed conflict	Dummy coded 1 if at least one lethal armed conflict event within 50 km of survey cluster during 1–12 months prior to survey	Own coding based on Uppsala Conflict Data Program (UCDP) Georeferenced Event Dataset (Sundberg and Melander 2013)
Time	Count of years since start of time-series (2000)	Own coding based on DHS
Excluded	Dummy coded 1 if survey cluster covers home land of politically excluded ethnic group, 49–72 months prior to survey	Ethnic Power Relations Geo-EPR (Wucherpfennig et al. 2011)
GCP	Log gross cell product of grid cell surrounding survey cluster, a local equivalent to gross domestic product	G-Econ data (Nordhaus 2006) adapted via PRIO-GRID (Tollefsen, Strand and Buhaug 2012)
Population	Log population size of grid cell surrounding survey cluster	Gridded Populations of the World v. 4, adapted via PRIO-GRID (Tollefsen, Strand and Buhaug 2012)
Periphery	Log travel time in hours to nearest major urban center with at least 50,000 citizens	(Nelson 2008), adapted via PRIO-GRID (Tollefsen, Strand and Buhaug 2012)

Table A.2: Descriptive statistics

Variable	N			Mean			SD			Min			Max		
	Pre-CEM	CEM all aid	CEM ag. aid	Pre-CEM	CEM all aid	CEM ag. aid	Pre-CEM	CEM all aid	CEM ag. aid	Pre-CEM	CEM all aid	CEM ag. aid	Pre-CEM	CEM all aid	CEM ag. aid
Wasting	138,103	48,139	15,667	-31,28	-39,28	-39,06	125,9	127,5	122,2	-400	-400	-400	599	596	586
Aid	138,103	48,139	-	0,416	0,386	-	0,493	0,487	-	0	0	-	1	1	-
Ag. aid	138,103	-	15,667	0,172	-	0,365	0,377	-	0,481	0	-	0	1	-	1
3+ aid	107,658	33,811	-	0,251	0,126	-	0,433	0,332	-	0	0	-	1	1	-
3+ ag. aid	122,659	-	10,493	0,068	-	0,052	0,251	-	0,222	0	-	0	1	-	1
Aid history	138,103	48,139	15,667	0,617	0,275	0,199	0,903	0,666	0,44	0	0	0	4,025	3,555	2,639
Drought severity	138,103	48,139	15,667	0,352	0,39	0,479	0,497	0,521	0,533	0	0	0	2,715	2,715	2,427
Age 0 year	138,103	48,139	15,667	0,219	0,223	0,22	0,413	0,416	0,414	0	0	0	1	1	1
Age 1 year	138,103	48,139	15,667	0,21	0,208	0,212	0,407	0,406	0,409	0	0	0	1	1	1
Age 2 years	138,103	48,139	15,667	0,194	0,192	0,194	0,395	0,394	0,395	0	0	0	1	1	1
Age 3 years	138,103	48,139	15,667	0,195	0,195	0,191	0,397	0,396	0,393	0	0	0	1	1	1
Male	138,103	48,139	15,667	0,501	0,504	0,5	0,5	0,5	0,5	0	0	0	1	1	1
Mother's education	138,103	48,139	15,667	0,775	0,634	0,488	0,755	0,738	0,637	0	0	0	3	3	3
Armed conflict	138,103	48,139	15,667	0,184	0,136	0,039	0,387	0,343	0,194	0	0	0	1	1	1
Time	138,103	48,139	15,667	9,352	8,611	7,568	4,18	4,374	4,545	1	1	1	16	16	16
Excluded	138,103	48,139	15,667	0,179	0,071	0,06	0,384	0,257	0,238	0	0	0	1	1	1
GCP	138,05	48,139	15,667	-3,09	-3,304	-3,701	1,385	1,281	1,004	-8,396	-7,416	-7,11	1,874	0,932	-0,992
Population	138,103	48,139	15,667	12,1	11,93	11,68	1,309	1,128	0,913	5,292	9,07	9,449	15,77	14,79	14,42
Periphery	138,103	48,139	15,667	5,484	5,495	5,523	0,546	0,494	0,403	4,102	4,173	4,316	8,243	7,055	6,751

Note: 'Pre-CEM' refers to complete (unbalanced) rural DHS sample of children under 5 years of age; 'CEM all aid' and 'CEM ag. aid' refer to the matched subsamples of respondents with any aid project and agricultural aid project as the treatment, respectively.

Table A.3: Summary of observations by country

	Complete sample		CEM all aid		CEM ag. aid	
Country	N	%	N	%	N	%
Kenya	7,455	5.40	1,313	2.73	905	5.78
Lesotho	2,054	1.49	1,041	2.16	0	0
Liberia	4,769	3.45	2,763	5.74	0	0
Malawi	11,261	8.15	1,227	2.55	1,135	7.24
Mali	18,168	13.16	12,879	26.75	7,404	47.26
Mozambique	6,338	4.59	798	1.66	452	2.88
Namibia	3,412	2.47	73	0.15	0	0
Nigeria	32,086	23.23	12,559	26.09	81	0.52
Rwanda	6,518	4.72	535	1.11	186	1.19
Sierra Leone	4,276	3.10	1,493	3.10	1,328	8.48
Swaziland	1,558	1.13	54	0.11	0	0
Tanzania	14,404	10.43	4,873	10.12	1,698	10.84
Togo	2,309	1.67	0	0	0	0
Uganda	3,591	2.60	744	1.55	329	2.10
Zambia	10,710	7.76	6,329	13.15	2,149	13.72
Zimbabwe	9,194	6.66	1,458	3.03	0	0
Total	138,103	100	48,141	100	15,667	100

2.8.1 Drought and child wasting

Table A.4 permits a brief inspection of the relationship between drought and wasting among 138,103 children under 5 years of age, based on the sample of children of rural female respondents in 32 DHS household surveys across 16 countries in sub-Saharan Africa between 2001 and 2016. The drought severity indicator is based on the Standardized Precipitation-Evapotranspiration Index (SPEI-12) and measures negative deviation from normal conditions during the 12 months preceding the survey date. Because this measure is location-standardized, it can be considered a random treatment and therefore the estimated effect is comparable across units and over time. One standard deviation below normal climatic water balance is associated with a 5.5-point loss of local under-5 WHZ score, all else held constant. This model is the basis for creating Figure 2.1B in the main article.

Table A.4: Determinants of under-5 WHZ score

	(S1)
Drought severity	-5.544**
	(1.124)
Age 0 year	25.869**
	(1.235)
Age 1 year	-29.413**
	(1.123)
Age 2 years	-13.316**
	(0.987)
Age 3 years	2.521**
	(0.977)
Male	-4.020**
	(0.657)
Mother's education	16.461**
	(0.632)
Armed conflict	8.145**
	(1.506)
Time	1.447**
	(0.130)
Constant	-44.683**
	(2.907)
Observations	138,103

Note: OLS regression coefficients with standard errors clustered on DHS survey clusters in parentheses; ** p<0.01, * p<0.05, + p<0.1. Constants for admin 1-level regions estimated but not shown. Dependent variable is WHZ index x 100.

2.8.2 Determinants of development aid allocation

Unlike location-standardized drought measures such as SPEI, development aid projects are not distributed at random across time and space. In order to provide an unbiased assessment of the effect of aid on child wasting, the observations must be matched on pre-treatment factors that predict the likelihood of aid allocation to the survey cluster. Table A.5 shows the influence of the selected pre-treatment factors on allocation of development aid of any kind (Model S2) and agricultural aid (Model S3). In both models, the control group consists of respondents from survey clusters not subject to any type of development aid.

Table A.5: Determinants of development aid allocation

	(S2) Aid	(S3) Ag. aid
Aid history	0.814**	0.811**
	(0.046)	(0.078)
Excluded	0.420**	0.464*
	(0.093)	(0.185)
Population	0.457**	0.330**
	(0.055)	(0.101)
GCP	-0.005	0.066
	(0.043)	(0.083)
Periphery	-0.333**	-0.841**
	(0.076)	(0.143)
Constant	-4.149**	-0.507
	(1.009)	(1.853)
Observations	136,009	88,880

Note: Logit regression coefficients with standard errors clustered on DHS survey clusters in parentheses; ** p<0.01, * p<0.05, + 0.01. Country constants estimated but not shown. Dependent variable is allocation of development aid within 50 km of respondent's survey cluster, 1–4 years prior to the survey date.

The variables shown in Table A.5 are then used in order to obtain a balanced sample of treated and control respondents where factors determining aid allocation have been accounted for. To this end, we conduct Coarsened Exact Matching with exact matching on country code, using Sturge's rule as binning algorithm, to ensure that treated observations are compared to respondents with a similar profile from the same country only. The multivariate L1 distance measure of global imbalance indicates very unbalanced data prior to matching: L1 = 0.94 (that is, treatment is not randomly distributed among respondents). After matching, the global imbalance score is reduced considerably, to L1 = 0.71, although at the cost of losing 90,230 observations that lacked proper matches in the treatment/control group. Figures A.1 to A.10 below provide balancing charts by means of treatment/control

averages and distribution of values for observations that were retained vs. dropped (i.e., unmatched) during the CEM. The balancing procedure entails exact matching on country codes; exact sample differences vary by country.

2.8.3 Balancing charts

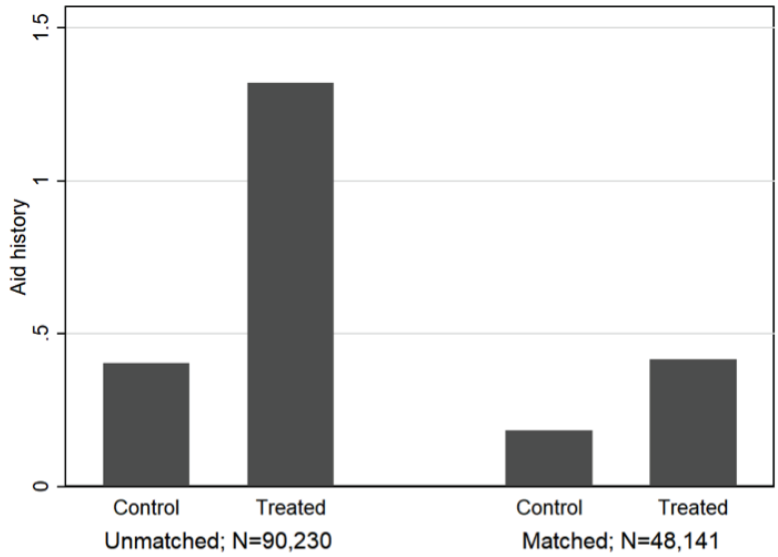

Figure A.1: Sample mean aid history score for treated vs. control groups.

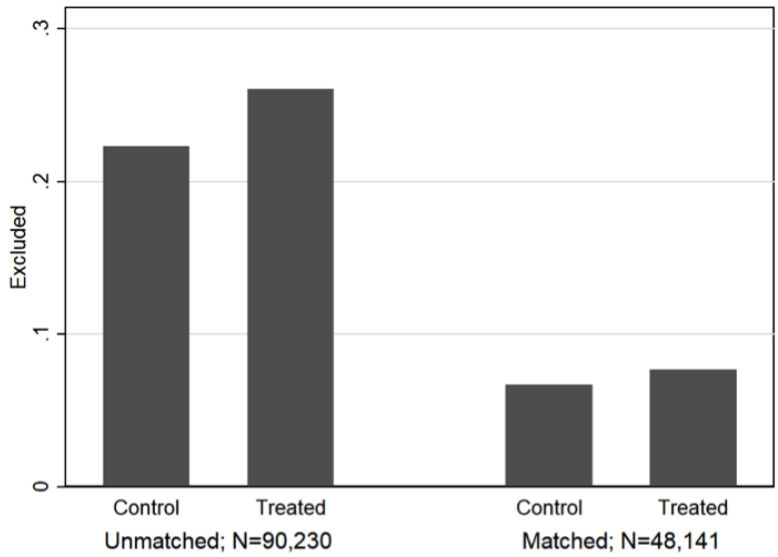

Figure A.2: Country mean excluded score for treated vs. control by sample.

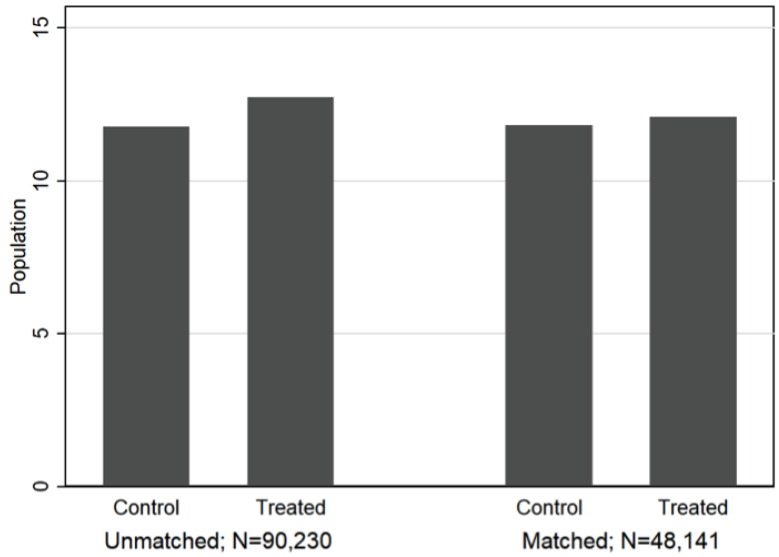

Figure A.3: Country mean population score for treated vs. control by sample.

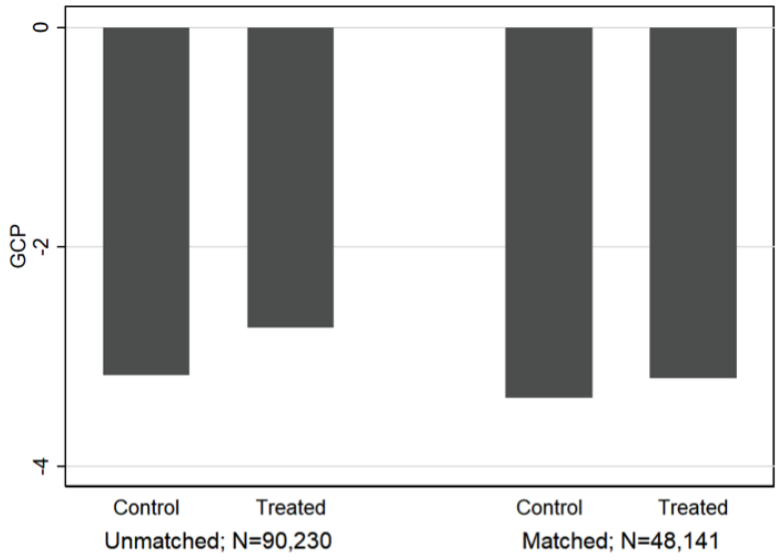

Figure A.4: Country mean GCP score for treated vs. control by sample.

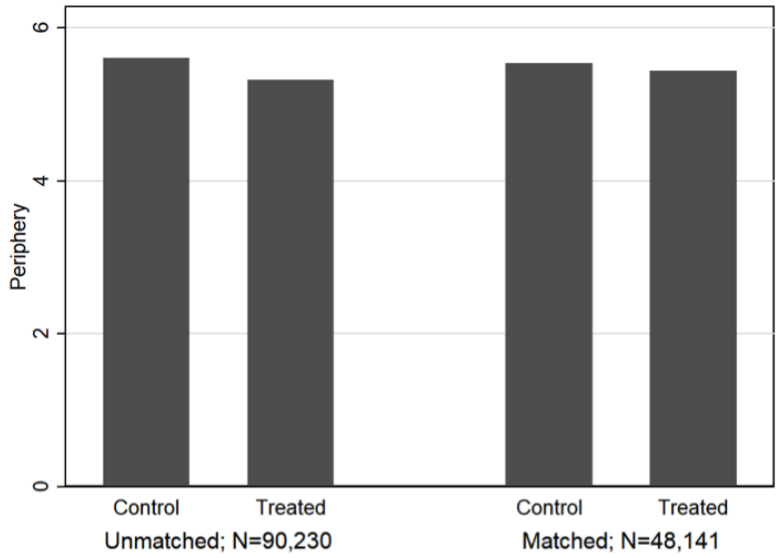

Figure A.5: Country mean periphery score for treated vs. control by sample.

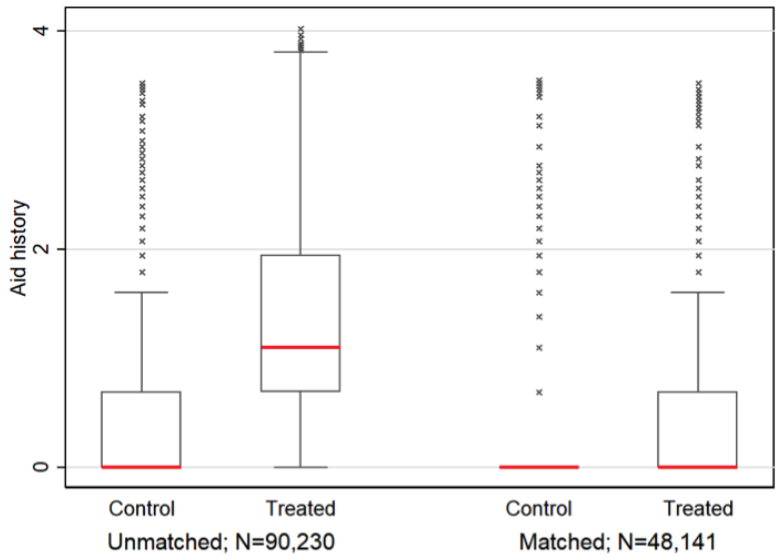

Figure A.6: Box plot distribution of aid history for treated vs. control by sample.Each box covers observations from the 25th to the 75th percentile with the red line denoting the median value.

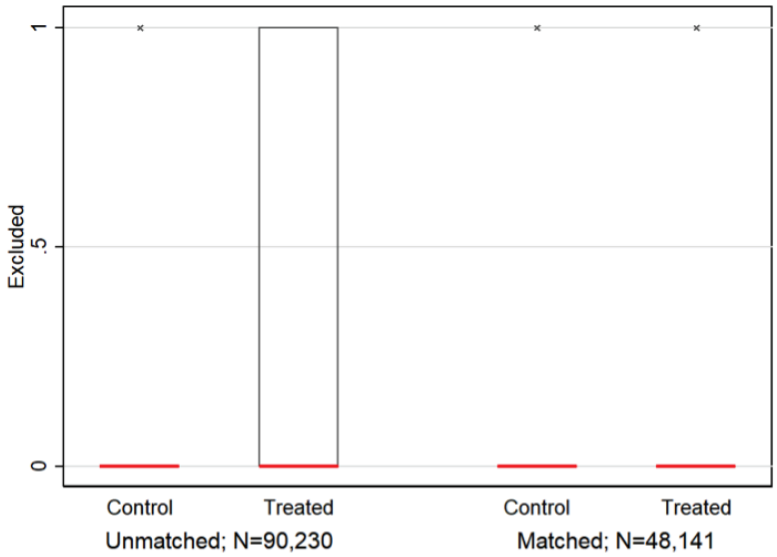

Figure A.7: Box plot distribution of excluded for treated vs. control by sample.Each box covers observations from the 25th to the 75th percentile with the red line denoting the median value.

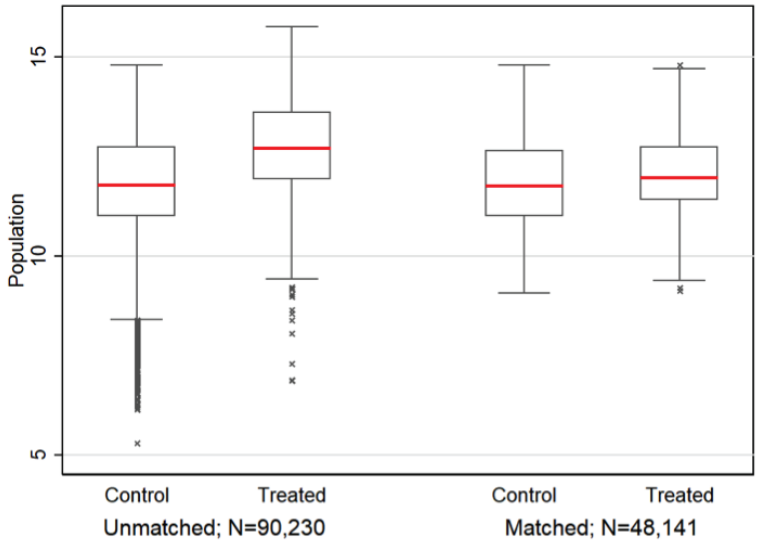

Figure A.8: Box plot distribution of population for treated vs. control by sample.Each box covers observations from the 25th to the 75th percentile with the red line denoting the median value.

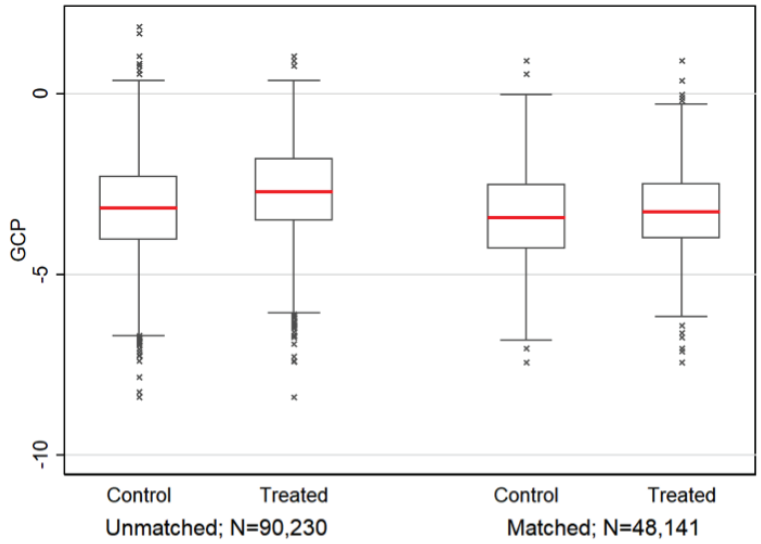

Figure A.9: Box plot distribution of GCP for treated vs. control by sample.Each box covers observations from the 25th to the 75th percentile with the red line denoting the median value.

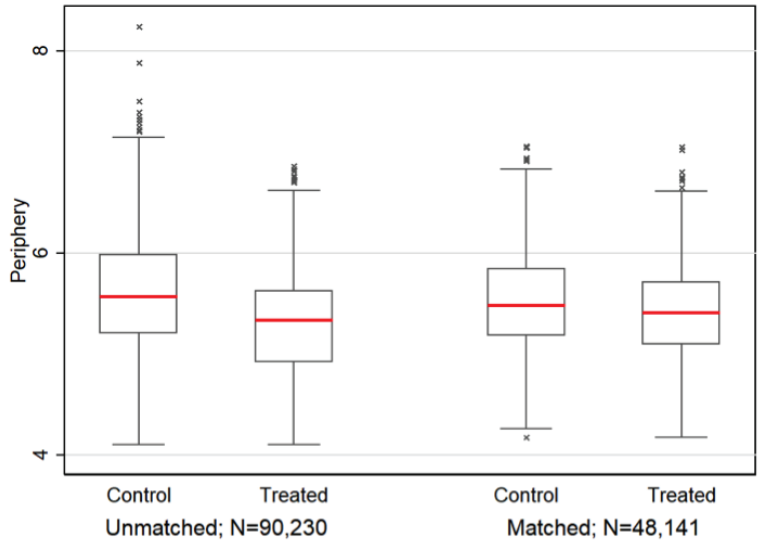

Figure A.10: Box plot distribution of periphery for treated vs. control by sample.Each box covers observations from the 25th to the 75th percentile with the red line denoting the median value.

2.8.4 Sensitivity test I: Value of aid project

In the main analysis, the treatment variable is set to capture proximity to at least one development aid project location during the specified treatment period (Figure 2.3). Due to missing and inconsistent information on the size of disbursements and unknown distribution of funds among a project's field sites, we are unable to estimate the effect of project size directly. However, here we replicate Models 1–3 but limit treatment to projects with a total budget in excess of 1 million USD (Table A.6). The results again indicate that development aid improves child health in droughty environments although now we find a positive and significant effect of aid on nutritional status also during normal conditions.

Table A.6: Treatment: Aid projects worth more than 1 mill. USD

	(S4)	(S5)	(S6)
Post-treatment weather:	All conditions	Drought SPEI <-1	Normal Conditions
Aid	8.803**	10.674+	7.576*
	(3.222)	(6.224)	(3.862)
Age 0 year	22.081**	2.869	27.005**
	(5.079)	(7.228)	(6.199)
Age 1 year	-31.152**	-59.399**	-28.206**
	(4.591)	(7.678)	(5.392)
Age 2 years	-13.744**	-19.217+	-14.660**
	(4.601)	(11.087)	(5.172)
Age 3 years	5.772	14.281+	2.245
	(3.840)	(7.401)	(4.541)
Male	-3.308	-9.227	-1.917
	(3.063)	(5.871)	(3.541)
Mother's educ.	22.716**	18.989**	22.319**
	(2.393)	(5.547)	(2.666)
Armed conflict	-2.773	-34.659*	1.166
	(7.851)	(16.421)	(8.690)
Time	2.465**	1.087	2.605**
	(0.501)	(1.114)	(0.565)
Constant	-68.362**	-38.982**	-61.577**
	(9.355)	(12.148)	(9.802)
Observations	30,607	4,237	24,084

Note: OLS regression coefficients with standard errors clustered on DHS survey clusters in parentheses; ** p<0.01, * p<0.05, + p<0.1. Constants for admin 1-level regions estimated but not shown. Dependent variable is WHZ index x 100.

2.8.5 Sensitivity test II: Number of aid projects

As an alternative test to explore the sensitivity of the main results to development aid comprehensiveness, Table A.7 replicates Models 1–3 but limits the treated group to respondents that were subject to at least three distinct aid projects during the treatment period. Although the number of matched observations naturally decline with more stringent coding of the aid variable, resulting in considerably larger standard errors and weaker statistical significance, the general pattern remains consistent with that reported in the article.

Table A.7: Treatment: At least three aid projects

	(S7)	(S8)	(S9)
Post-treatment weather:	All conditions	Drought SPEI <-1	Normal conditions
Aid	-5.465	16.595	-4.075
	(5.770)	(11.457)	(6.559)
Age 0 year	8.863	-12.888	17.553*
	(7.347)	(14.183)	(6.951)
Age 1 year	-41.538**	-53.376**	-41.717**
	(5.943)	(11.910)	(7.191)
Age 2 years	-18.090**	-25.457*	-16.247*
	(6.523)	(11.416)	(7.650)
Age 3 years	4.089	15.862	1.001
	(4.852)	(9.676)	(6.289)
Male	-8.809*	-5.885	-10.100*
	(4.197)	(8.141)	(4.187)
Mother's educ.	13.636**	8.827	12.203**
	(3.488)	(6.815)	(3.758)
Armed conflict	4.635	2.153	3.841
	(9.849)	(20.343)	(10.958)
Time	1.370	0.718	2.398**
	(0.834)	(1.355)	(0.790)
Constant	-27.205*	-12.138	-31.646*
	(12.083)	(14.866)	(14.813)
Observations	10,734	2,222	7,509

Note: OLS regression coefficients with standard errors clustered on DHS survey clusters in parentheses; ** p<0.01, * p<0.05, + p<0.1. Constants for admin 1-level regions estimated but not shown. Dependent variable is WHZ index x 100

2.8.6 Sensitivity test III: Health and water projects

In the main analysis, we study the effects of development aid in general as well as aid projects that target the agricultural sector specifically. Yet, it is clear that other types of aid also could have a beneficial impact on local coping capacity. In Table A.8, we consider two additional sector-specific development projects: health aid projects and water and sanitation aid projects. As always, the control group consists of respondents not receiving any form of development assistance. Here, results are weaker in statistical terms (at least partly due to fewer observations) but the general pattern, whereby the aid treatment effect is greater in the drought subsample, is reproduced.

Table A.8: Treatment: Health aid and water & sanitation aid

	Health projects			Water & sanitation projects		
	(S10)	(S11)	(S12)	(S13)	(S15)	(S15)
Post-treatment weather:	All conditions	Drought SPEI <-1	Normal conditions	All conditions	Drought SPEI <-1	Normal conditions
Aid	3.037	27.702	-0.667	2.831	6.392	1.166
	(5.207)	(16.706)	(5.154)	(4.988)	(9.344)	(5.356)
Age 0 year	27.240**	14.840	36.553**	25.812**	8.161	31.010**
	(9.182)	(17.532)	(7.165)	(9.949)	(12.178)	(10.890)
Age 1 year	-21.460**	-13.398	-20.721**	-22.447**	-34.633**	-23.013**
	(5.563)	(18.081)	(5.751)	(7.566)	(12.358)	(8.346)
Age 2 years	-15.372**	-15.947	-12.618*	-11.655	-28.987+	-10.358
	(5.570)	(17.394)	(5.792)	(8.116)	(14.774)	(9.218)
Age 3 years	1.662	5.277	1.319	5.720	21.842+	3.175
	(5.458)	(17.059)	(5.976)	(5.197)	(11.602)	(5.791)
Male	-2.359	10.785	-5.798+	3.425	14.451+	-2.024
	(4.188)	(8.597)	(3.466)	(4.716)	(8.112)	(4.836)
Mother's educ.	13.858**	3.209	13.594**	14.571**	-13.694	11.813*
	(3.809)	(9.730)	(4.017)	(5.123)	(10.992)	(5.115)
Armed conflict	1.884	21.942	3.009	30.261**	58.455**	29.332**
	(9.914)	(22.786)	(11.485)	(10.687)	(22.097)	(10.919)
Time	-1.305	-1.138	-0.441	1.435+	-0.669	2.804**
	(0.795)	(1.639)	(0.686)	(0.870)	(1.402)	(0.701)
Constant	-14.669	-6.556	-28.411*	-70.832**	11.671	-67.448**
	(12.378)	(23.707)	(12.851)	(16.906)	(19.226)	(14.484)
Observations	6,508	570	5,722	13,780	1,696	10,797

Note: OLS regression coefficients with standard errors clustered on DHS survey clusters in parentheses; ** p<0.01, * p<0.05, + p<0.1. Constants for admin 1-level regions estimated but not shown. Dependent variable is WHZ index x 100.

2.8.7 Sensitivity test V: Alternative treatment buffer

As a final test, we alter the distance threshold for identifying treated respondents. In the main models, this was set at 50 km from survey cluster, to account for some imprecision in the geocoding (the municipality or district centroid coordinates for aid project locations may not necessarily represent the actual sites, and the DHS cluster coordinates are jittered to preserve anonymity). In Table A.9, we apply a stricter threshold, where only aid projects that fall within a 25 km radius from the survey cluster is counted as treatment (preserving $>$ 50 km for the control group). Yet again, we see that the treatment effect is larger in the drought subsample, although the confidence interval around the aid coefficients in the drought and normal conditions samples overlap, and are therefore not statistically distinguishable.

Table A.9: Treatment: Aid projects within 25 km radius

	All aid projects <25 km			Agricultural aid projects <25 km		
	(S16)	(S17)	(S18)	(S19)	(S20)	(S21)
Post-treatment weather:	All conditions	Drought SPEI <-1	Normal conditions	All conditions	Drought SPEI <-1	Normal conditions
Aid	1.760	12.621	1.453	0.797	5.443	1.791
	(3.780)	(8.988)	(4.251)	(4.785)	(11.722)	(5.322)
Age 0 year	23.866**	-6.928	32.930**	31.624**	-9.509	44.893**
	(8.122)	(12.586)	(9.618)	(11.074)	(11.875)	(13.574)
Age 1 year	-27.704**	-47.966**	-24.944*	-11.287	-48.398**	-0.773
	(8.365)	(12.714)	(10.322)	(12.415)	(16.132)	(14.653)
Age 2 years	-10.410	-22.942*	-6.026	-4.041	-37.426**	8.704
	(7.839)	(9.777)	(9.668)	(11.890)	(13.386)	(14.807)
Age 3 years	7.101	-0.009	6.827	18.592	-28.653*	30.516*
	(7.432)	(9.478)	(9.172)	(11.299)	(11.166)	(13.802)
Male	1.098	-11.474	3.647	5.744	2.953	8.337
	(4.411)	(9.310)	(5.245)	(6.306)	(10.828)	(6.899)
Mother's educ.	16.869**	21.990*	13.693**	15.933**	33.659**	9.776*
	(2.626)	(9.026)	(3.010)	(4.161)	(11.861)	(4.468)
Armed conflict	-7.660	0.446	-3.952	5.299	40.112	-6.399
	(8.372)	(40.284)	(8.517)	(12.611)	(52.770)	(10.155)
Time	2.002**	1.379	2.153**	1.618+	-0.602	3.171**
	(0.648)	(1.489)	(0.765)	(0.865)	(1.854)	(0.922)
Constant	-72.821**	-35.243*	-74.807*	-73.499*	-39.186+	-97.486*
	(21.916)	(13.651)	(30.590)	(36.984)	(22.617)	(40.580)
Observations	30,694	4,428	22,258	12,690	2,699	9,085

Note: OLS regression coefficients with standard errors clustered on DHS survey clusters in parentheses; ** p<0.01, * p<0.05, + p<0.1. Constants for admin 1-level regions estimated but not shown. Dependent variable is WHZ index x 100.

Chapter 3

Windows of opportunity? Natural disasters and the intensity of armed conflict

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Abstract: This paper follows recent research on exogenous shocks and conflict dynamics, investigating the so-far unstudied connection between natural disasters and the intensity of armed conflict. By making use of a regression discontinuity design, the paper specifically examines the effects of rapid-onset natural disasters on the intensity of armed intrastate conflict between 1989 and 2015. The analysis aims to discover whether abrupt natural shocks intensify or de-intensify ongoing violence. The applied design makes it possible to compare the expected trajectory for the number of violent events in the days and months just before and just after a disaster occurs. The spatial dimension of the analysis is the provincial level. This enables a distinction between effects on violence when disaster strikes areas with ongoing fighting and when disasters occur in areas unaffected by violence. The paper shows that in territorial conflicts, disasters induce an immediate decrease in the level of violence within disaster-affected provinces. This effect is not present for governmental conflicts, supporting the notion that when insurgents are the provider of public goods and services, they have stronger incentives to refrain from post-disaster violence. When the disaster occurs in a different part of the country than the ongoing fighting, the effects are much weaker, highlighting the importance of going beyond the country-level when looking at conflict dynamics.

Chapter 4

Fighting the river: Flood impacts on local conflict dynamics

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Abstract: How do local floods influence combatants' choice of where to continue the fight? If a conflict zone becomes flooded, does the fighting cease only temporarily, and if so, is it offset by increased fighting outside the disaster zone? By identifying riverine floods that hit active conflict zones, we investigate how disasters influence the spatial strategies of conflict actors. We join flood data from a newly geocoded version of the EM-DAT emergency events database with geographic information on rivers to identify the spatial prevalence of the floods. The flooded areas are then linked with geolocated conflict events from the UCDP-GED database. Combining these global databases gives us a set of 177 relevant disasters occurring in active conflict zones in 18 countries between 1989 and 2015. Our results show that, on average, conflict activity is lower in periods after disasters compared to the equivalent pre-disaster periods. However, this effect is not universal across different conflict types, as conflict characteristics determine the magnitude of the floods' conflict dampening effect. Most notably, we find that when rebel groups are tied to the territory or when lootable resources are present, the conflict-dampening effect of floods is weakened or even reversed.

Chapter 5

Disaggregated determinants of aid: Development aid projects in the Philippines

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Motivation: Across the world, natural disasters such as storms and floods return with seemingly greater force every year. Many of the disaster hot-spots are particularly vulnerable because of already fragile humanitarian and political situations, some having been affected by armed conflict for decades. These phenomena augment the need for long-term aid, but do they influence the dispersal of aid projects?

Purpose: This paper revisits the classical debate on whether donor interests or recipient needs best predict the distribution of development aid. Disaggregating the analysis down to province level, it includes local hazards when assessing an area's need for aid.

Approach and methods: Making use of geocoded data on aid projects, rapid-onset natural disasters and armed conflict in Philippine provinces between 1996 and 2012, this paper provides an exhaustive assessment of the within-country determinants of World Bank development aid projects.

Findings: The paper finds that need to some extent influence the distribution of aid projects across Philippine provinces, but domestic political alliances bias the dispersal of projects. Previous conflict exposure is associated with increased likelihood of new projects, but only in dominant group-majority provinces. While previous disaster exposure is a weak predictor of aid in all provinces, low Human Development Index-levels significantly predict aid inflow in excluded group-majority provinces.

Policy implications: The paper challenges the idea that donors' priorities override the interests of the recipient government in the distribution of aid projects. Despite the donor's explicit policy on disaster mitigation and relief, these considerations are not yet effectively incorporated into development aid efforts.

5.1 Introduction

The general aid allocation literature maintains that two considerations determine the distribution of aid: recipient need and donor interest. In most cases, both elements come into play, as "... donors are neither entirely selfish, nor entirely altruistic" (Neumayer 2003, p.20). The altruistic component has been argued to be of greater importance at the multilateral level than it is for individual donors, but in few cases is this a zero-sum game. Existing research is predominantly concerned with looking at development aid across countries, or evaluating the allocation of emergency aid following specific disasters. On the sub-national level, the distribution of development aid projects remains largely unstudied, but the release of geocoded data on development aid projects from the World Bank has made it possible to begin filling this gap. Using disaggregated data, this paper investigates the determinants of development aid[1] across the Philippines, evaluating the impact of development, disasters, armed conflict and political alliances on a province's likelihood of receiving new aid projects.

In this paper, I argue that the inclusion of current (extreme) events allows a more dynamic evaluation of recipient need within a country. Extreme events, such as natural disasters or civil conflict, increase an area's need for outside aid – beyond emergency relief. Such extreme events necessitate development aid – in addition to more immediate crisis relief efforts – in order to help mitigate over time the myriad negative consequences that evolve. In addition, such events are particularly targeted in the policies of the international aid agencies, and taking them into account should therefore be paramount in any endeavor measuring recipient need. Nevertheless, even on the sub-national level, donor interests – now in the form of local government preferences – will impact aid dispersion. This means that despite good intentions on the part of the (multilateral) donor, political alliances in the recipient country will influence aid distribution. Because of information asymmetries and increased discretion over incoming resources, the interest and alliances of the recipient government distorts the distribution of aid funds away from objective need considerations as incoming projects are used instead to reward political

[1] Generally speaking, aid is either development assistance or humanitarian assistance (emergency aid). This paper is concerned with the former, and specifically looks at so-called official development assistance (ODA). It is the OECD Development Aid Committee (DAC) who decides which countries are eligible recipients of ODA, from which the objective is to eliminate poverty and its causes. ODA is concessional, and is defined as "government aid designed to promote the economic development and welfare of developing countries ... . [It] includes grants, 'soft' loans (where the grant element is at least 25% of the total) and the provision of technical assistance" (OECD 2016). ODA includes aid flows from individual countries and international financial institutions, the latter being the focus of this paper. As the paper is about development aid, I use the terms aid and development aid interchangeably.

supporters.

These theoretical propositions are tested on the case of the Philippines, which is among the world's top ten disaster-prone countries, and have in addition had two protracted intrastate conflicts going on since the 1940s. These phenomena massively strain the economy of the country, making it increasingly reliant on outside assistance. This combination makes the Philippines a strongly suitable case for empirical testing of the theoretical arguments of this paper. In line with the World Bank's stated policy for aid distribution, we should expect aid projects to go to areas in the Philippines that have been hit hard in the past by disasters and armed conflict because they elevate the need for outside help. However, to the extent that the domestic political situation – characterized by the ongoing conflicts – is likely to influence the distribution of aid, this implies that the Philippine government can be expected to bias the distribution according to their own interest. Their adversaries (and their locations) are easily identified, and by assumption the politically excluded groups should be disfavored in the distribution of aid.

The analysis shows that need, measured by the Human Development Index (HDI), to some extent determines the distribution of World Bank aid projects across Philippine provinces. However, it also reveals that the interests of the recipient government significantly influence the aid delivery. Provinces receive more aid projects the larger the share of the province inhabited by the politically dominant group, the Christian lowlanders. Previous exposure to disasters does not substantially affect a province's likelihood of receiving aid, while conflict exposure does, but only for Christian majority provinces. These findings challenge the policy of the donors (in this case, the World Bank), who claim to be increasingly oriented towards current events such as natural disasters and excluded groups in the south affected by armed conflict.

5.2 Aid allocation: Existing literature

The literature on determinants of aid is sizeable, and it is well established that it is not necessarily need that determines who receives aid. In an exhaustive investigation of foreign aid, Alesina and Dollar (2000, p.55) find that "[f]actors such as colonial past and voting powers in the United Nations explain more of the distribution of aid [among countries] than the political institutions or economic policy of recipients". Along with democratization, foreign policy and alliances seem to be decisive factors for aid donors in their evaluation of potential recipients. Others go as far as to say that humanitarian motivations appear only secondary for the lion's share of the donors (de Mesquita and Smith 2009). In a comprehensive study of aid allocation by 22 Development Assistance Committee (DAC) donors to 168 recipient countries between 1980 and 2004, Hoeffler and Outram (2011) find support

for donor interest as more important than recipient need. However, they also find recipient characteristics (for instance institutions), which are unaccounted for in their models, to have large effects on aid allocation, illustrating that there is still limited understanding of important drivers of aid.

The consensus that donor interest is a better predictor for the distribution of aid than recipient need – conventionally understood as the level of economic development of the recipient – comes from a literature that has predominantly looked at the distribution of aid between countries. In addition to donor interest, a more recent explanation is recipient merit. According to this model, donors use aid to reward recipients with good institutions, and attempt to inspire those that still have a way to go by doing so (Neumayer 2003). In a study on the distribution of climate change adaptation aid, Weiler, Klöck and Dornan (2018) find that the countries with the lowest adaptational capacities are not the ones receiving most support, but rather the aid projects go to those more able to utilize it. The authors find no evidence that not giving aid to the poorest countries is due to donor interest, but instead ascribe it to recipient merit. However, this is still a contested explanation, and in their study, Hoeffler and Outram (2011) found that less than 1% of the variation in aid allocation could be accounted for by merit.

Studies that look at the distribution of aid within recipient countries have traditionally been limited to assessing the distribution of emergency assistance, often after natural disasters. With the release of geocoded aid data (a result of AidData's efforts in particular), however, analyses of within-country distribution of aid have been expanded to also include development aid. Representing an early example of this, Zhang (2004) looks at World Bank loans to Chinese provinces and concludes that the Chinese government has substantial control over the distribution of funds, and that the poorest provinces are at the bottom of the recipient list. Similarly, Briggs (2014) finds aid from bilateral donors and the African Development Bank to be skewed in favor of the Kenyan president's political base. Looking at India, Nunnenkamp, Öhler and Andrés (2017) find no evidence that World Bank projects are needs-based in their distribution, but rather that districts where foreign direct investors can benefit from infrastructure programs are favored. Two studies expand their analyses beyond a single country; Öhler and Nunnenkamp (2014) and Briggs (2018) look at the sub-national distribution of World Bank and African Development Bank projects across (a sample of) African countries, both concluding that the richer regions get more aid than the poorest.

Although aid is increasingly designed with respect to distributional considerations, distortions frequently occur (Winters 2010). Multilateral aid is often considered to be 'more fair' in its dispersion than bilateral aid, whereas emergency relief and

and particularly food aid is often considered to be even more effective.[2] Neumayer (2005), Findley, Milner and Nielson (2017) on the other hand argues that the scientific basis for such claims is weak. For instance, several international financial institutions have been found to advance political interests of the major players in the system in their dispersion of aid (see for instance Dreher, Sturm and Vreeland 2009, Tierney et al. 2011). Studies on the provision of humanitarian aid after disasters find that in addition to media coverage and casualties, political considerations, wealth and government support often predict who gets aid better than need (see Drury, Olson and Belle 2005, Olsen, Carstensen and Høyen 2003, Fuchs and Klann 2012, Strömberg 2007, Fink and Redaelli 2011, Aldrich 2010, Francken, Minten and Swinnen 2012, Gunawardena and Baland 2016). In an extensive survey of food aid in Ethiopia, Jayne et al. (2001) find that the distribution of food aid failed to reach those who needed it the most, nor did it reflect changes in need over time.

An important reason for distortions is that despite good intentions, donors often have limited information, leaving recipient governments much discretion in the distribution (Jablonski 2014, Neumayer 2003). This has led to a shift away from programmatic aid (structural adjustment programs) to project aid (Winters 2010), the latter being perceived as less fungible and more directed at developmental causes. This shift is particularly evident in cases where recipient governments have a bad track record. Nevertheless, it is well documented that beneficiary governments and/or leaders use foreign aid to enhance their own power and reap electoral benefits (Neumayer 2005, Plümper and Neumayer 2009, Jablonski 2014, Briggs 2014). Even in instances where the recipient government has no control over the distribution, political leaders have been found to benefit from development projects (Cruz and Schneider 2016).[3] Böhnke and Zürcher (2013) find that although more aid flowing into Afghanistan between 2007 and 2009 did not make people more sympathetic towards international actors or increase their security, there was a positive relationship between the amount of aid and perceived state legitimacy.

Another potential influence on aid allocation is the prevalence of armed conflict. There is a large literature on aid and armed conflict, finding that in some cases the inflow of aid is found to fuel ongoing hostilities (see for instance Nunn and Qian 2014, Crost, Felter and Johnston 2014), while other times the opposite is the case

[2] Disaster relief and development aid are however becoming increasingly integrated, see Paul (2006) for a review of the provision of disaster relief and development efforts.

[3] Cruz and Schneider (2016) looked at a World Bank development program in the Philippines that was specifically designed to prevent (local) politicians from politically exploiting it. They found that local politicians often took credit for the projects by visiting projects etc. and that consequently re-election of Mayors in receiving municipalities was more likely.

(van Weezel 2016). Sometimes it is both, depending on the type of aid (Strandow, Findley and Young 2016), but also on the specific group one is looking at (Arcand, Bah and Labonne 2011).[4] However, conflict also affects aid. The circularity of this is still uncharted territory, but in a recent study looking at development aid commitments in Sub-Saharan Africa between 1990 and 2007, Bezerra and Braithwaite (2016) find that donors react to local needs in violent periods, and also that financing continues after violence ends.[5] However, when the violence becomes severe, donors appear put off and new commitments halt. Relatedly, Hoelscher, Miklian and Nygård (2017) find that the presence of conflict increases the likelihood of attacks on aid workers. Addressing existing disparities, Bezerra and Braithwaite (2016) conclude that "violence both attracts and deters new foreign aid".

The brief survey above shows that the literature on the determinants of aid between countries is ample, and also that studies on within-country distribution of aid is on the rise. The main conclusion in existing literature is that recipient need often gives way to donor interest, and that need is not the main driver behind the distribution of funds within countries. However, as Hoeffler and Outram (2011) note, unobserved recipient effects appear to be sizeable, and researchers have yet to unpack central mechanisms concerning recipients and donors alike. There are several potential reasons for existing disparities, one being the operationalization of need. The standard measurements of recipient need are on slow-moving variables like GDP per capita and the Human Development Index (UNDP 2019). Although they reflect divergence in need, they do not incorporate current (extreme) events that significantly escalate need, and which also constitute a policy priority for international aid agencies. The literature on emergency aid is an exception, and contains several elements that could be incorporated in assessments of recipient need as both natural disasters and armed conflict exacerbate an area's need for outside assistance. Some of the studies on sub-national aid distribution include conflict aspects, but this is not done in a very systematic way.[6] That most of these studies (see Briggs 2018, Zhang 2004, Dreher et al. 2016, Jablonski 2014) do not

[4] Arcand, Bah and Labonne (2011) find that one specific aid project in the Philippines (the same project that was evaluated by Cruz and Schneider (2016), the World Bank's KALAHI-CIDSS program) led to an increase in events perpetuated by the New People's Army (NPA) but a decrease in events initiated by the Moro Islamic Liberation Front (MILF). This is consistent with the idea that the latter group operates in areas with grievances against the government, and such grievances might be offset by inflow of aid.

[5] Both civil conflict and terrorist attacks are included.

[6] For instance Nunnenkamp, Öhler and Andrés (2017) use riots and civil unrest as a predictor for recipient merit, while Öhler and Nunnenkamp (2014) use conflict as a predictor of bad regional governance conditions. Similarly Briggs (2017) controls for conflict as a security concern for the donors, but the issue does not receive much attention beyond being included as a control in the models.

mention conflict at all is worrisome given the regions under investigation.

5.3 Conceptual framework: Need versus interests

In any consideration of the determinants of aid, recipient need is a crucial factor. From a normative perspective, it should also be the most important predictor; aid should go to those who need it the most. However, determining what makes up people's need is difficult, and looking at existing literature, the most common approach is to measure need in terms of poverty and/or economic growth.[7] Going beyond the country level, I argue that this expectation should also hold subnationally. The first hypothesis of the paper thus follows convention in expecting that the less developed provinces within a country are the most likely recipients of new aid projects.

> *H1: Less developed provinces are more likely to receive new aid projects compared to provinces that are more developed, all else equal.*

In the appraisal of aid determinants, taking into account the priorities set by the donors to reach the goal of poverty alleviation provides a useful benchmark in evaluating the success. Looking specifically at one central multilateral donor, the World Bank, their most important development priorities are climate change, education, health, conflict/violence and sustainable development (World Bank 2014*b*). Although *development* is more encompassing than poverty per se, traditional development measures also fail to take into account factors that might influence an area's need in a more abrupt manner. All the priorities mentioned above will be influenced by extreme events, some more directly than others. Incorporating the extreme events pertaining specifically to the circumstances one is studying provides sustenance for a more comprehensive conceptualization of need, and improves the possibilities for comparing recipient need across space.

Current (extreme) events, such as disasters and armed conflict, increase the need for aid across most, if not all, priorities stated by both the World Bank and other donors (countries as well as organizations). Even though their origins differ, both types of events have seriously detrimental consequences augmenting affected areas' need. Nevertheless, the magnitude of disasters are often not fully anticipated, and might create an impression of the affected as more deserving of help than people that are 'just' poor. As disasters and complex humanitarian emergencies increasingly strain the economic stability of many countries, the World Bank is taking on a more pronounced role in mitigation and reconstruction (Coppola 2006). In

[7] The traditional measures are GDP per capita, purchasing power parity (PPP) and recently also the human development index (HDI)

the wake of disasters, affected countries often request additional emergency loans from international financial institutions, perhaps knowing that funding related to disasters is easier to get than other types of aid. Taking into account that most natural disasters happen in disaster-prone areas, the second hypothesis concerns an expanded needs operationalization, where areas that suffer from extreme events are more likely to be the recipients of new aid projects.

> *H2: Provinces with high previous exposure to natural disasters are more likely to receive new aid projects than provinces with lower disaster exposure, all else equal.*

The prevalence of armed conflict also increases the humanitarian – and likely also material – need of affected areas. Often more protracted than disasters, armed conflicts have been found to induce an annual loss of GDP per capita 17.5 % per year (in conflict) (Costalli, Moretti and Pischedda 2017). Armed conflict is undoubtedly development in reverse (Gates et al. 2012, World Bank 2012), and the expanded needs conceptualization is also reflected in the third hypothesis, proposing that areas that have recently experienced conflict are also more likely aid recipients.

> *H3: Provinces with recent conflict activity are more likely to receive new aid projects than provinces without conflict, all else equal.*

A potential objection is the fact that ongoing conflict might also restrict access. Access is about security and physical entry for aid workers and project teams, but also about the institutions and legitimacy of the government and other external actors in conflict zones. In many cases access is intrinsically linked to need, and cloud mean that access considerations restrict provision of aid to the most disadvantaged.

The first three hypotheses of the paper reflect an expanded conceptualization of recipient need, and propose that current events which both increase need and are stated priorities on the part of the donor will increase the likelihood that affected areas receive aid. However donor interests are not necessarily a mirror of recipient needs, even if the stated intentions are. Looking at the distribution of aid on a disaggregated level throws the interests of the recipient government into the mix. This is particularly the case for multilateral aid because donors often have limited information about the situation 'on the ground' (Jablonski 2014). The 2005 Paris Declaration on Aid Effectiveness ensures that it is the developing countries themselves that set their strategies for fighting poverty. Only when governments have proven an inability to do so do donors take control of the process (OECD 2005).

Even if the strategies and project plans in some sense have to be approved by the donor (by granting the project loans), it is the recipient governments that are the 'partners' through which all projects go, unless the donor has taken full control of the process.

This is a classical principal-agent problem (Arrow 1985, Radelet 2006) where the recipient government (the agent) has a considerable amount of discretion in the distribution of aid projects. In many respects it is possible to view the recipient government in the same manner as a bilateral donor, 'rewarding' its own supporters, at the cost of perhaps more needy adversaries. The interests of the local government may of course vary substantially, but favoritism – regional or ethnic – should cut across most of these. Regional favoritism holds that the provinces with ties to the government, be it communal groups, partisan coalitions, social classes or other interests, are favored in the distribution of funds from the government (Kramon and Posner 2013). This is likely to be reinforced when the recipient government is involved in armed conflict, as incentives for improving the situation for disaster- and conflict-affected populations in areas where their opponents have strong footholds are weak.

That this is the case for a conflict-affected region is evident, but even if natural hazards are apolitical, the *consequences* of a disaster are in many instances highly politicized. The classic example being that famines are not necessarily a result of drought but rather politics (Sen 1991). Several examples can also be found of governments not engaging in mitigation, or governments or insurgents denying relief aid after disasters (see for instance de Waal 1991, Le Billon and Waizenegger 2007). From this then, the final expectation of the paper is that areas that support the recipient government should see more aid projects than areas that are inhabited by excluded or minority groups. Importantly, this is expected to be a more salient predictor of aid distribution than the needs-based indicators.

> *H4: Provinces inhabited by the politically dominant group are more likely to receive new aid projects than provinces inhabited by other groups, all else equal.*

To sum up, I have proposed three hypotheses concerning the role of recipient need as a predictor of aid distribution, incorporating extreme events into the needs matrix. I have also proposed a fourth and final hypothesis, however, that goes counter to these and holds that domestic political alliances are more important than need, as the government is likely to reward its own supporters in the distribution of aid projects. All hypotheses are tested empirically by looking at Philippine provinces, where recurring natural disasters and armed conflict are extreme events which in-

terchangeably influence the different provinces' need for aid.

5.4 The case of Philippines

Being in the *Pacific Ring of Fire* and situated along the *Pacific Typhoon Belt*, natural disasters – both extremely severe and smaller ones – are frequent in the Philippines (Asian Disaster Reduction Centre 2008). In December 2012, Mindanao Island in the Philippines was hit by the most severe typhoon the country had seen in decades. Typhoon Pablo killed almost 2,000 people, and some 6 million people were directly affected by the tropical storm. A year, and a 7.2 magnitude earthquake, later, the central islands were struck by typhoon Yolanda, "probably the strongest tropical cyclone to hit land anywhere in the world in recorded history" (Mullen 2013). Yolanda took the lives of more than 7,000 people, and over 16 million people were affected by the storm. Of course, disasters are endogenous in the sense that two similar weather phenomena will materialize differently depending on the situation on the ground where they hit. However, in the Philippines the majority of the disasters are severe, with the median number of affected people by each disaster between 1990 and 2012 at 33,094 (Guha-Sapir, Hoyois and Below 2015), testifying to the extreme force of the phenomena even before they hit land.

In addition, the Philippines is a relevant case because it has been in civil conflict(s) more or less continuously since the country became independent in 1946. The Communist Party of Philippines (CPP) has been fighting for government power since 1946, while a territorial conflict between the government and the Muslim Moro minority over the western parts of Mindanao island has been going on in an organized manner since the 1970s. Since 1989, more than 17,000 people have been killed in these conflicts (Croicu and Sundberg 2017). Next to disasters, armed conflict is the country's most important obstacle on the road to achieving the Sustainable Development Goals (World Bank 2014*b*;*a*). The dual burden of disasters and conflict is clearly echoed in the World Bank's partnership strategy with the Philippines:

> *With the Philippines among the fastest growing countries in the world, this strategy offers a unique opportunity for the World Bank Group to support the government's efforts to improve the lives of the poor and vulnerable by creating more jobs and better opportunities. We will leverage our public and private resources to help Filipinos build resilience to economic shocks from natural disasters and climate change and to build shared prosperity including for people in Mindanao seeking the rewards of peace* (World Bank 2014*b*).

The long-lasting conflicts naturally impact the political climate in the country.

Three different politically relevant groups can be distinguished: the Indigenous Cultural Communities (ICC), the Moro and the Christian lowlanders (Girardin et al. 2015). The Christians more or less control national politics, while the two other groups remain excluded by and large. The Muslim Moros have after a protracted civil conflict obtained access to political power at the sub-national level, and already in 1989 the Autonomous Region in Muslim Mindanao (now encompassing five provinces on the Mindanao island) was created. Nevertheless, efforts towards increased autonomy and agreement are still obstructed by insurgent and terrorist attacks from groups such as Abu Sayyaf and the Moro Islamic Liberation Front (MILF). In a different effort, the indigenous populations have struggled for local control and creation of indigenous areas, but have been less 'successful' in terms of winning regional power than the Moros. Consequently, the Communist Party has a strong base in many indigenous communities, even if their grievances are not identical.

Despite being a fast-growing economy, ongoing conflict and the increasing number of disasters across the country have rendered the Philippine economy contingent on development aid. Figure 5.1 shows a marked increase in the number of aid project locations in the country over the relevant time period. It is evident that the occurrence of both disasters and protracted conflict inflates any given area's need for assistance, but it is also likely that the political situation in the Philippines influences the distribution of aid. Despite the focus of the World Bank (the donor) on disaster mitigation and conflict-affected populations in Mindanao, the aid projects, or loans as they in fact are, all go through the Philippine government in their dispersion. As the government has a fair amount of discretion in the aid decisions, and is involved in two conflicts, it is reasonable to assume that it would want to reward its own supporters rather than its adversaries whenever possible.

An geographical overview of the prevalence of aid, disasters, conflict activity, level of development and political groups across the Philippine provinces are presented in Figure 5.2. The maps illustrate that there is considerable variation both temporally and spatially in the different phenomena across the Philippines, substantiating the relevance of the case. In addition, the substantial overlap between conflict activity and the oppositions' living areas is crucial for the proposed mechanisms to be applicable.

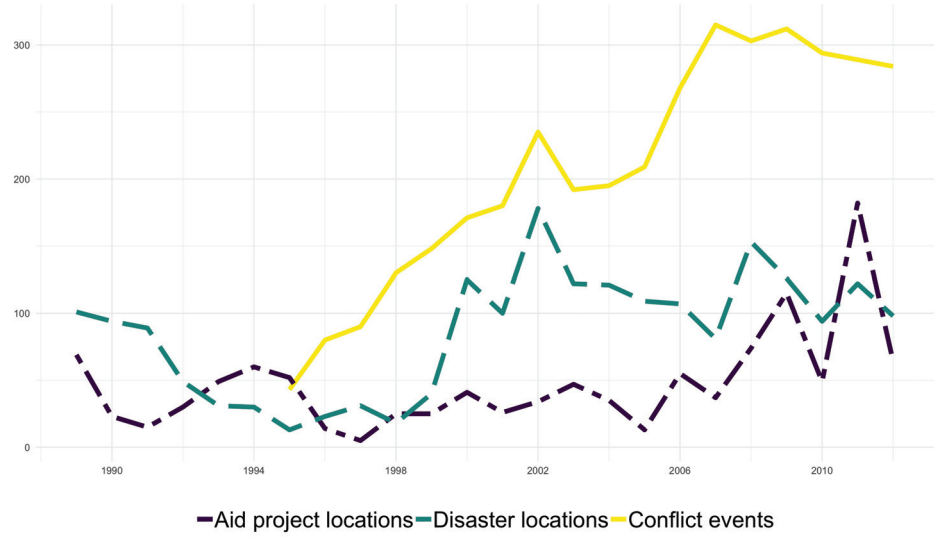


Figure 5.1: Trends in number of aid projects, disasters (both by province) and total number of conflict events, 1989-2012

5.5 Data and empirical analysis

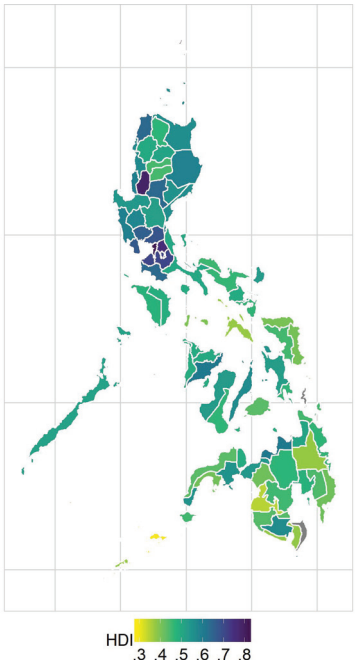
5.5.1 Dependent variable: Dispersion of development aid projects

The unit of analysis is province years, and the analysis covers 80 provinces in the Philippines between 1996 and 2012.[8] The dependent variable records whether a new aid project was started (meaning money started flowing in) in any given province-month, and takes the value 1 if a project began and 0 if not.[9] I use this measure rather than a count of the total number of ongoing aid projects to be able to capture responses to altered needs situations – for instance, those induced by a disaster. The aid data consists of World Bank development aid projects in the International Bank for Reconstruction and Development (IBRD) and the International Development Agency (IDA) lending lines between 1995 and 2014. Being in the lending group for lower-middle-income economies, the Philippines is only eligible for loans from the IBRD. The projects recorded are both structural adjustment programs and loans targeted at specific projects. The data have been geocoded and

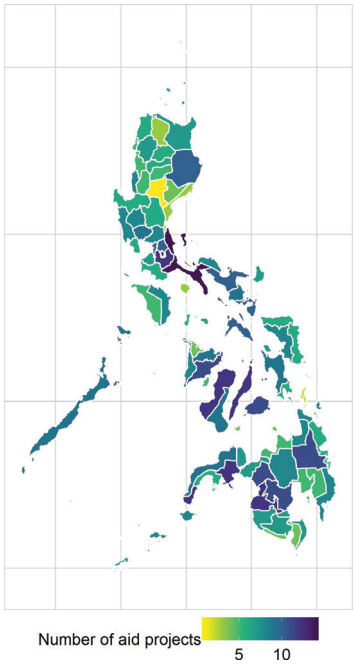
[8] Today there are 81 provinces in the Philippines, but Davao Occidental was split from Davao del Sur in 2013, falling outside the time-frame of the analysis. The time-span is restricted by the aid data that begins in 1995 (1996 is the start-year in order to include the lagged incidence variable), and by the disaster data that is only recorded until 2012.

[9] Looking at the amount of money flowing in would be desirable, however the data only provides disbursement figures for the project as a whole, not for each location.

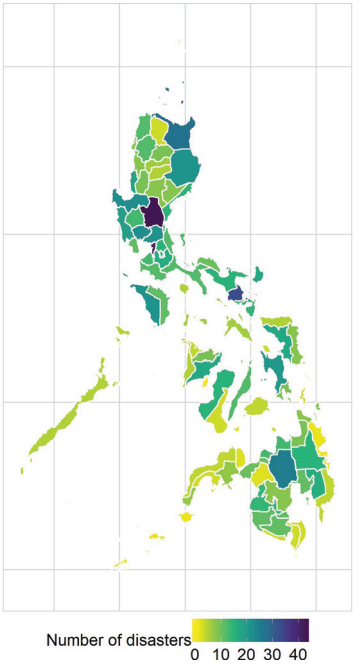
(a) Provincial HDI, 2012 levels



(b) Development aid projects



(c) Disaster prevalence



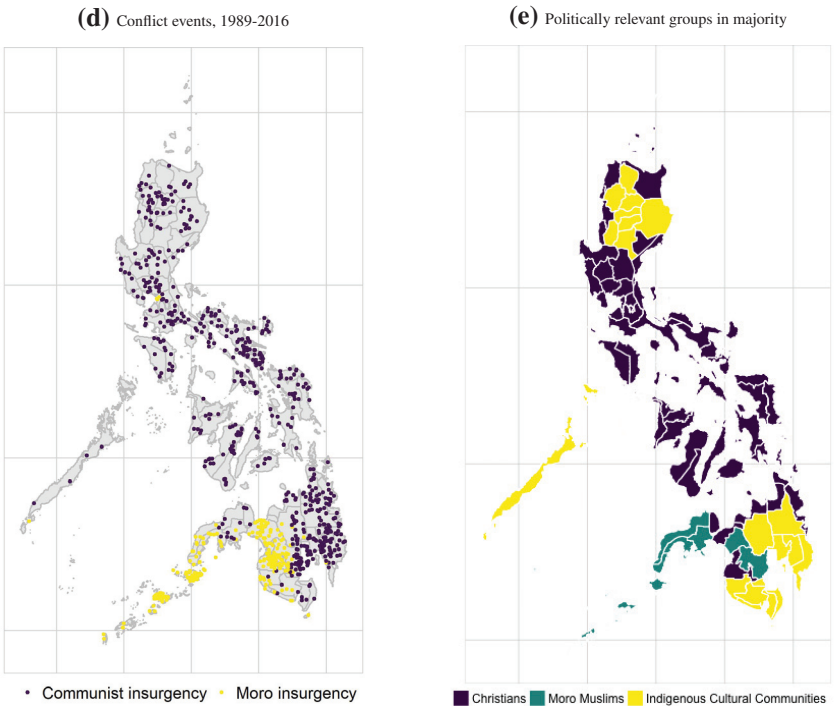


Figure 5.2: Maps of central indicators

made available by AidData (AidData 2017).

The probability of receiving an aid project might not be the same in provinces that recently received a project compared to provinces where it has been a while since a new project started. To deal with temporal dependence, a lagged incidence variable is included in the models. This variable records whether the province had any ongoing projects in the given year, coded as 1 if that was the case, and 0 if not.

5.5.2 Independent variables: Recipient need

In line with existing literature on recipient need, the first independent variable is a traditional measure of need, namely provincial human development index (HDI) score. The index consists of measures of health, education and standard of living, and ranges from 0 to 1, with 1 being the highest level of development. The HDI data comes from the Philippine Statistics Authority, and as it is collected in 3-year intervals between 1997 and 2012, the data has been inter- and extrapolated to cover each year between 1996 and 2012. To allow different levels of development to have different effects on aid distribution, I also include a square term of HDI.

In expanding the concept of need to incorporate current events, I include a measure of previous disaster exposure. This variable records the moving average (ma) of the number of disasters in the province over the previous two years (t_{-2} to t_{-1}).[10] Included disasters are the rapid-onset disaster types: floods, storms, earthquakes and landslides. Data on their prevalence comes from the Emergency Events Database (EM-DAT) (Guha-Sapir, Below and Hoyois 2016) provided by the Centre for Research on the Epidemiology of Disasters. The EM-DAT database originally covers all countries in the world, but I use a geocoded version of all disasters in the Philippines from 1980 to 2012 that has been geocoded and made available by AidData (AidData 2016).

To be included in the EM-DAT database, the criteria are that either (1) ten or more people must be reported killed, (2) one hundred or more people are reported affected, (3) a state of emergency is declared or (4) a call for international assistance is made (Guha-Sapir, Below and Hoyois 2016). This means that the disaster indicators are consequence-based, as only disasters of a certain magnitude/severity are included in the sample. However, for the Philippines, who is among the world's ten most disaster-prone countries, this is not a particularly high threshold. It is reasonable to assume that most disasters (that hit shore in the case of typhoons) will be coded in the dataset, alleviating potential endogeneity concerns.[11] The total number of disasters between 1994 and 2012 (the two-year moving average means included disasters go back to 1994) is 1,297, most of which occurred in more than one province.

The final predictor of need is armed conflict, and I include conflict events (state-based violence only) from the The Uppsala Conflict Data Program's Geocoded Event Dataset (UCDP GED) (Sundberg and Melander 2013, Croicu and Sundberg 2017). The conflict exposure variable records the moving average of the number of conflict events over the previous two years (t_{-2} to t_{-1}). For the conflict events to enter the UCDP GED data, there must be a minimum of 25 battle-related deaths in a calendar year. After entry, all events related to that conflict with at least one fatality is geolocated in the GED dataset (Sundberg and Melander 2013).

The overall severity of the conflicts in the Philippines is relatively low, with a me-

[10] The two-year threshold is chosen to capture recent events, while also keeping in mind the more long-term exposure to disasters, as well as taking into account the relatively short time-span of the analysis.

[11] Taking into account the severity of the disasters would of course be desirable. Due to lack of reliable data however, I do not make use of the severity variables in the EM-DAT, but rely on the fact that all disasters included are above a certain severity threshold. The severity of disasters is notoriously difficult to measure, and a recent discussion of this can be found in Guha-Sapir and Checchi (2018).

dian of 3 battle-related deaths per conflict event between 1994 and 2012 (again the two-year moving average means that conflict events back to 1994 are included in the analysis). Over this period there were 1,974 conflict events in the Philippines, with the deadliest 10% of the events having between 10 and 180 fatalities (Croicu and Sundberg 2017). Because of this, I prefer the conflict event measure over conflict severity.[12]

5.5.3 Conditioning variable: Political alliances

To capture political favoritism by the Philippine government, I look at the geographic prevalence of politically relevant ethnic groups across provinces. These groups are defined as those that either have representatives making political claims on behalf of their group or those that are singled out by the state through discrimination. The groups are presented in the previous section, and data on these groups come from the GeoEPR-ETH dataset (Vogt et al. 2015). The first group variable records the share of a province area that is inhabited by the politically dominant group, the Christian lowlanders, and ranges from 0 to 99.28. Secondly, I also include a dummy variable recording whether or not the Christians are in majority in any given province. If this variable takes the value 1 it means that the Christian lowlanders have a larger settlement area, in terms of square kilometres, than the two remaining groups within a province. In order to find the conditional effect of the domestic political alliances, the Christian majority dummy is interacted with the need indicators.

5.5.4 Statistical model and potential confounders

As the dependent variable – aid project start – is dichotomous, logit models are used. To make sure that the results are not driven by a temporal trend, year fixed effects are included in all models. Because I am interested in variation in the distribution of aid projects over space, random effects are preferred for the provinces.

In order to rule out that the results are driven by other confounding factors, a series of controls are also included. As mentioned, a lagged incidence of ongoing aid projects is included in all models to account for temporal dependence. However, it is not unlikely that the number of ongoing aid projects would matter, and consequently I also include a measure of the number of ongoing aid provinces. Furthermore, aid is likely to go to areas where there are people, and the models consequently control for the number of people living in each province. To account for accessibility, both in terms of geography and politically, the distance (in kilometres) to the capital, Manila, is included. Both this and the population measure

[12]For robusteness I run all analyses using the battle-deaths specification as well. The results of these are reported in the Appendix.

are transformed using the natural logarithm in the analyses. Variables that are time invariant, or calculated as moving averages ending in time t_{-1}, are lagged one year to make sure the sequence of events is correct.[13] Table C.1 in the Apppendix shows the summary statistics for all variables included.

5.5.5 Results

Table 5.1 shows the logit models, beginning with the first two models which include only the traditional measure of HDI and the controls. The models are then expanded (with and without controls) to include the two exposure variables (models 3–4), the conditioning variable (models 5–6) and finally the interactions (models 7–8). Looking at the development indicator, model 2 shows that the higher the HDI of a province, the less likely it is to receive a new aid project. Although this is not a statistically significant finding, this is in line with the first hypothesis that need predicates the inflow of new aid projects. The next set of models reflect the expansion of need to include current events, and from model 4 it appears that previous disaster exposure reduces the likelihood of receiving a new aid project, while the opposite is the case for conflict activity. These effects are both small and not statistically significant, and while the conflict exposure coefficient is in line with the third hypothesis, this is not the case for the disaster coefficient which is counter to the third hypothesis.

Including the measure for political alliances, model 6 shows that this is a more important predictor of new aid projects. The larger the share of a province that is inhabited by the politically dominant group, the Christian majority, the more likely it is that the province will receive new aid projects. This effect is statistically significant, and provides support for the fourth hypothesis. Nevertheless, the findings so far are rather weak. Looking at the control variables, the probability of receiving a new aid project appears to decrease with the number of active aid projects the year before. The coefficient for distance to capital is positive, indicating that less central provinces are more likely to receive new projects. However, this is likely a result of the fact that the least developed areas lie the furthest away from the capital. Finally, in line with the expectation, the number of people living in a province significantly increases its likelihood of receiving new aid projects. Looking at the model fits, the models that include control variables perform the best with lower scores on all identification criteria.

To evaluate the influence of political alliances on the measures of need, models 7–8 include interactions between a dummy for being a majority Christian province and the three independent variables. Again, the models include a step-wise adding of controls, which stay the same after including the interactions. Model 8 shows

[13] This applies to the previous projects, HDI and population variables.

Table 5.1: Logit random effects models on aid project start, 1996-2012

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Provincial HDI	0.158	-1.534	0.295	-1.340	-0.005	-1.228	-1.667	-2.547*
	(0.949)	(1.268)	(0.870)	(1.254)	(0.827)	(1.198)	(1.317)	(1.157)
Disaster exposure, 2 year ma			0.152	-0.051	0.128	-0.060	-0.165	-0.171
			(0.123)	(0.133)	(0.127)	(0.135)	(0.386)	(0.353)
Conflict exposure, 2 year ma			0.045	0.027	0.062*	0.040	0.010	-0.005
			(0.028)	(0.026)	(0.027)	(0.026)	(0.020)	(0.017)
Share of Christian area					0.007**	0.005*		
					(0.002)	(0.002)		
Christian majority province							-1.209	-1.072
							(0.807)	(0.876)
HDI X Christian							2.650	2.440
							(1.612)	(1.824)
Disaster exposure X Christian							0.328	0.116
							(0.403)	(0.373)
Conflict exposure X Christian							0.130***	0.118***
							(0.034)	(0.035)
No. aid projects year before		-0.006		-0.006		-0.017		-0.026
		(0.066)		(0.067)		(0.066)		(0.071)
Distance to capital, km (ln)		-0.023		-0.036		0.010		0.050
		(0.092)		(0.092)		(0.092)		(0.113)
Population (ln)		0.620***		0.612***		0.602***		0.604***
		(0.117)		(0.117)		(0.112)		(0.106)
N	1 360	1 360	1 360	1 360	1 360	1 360	1 360	1 360
aic	1243.622	1205.416	1244.311	1208.400	1241.646	1207.465	1242.656	1208.894
bic	1347.927	1325.366	1359.046	1338.781	1361.597	1343.061	1378.253	1360.136
ll	-601.811	-579.708	-600.156	-579.200	-597.823	-577.733	-595.328	-575.447

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Clustered on provinces, all models have time-fixed effects and control for lagged incidence

that for excluded group-majority provinces, there is a statistically significant negative effect of the level of HDI on the province's likelihood of receiving new aid projects. This means that the less developed provinces are more likely recipients of new aid projects, in line with expectations. For the same provinces, but not statistically significant, previous disaster exposure is associated with a lower likelihood of receiving new aid projects, while previous conflict exposure has the opposite effect. Distinguishing the pattern for the Christian majority provinces, as well as the differences between the groups, is difficult from the regression coefficients, and are best distinguished by looking at the marginal effect plots.

Figure 5.3 shows the marginal effect plots for the interactions between the Christian majority provinces and the three needs indicators, all based on model 8. Looking at province level HDI, Figure 5.3(a) confirms the negative association between HDI levels and the likelihood of an aid project being disbursed. For Christian majority provinces, the likelihood of getting a new aid project appears unrelated to a province's HDI score, which generally lies at a higher level than for excluded

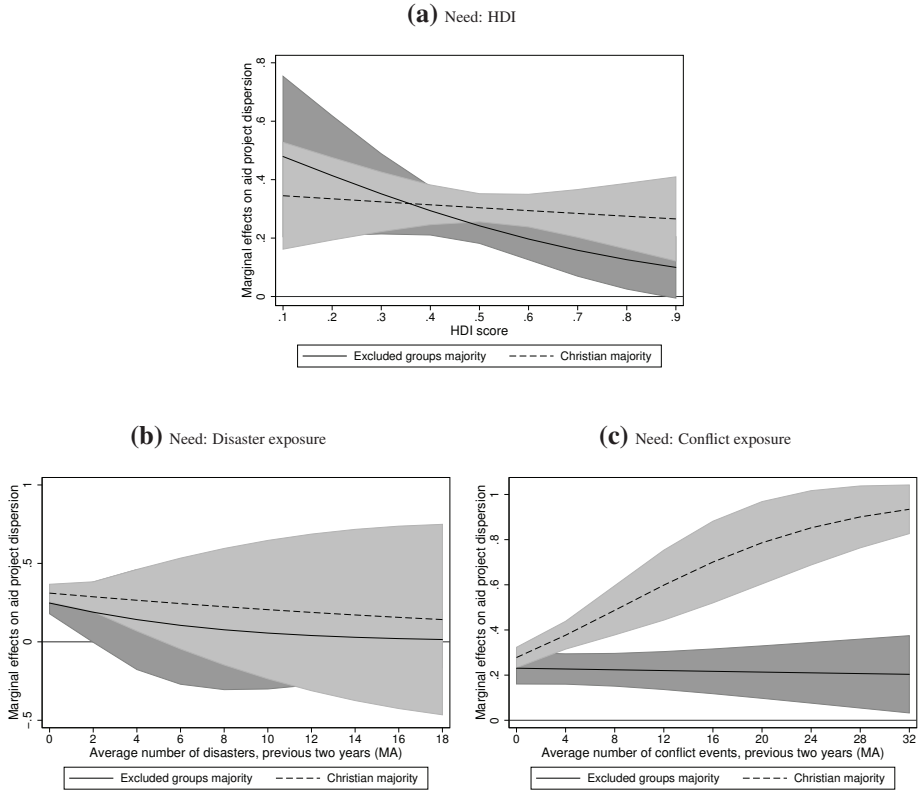


Figure 5.3: Marginal effect plots of the effects of different needs indicators on the likelihood of receiving an aid project in different majority group provinces

groups. However, overlapping confidence intervals reveal that the patterns between the groups are not significantly different from each other. This means that the first hypothesis can only be confirmed if we look at excluded group-majority provinces in isolation. The map in Figure 5.2(a) also reveals that the level of development is generally lower in the southern provinces, which are predominantly inhabited by Muslim Moros. Consequently, this could reflect the policy of the World Bank of targeting the Moro (i.e. excluded group) areas.

Looking at the disaster exposure as a moving average over the two previous years, the marginal effects plot in Figure 5.3(b) shows that there is a weak negative relation between having been hit by disasters and the probability of a new aid project being initiated in the province. For this measure, there is no observable difference

related to the political status of a province. Although this effect is quite weak – and surprising – it could be an indication that for some extreme events, political alliances matter less. This suspicion is strengthened by looking at the last margins plot, Figure 5.3(c). For previous conflict exposure, its effect on the likelihood of receiving aid projects is clearly different between provinces that are majority Christian and provinces where an excluded group (Moros or indigenous) is the largest. Christian majority provinces are much more likely to get aid than equally conflict exposed minority provinces, and the difference is increasing for higher levels of conflict. This means that the third hypothesis can only be confirmed for provinces inhabited by the politically dominant group.

All three interaction plots also imply that apart from areas with the lowest levels of HDI, Christian majority provinces have a higher probability of receiving aid than other provinces across the different predictors. This is also shown in model 6 in Table 5.1, and the fourth hypothesis can thus be confirmed. In other words, it appears that the Philippine government's preferences influence the distribution of World Bank aid projects, and that they use aid projects to reward their own supporters more than distributing it according to need.

5.6 Concluding remarks

This paper adds to recent efforts evaluating the determinants of development aid distribution in a disaggregated setting, and is novel in arguing that current extreme events – in this case disasters and armed conflict – should be taken into considerations of recipient need because these events to a large extent shape different areas' need for aid. Ultimately however, aid is political, and favoritism on the part of the recipient government is expected to bias the aid dispersal, even if the donor is a multilateral aid agency.

The theoretical arguments of the paper are tested by looking at the dispersal of development aid projects from the World Bank to the Philippines between 1996 and 2012. The Philippines provides an excellent case because of its spatial and temporal distributions of the phenomena at hand, namely disasters, armed conflict and aid. The paper finds that although need can be a predictor of who receives aid within the Philippines, overall, the political alliances of the recipient government considerably influence the distribution of development aid, sometimes away from those that need it the most. This political bias is not present when looking at the role of disaster exposure for the likelihood of receiving a new aid project, but the observed effect is surprisingly negative (although weakly so) for both groups, meaning that higher levels of disaster exposure actually decrease the likelihood of receiving an aid project. If anything, it appears that the policy of the World Bank to target disaster-affected areas has not yet materialized. A possible reason might be

that the negative effects of experiencing a disaster could be more pronounced for the most well-off provinces than for the less-developed ones. Another explanation could be that there is still a certain backlog to this policy, and that looking beyond the time-frame of this analysis (ending in 2012) would yield different results. Until updated data is released however, this cannot be confirmed.

On the other hand, previous conflict exposure predicts increased dispersal of new aid projects in political majority-provinces, but not for provinces where excluded groups make up the largest share. This could illustrate that the type of extreme event matters, and that some types of need are more politically and materially costly to react to depending on their cause. For instance, providing aid to the violent provinces in Mindanao – even though these are the explicit target of the donor – might be undesirable for the government as it could contribute to strengthening their opponents. In line with Hoelscher, Miklian and Nygård (2017), it is also likely that the security of aid workers would be more compromised in minority-provinces.

Although the arguments of this paper have been evaluated using the empirical case of the Philippines, its theoretical contributions – especially concerning the expansion of need – are applicable beyond this specific case. This is particularly so for other countries that are ravaged by natural disasters and/or armed conflict, of which there are many eligible candidates across Asia and Africa. The finding that domestic political alliances determine the distribution of aid projects to a greater extent than the priorities of the donor is in line with existing research, but the analysis does not allow any conclusions on this outside the specific context studied here. In the future, this should be investigated also for other donors than the World Bank, and across a variety of countries and contexts.

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5.8 Appendix

5.8.1 Descriptive statistics

Table C.1: Descriptive statistics

	Mean	SD	Min	Max
Aid project start	0.349	0.477	0	1
			(65.15)	(34.86)
Ongoing aid project	0.902	0.297	0	1
			(9.79)	(90.21)
Provincial HDI	0.517	0.110	0.201	0.873
Disaster exposure, 2 year ma	0.568	0.752	0	5
Conflict exposure, 2 year ma	1.073	2.65	0	28
Christian majority province	0.675	0.469	0	1
			(32.5)	(67.5)
Share of Christian area	62.090	32.376	0	99.28
No. aid projects year before	4.037	2.979	0	14
Population	1 012 390	1 323 559	14 180	11 855 975
Conflict affected (battle-deaths), 2 year ma	5.772	19.588	0	242
Distance to capital, km	487.621	308.841	0	1049.94
Observations	1 440			

5.8.2 Different conflict exposure specification: Battle-related deaths

All models have also been run with an alternative conflict exposure specification of battle-related deaths.

Table C.2: Logit random effects models on aid project start, 1996-2012

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Provincial HDI	0.158	-1.534	0.039	-1.495	-0.265	-1.432	-1.865	-2.660*
	(0.949)	(1.268)	(0.914)	(1.262)	(0.876)	(1.216)	(1.383)	(1.178)
Disaster exposure, 2 year ma			0.155	-0.052	0.135	-0.058	-0.177	-0.181
			(0.127)	(0.135)	(0.131)	(0.138)	(0.393)	(0.355)
Conflict affected (battle-deaths), 2 year ma			0.002	0.001	0.003	0.002	-0.002	-0.002
			(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.003)
Share of Christian area					0.006*	0.004		
					(0.003)	(0.002)		
Christian majority province							-1.205	-1.000
							(0.828)	(0.879)
HDI X Christian							2.626	2.296
							(1.676)	(1.852)
Disaster exposure X Christian							0.359	0.138
							(0.409)	(0.372)
Battle deaths X Christian							0.019**	0.016*
							(0.007)	(0.007)
No. aid projects year before		-0.006		-0.003		-0.012		-0.014
		(0.066)		(0.068)		(0.067)		(0.071)
Distance to capital, km (ln)		-0.023		-0.033		0.006		0.042
		(0.092)		(0.093)		(0.093)		(0.115)
Population (ln)		0.620***		0.622***		0.614***		0.610***
		(0.117)		(0.119)		(0.115)		(0.109)
N	1 360	1 360	1 360	1 360	1 360	1 360	1360	1360
aic	1243.622	1205.416	1246.030	1209.173	1244.368	1208.868	1244.500	1210.278
bic	1347.927	1325.366	1360.766	1339.554	1364.318	1344.464	1380.096	1361.520
ll	-601.811	-579.708	-601.015	-579.586	-599.184	-578.434	-596.250	-576.139

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Clustered on provinces, all models have time-fixed effects and control for lagged incidence