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Evaluating the Effects of Food Aid on Conflict in Sub-Saharan Africa: A Disaggregate Approach

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Evaluating the effects of food aid on conflict in Sub-Saharan Africa: A disaggregate approach

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NOMENCLATURE

ACLED	Armed Conflict Location & Event Database
FAO	Food and Agricultural Organization
KM	Kilometer
MT	Metric Ton
ODA	Official Development Assistance

ABSTRACT

Despite the benefit to hungry people in recipient countries, the use of food aid as a form of international assistance has become a source of contention among policy makers and researchers. The accusation is that food aid promotes the onset of conflict and sustains conflict in already volatile areas. This paper examines the relationship between food aid and conflict at the disaggregate, local level, with the purpose of determining if the provision of food aid increases conflict in recipient areas. The geospatial analysis performed as part of this study focused on 346 individual food aid events across 17 African countries between January 1995 and February 2016, and 19,498 corresponding conflict events occurring during the same time.

The number of localized conflict events was not found to increase with the provision of food aid when compared to numbers observed in the pre and post aid periods. Examination of the active aid period indicated that the provision of emergency aid increased the number of localized conflict events more than the provision of non-emergency aid (planned or program aid). From this finding, it is recommended that aid be provided as quickly as possible to segments of the population struggling due to economic disadvantage or isolated crop failure. To reduce conflict associated with aid theft during transport, this study suggests that food aid is most effectively provided at secure distribution sites located away from main supply routes and in areas with well-developed road networks.

CHAPTER 1

INTRODUCTION

Food aid is provided to countries experiencing periods of transitory food insecurity — due to natural disaster, a poor crop year or war — or to states suffering from chronic undernourishment problems. The provision of food aid in itself thus indicates the presence of food insecurity among at least a few segments of the population and signals the increasing value of food in these areas. Any existing food production resources or provisions of food aid then gain an inflated value, providing incentive to control these goods. Attempts to gain this advantage are likely to motivate conflict, so more conflict may occur in regions surrounding food aid. If the costs associated with stealing food or staging attacks to gain control of a food resource outweigh the gains, then food aid would likely not be provided or needed in that area to begin with.

The analysis presented in this paper attempts to expand upon existing work assessing humanitarian aid's role in conflict. Locational analysis is used with a focus on individual food aid events in Africa and conflict events in the surrounding regions. Limiting the analysis to food aid events focuses the results on the largest form of international humanitarian assistance. This study then acts as narrower look at humanitarian aid than is provided by much of the existing research, to determine if the allocation of food aid brings different results in recipient regions than does other forms of aid. The purpose of this paper is to address several questions: What is the expected effect of food aid on localized

conflict? What physical and regional characteristics make a food aid distribution site most vulnerable to attack? What types of aid are most affected by conflict?

A total of 346 individual food aid events across 17 African nations and 19,498 corresponding conflict events were considered. These events occurred between January 1995 and February 2016. The relationships between each aid characteristic and demographic factors and conflict was tested using OLS regressions. The effect of food aid on the change in incidence of conflict was then examined more closely using a first difference model. Policy recommendations targeted at donor organizations are suggested based on the analytical findings.

CHAPTER 2

REVIEW OF LITERATURE

Food Security and Conflict

Food security exists when "all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" (World Food Summit 1996(Rome), 1996; Clay, 2002). At the national level, access describes the amount of food that exists for human consumption within a country and measures whether sufficient food exists to feed the population. This includes total production as well as trade, food stocks and food aid. At the individual level, access requires not only the availability of sufficient food, but also the economic ability to obtain adequate nutrition. Cyclical or transitory patterns of food insecurity, which are periods of reduced food access, may result from seasonal production variations (rainy season versus dry season) or the temporary decline in an individual's purchasing power due to any number of economic and political factors. These situations have the potential to push large portions of a country's population into a food insecure situation at one time creating a food crisis.

Transitory food insecurity and prolonged states of malnourishment lead to compromised human health, weaken the labor force and ultimately hinder economic development. Food insecurity can also weaken political stability and induce conflict (Cohen & Pinstrup-Andersen, 1999). Income poverty, poor health and nutritional status have been shown to be more closely associated with the onset of armed conflict than overall economic growth and performance (Pinstrup-Andersen & Shimokawa, 2008; Margulis, 2013).

Hunger issues pose a serious challenge to governmental and non-governmental institutions and policy decisions at all levels including the international level. The 2015 FAO Report on undernourishment finds Africa to be the region with the highest proportion of hungry inhabitants with 23.3 percent of its population facing some level of food insecurity. This is 11 percent higher than Asia and the Pacific and nearly 18 percent higher than Latin American and the Caribbean, which are also regions known for struggling, developing countries (FAO, 2015). There is much debate over the cause of food insecurity. The cause of the food crisis in Africa has been a contested issue by policy makers looking to ease suffering and promote development. Several studies point to mixed economic and political factors that limit access to existing food sources as a key component (Mano et al., 2002; USAID, 2003; Aker and Lemtouni, 1999).

International Food Aid

Food aid is the main form of humanitarian aid used by donor nations to address hunger, malnutrition and suffering in the developing world. Aid of this type generally takes one of two forms — direct transfers of food supplies, often with donor nations shipping excess food abroad, or food assistance grants. Direct transfers of food are often favored by large agricultural countries, such as the United States, which use foreign aid to support domestic prices by reducing excess market supply. Net food importing countries and non-governmental organizations, which lack access to national food supplies, tend to give financial assistance. Food grants allow needed food supplies to be purchased locally, either

in the recipient country's own market or from one of its neighbors. This not only reduces the cost of transportation, but also provides a benefit to the regional economy.

Donor countries typically have mixed motivations in providing food aid to developing or crisis-ridden countries. One objective is, of course, to feed hungry people. Other motivations historically have been to promote peace, improve diplomatic relations with foreign governments, establish foreign markets, and foster economic development. Motivations may vary across recipient countries and may change over time. For example, the United States had four main objectives when it established the Food for Peace program (PL 480) in 1954. These included — establishing external markets, providing an outlet for excess agricultural production to support domestic prices, stopping the spread of communism, and providing humanitarian assistance. Throughout the 1970s, food aid was given primarily to promote the economic self-interest of the United States. Starting in the 1980s, humanitarian aid became the primary stated objective (Ball & Johnson, 1996). The only type of food aid still provided is through emergency and private assistance programs (Title II) in which donated commodities are given directly to nations in crisis.

Despite the benefit to food insecure persons in recipient counties, the efficacy of food aid in reducing overall suffering and aiding local populations has received increasing criticism in recent years (Anderson, 1999; Nunn & Quian, 2012). The accusation is that food aid promotes conflict onset, and sustains conflict in already volatile regions. Examples of aid's negative effect may be when it: i) supplies needed materials that allow the local population to be freed from labor and have more time to fight, ii) gives conflict leaders increased access to resources or international attention, iii) helps selected groups

disproportionally, or, iv) assists agencies that condone or support one party in an existing conflict." Examples of aid's positive effect include: easing suffering, supporting local economies, and promoting peace.

Stealing Food Aid

Accounts of conflicts across Africa point to aid stealing as a key way in which food aid promotes conflict. Both food aid grants and direct food transfers are stolen, however, direct food and material transfers are much more vulnerable to theft than is monetary assistance. Shipments of food are particularly easy for armed factions and rebel groups to appropriate as they are physically transported long distances. Supply routes often run through rural areas in which there is little government control or protection. This makes it easy for opposition groups to attack aid convoys. Reports indicate that up to eighty percent of aid shipments are stolen en route (Polman, 2010). Lack of transportation infrastructure, especially a well-developed road system, has been thought to significantly increase the frequency by which aid is stolen prior to delivery as drivers have little to no option in routes they take. This makes it easy for antagonists to anticipate the movement of aid and set roadblocks or traps. Even if aid shipments successfully reach their target locations, they may still be kept from their target populations due to "taxes" enforced by opposition groups or the government. The misappropriated aid is then used to fund conflict (Nunn & Qian, 2012).

The total amount of aid stolen can exceed the value of the food itself. In many cases, transport vehicles and equipment are also seized and either used for the rebel cause

or sold for the purchase of arms. Food grants can also be misappropriated, but doing so requires gaining control over the local or national government through which the funds are dispersed. Incentive to gain access to this monetary resource can give armed groups motivation to overthrow the government. However, acquiring the resources to do so may take some time, which makes more accessible aid sources, such as physical aid, to be first-level targets for most groups (Findley et al., 2011).

Aid is not only stolen by opposition groups but also be misappropriated by the government or national military. Governments that receive aid often use their control to maintain political support and power. Specific populations, such as loyal supporters or swing voters, are often rewarded while opponents are excluded (Uvin, 1998; Dixit & Londregan, 1996; Robinson & Acemoglu, 2012). In countries with already tumultuous political climates, favoritism in this manner is often seen as an additional form of corruption, and is a contributing factor in unrest and conflict. Cases of this can be seen in Rwanda in the 1990s, where government misappropriation of aid was so problematic that aid shipments were largely canceled (Uvin, 1998), and in Zimbabwe in 2003 where only residents with ZANU-PF Party membership cards were allowed to collect food rations (Thurow & Kilman, 2009). The fungible nature of food aid, and the continued support of such international assistance programs by developed nations, has made it so that food aid has become a logistical support system for the government and opposition groups alike. Some even consider aid capture as a “permanent feature of military strategy” (Polman, 2010, p. 10).

Aid and Government Accountability

One critical factor in determining the effectiveness of food aid in promoting the donor-intended goals is the ability of that aid to reach the intended recipients to be used for its intended purpose (Awudu et al., 2005; Findley et al., 2011; Nunn & Qian, 2012). Aid is traditionally thought to work best in environments with high quality public institutions (Burnside and Dollar, 2000; World Bank, 1998). Although the robustness of this assertion was brought under scrutiny by William Easterly's 2003 paper. "New Data, New Doubts: A Comment on Burnside and Dollar's "Aid, Policies, and Growth"" (Easterly, 2003) institutional strength is still a factor considered by many institutions in determining aid allotments and disbursement. Considering the level of democracy present in a nation is one way of estimating how effectively aid will be utilized throughout the recipient country (Robinson & Acemoglu, 2012).

States that can raise a substantial proportion of their revenues from the international community are less accountable to their citizens and under less pressure to maintain popular legitimacy (Moss et al., 2006). In this way, large aid flows can reduce public participation if citizens notice their leaders are more attuned to their relationships with donor countries than with the needs of their nation. This may result in a strong, corrupt president and a population that is not politically motivated and submissive to the whims of its government (van de Walle, 2001; Joseph, 2003). Alternatively, such behavior may fuel opposition groups and induce conflict as citizens seek to fight against government corruption.

Market Disruption and Conflict

An additional way in which food aid may induce conflict is through its effect on local markets. This is most probable in the case of direct food transfers. Adding a sudden, additional amount of food to domestic supply at low or no cost may significantly disrupt agricultural incomes by substantially lowering market prices (Pedersen, 1996; Kirwan & McMillan 2007; Smith, 2014). This may create a disgruntled farming population and increase incidences of conflict.

Dependency also becomes a concern in the case of perpetual aid. The "aid curse" similar to the resource curse suggests that large aid flows create dependency that induces perverse incentives and leads to anti-developmental outcomes (Moss et al., 2005). In terms of agriculture, domestic production may decrease thereby creating a loss of livelihood for the farming population and igniting conflict. This concern is supported by decreasing per capita food production observed in Sub-Saharan Africa, and increasing levels of food aid observed during the 1970s-1990s (Barrett & Maxwell, 2005; Donovan et al., 1999). However, to the extent that those in receipt of aid are not in possession of their own food source (for example, are not farmers) or that supply is sufficiently low due to drought or pest infestations, adding additional supply to the market in the form of food aid may have little to no effect on incomes, production levels, or conflict (Awudu & Barrett, 2005).

Conclusion

Not all studies find a positive relationship between foreign aid and conflict (Collier & Hoeffler, 2002) and some suggest that an increase in Official Development Assistance (ODA)

actually reduces conflict. The difference in findings is likely linked to the type of aid investigated and the empirical strategies used. This paper does not seek to end the debate over the relationship between international development assistance and conflict. It merely seeks to investigate further the relationship between food aid and conflict at a disaggregated level. Time-series analysis of geocoded data pertaining to individual food aid distributions and armed conflicts are used for this analysis.

CHAPTER 3

THEORY

Food insecurity is a recognized contributor to civil unrest and is frequently included in standard conflict models (Collier & Hoeffler, 2002; Besley & Persson, 2011; Cohen, 1999). Food aid is provided to countries experiencing periods of transitory food insecurity — due to natural disaster, a poor crop year or war — or to states suffering from chronic undernourishment problems. The provision of food aid in itself thus indicates the presence of food insecurity among at least a few segments of the population and the increasing value of food in these areas. Any existing food production resources or provisions of food aid then gain an inflated value, providing incentive to control these goods. Attempts to gain control of valuable food and aid resources are likely to induce conflict in regions surrounding food aid.

If the costs associated with stealing food or staging attacks in order to gain control of food resources outweigh the gains, then food aid would probably not be provided or needed in that area to begin with. The following hypotheses follow from this theorized relationship:

Hypothesis 1a: The provision of food aid increases the number of conflict events within 50 km of an aid event.

Hypothesis 1b: Conflict is more likely to occur as the distance from an aid event decreases.

This theory relies on a supply-based argument claiming that it is the lack of available food that increases conflict in recipient regions. The desire to control valuable resources is thus the driving factor behind the conflict, not the aid itself. This is not the argument made by all scholars. The main difficulty in assessing the impact of food aid on the incidence of conflict arises from reverse causality and joint determination. Specifically, is the conflict observed a direct result of the provision of food aid, or is the food aid being provided to assist those in an already volatile region? This is a difficult distinction to make and is not entirely resolved through this theoretical argument, as conflict is a known cause of limited food production and food insecurity. Empirically, this issue is addressed through the use of temporal models which assess the level of conflict in a given area before the provision of aid and following the aid's receipt.

Competing Theoretical Arguments

A competing theory as to why food aid induces conflict is that it "crowds out" other forms of humanitarian assistance that may be more effective at conflict prevention and resolution. In the case where donor nations use their excess domestic supply to fund food aid contributions, willingness to give is not expected to hinder any additional monetary aid commitments. This may lessen any crowd-out effect between food aid and other forms of ODA. Nunn and Qian explore this theory in their paper "Aiding Conflict: the Impact of U.S. Food Aid on Civil War", and find no evidence of a crowd-out between food aid and other forms of aid (Nunn & Qian, 2012). Additionally, they find no interaction between the aid provided by one country and that of other donors. For example, if the United States were

to increase its food aid to Africa by one million metric tons (mt) of food annually, no other donor country would reduce its aid commitment.

An additional argument is that food aid drowns out local production, disrupting the local economy and creating unrest. As addressed in the review of literature, this scenario is most probable in the case of direct food transfers. Adding a sudden, additional amount of food to domestic supply at low or no cost may significantly disrupt agricultural incomes by substantially lowering market prices (Pedersen, 1996; Kirwan & McMillan 2007; Smith, 2014). This may create a disgruntled farming population and increase incidences of conflict.

The chances of this scenario occurring are somewhat unknown. An examination of the Armed Conflict Location & Event Data project's (ACLED) listing of events in Africa, from 1995 to the present, yields several hundred observations of farmers protesting, or violently resisting, policies or events with which they are unhappy. Among these events are incidences of government sale of communal farming lands, clashes between farmers and pastoralists, and complaints about low prices and undelivered subsidy payments. However, it is not possible to determine the effects of food aid on the onset of these protests from the available data. In cases such as a multiday protest by Kenyan farmers in 1999 against the import of wheat and falling wheat prices, it is possible that the provision of food aid may have played a role when it is noted that Kenya received 37,670 thousand mt of externally provided wheat aid that year (FOASTAT). But again, this claim cannot be made with certainty.

Expected Effects of Aid Characteristics

Procurement of food resources for aid from farmers within the country or surrounding region would likely have a lower impact on conflict by reducing any supply or price effects on the recipient area's local market. However, this option is only viable for program aid where the intended beneficiaries are selected undernourished groups within a relatively stable community. Local procurement is not assumed to be an option for emergency aid because emergency aid is usually provided in cases of widespread food shortage. In locations where this type of aid is required, local food markets are presumed to be in an already volatile situation and thus the provision of aid is not thought to provide any additional negative market effects.

The effect of food aid on production is likely seen only in cases of habitual aid. Short-term or emergency aid is not likely to affect planting decisions that are typically made months in advance and without knowledge of the aid that is to come. This would suggest that more conflict events surround program aid sites than emergency aid sites. However, the supply-based theory used in this paper refutes this argument and expects project aid to result in fewer conflict events than emergency aid.

Hypothesis 2a: Conflict is more likely to occur if the aid event type is emergency instead of project aid.

Program aid

Program aid typically targets select population segments such as schoolchildren or expectant mothers. The overall market effects of this type of aid are presumably small as it

is assisting groups that were thought to be underrepresented in the market. For example, a food aid program providing free lunches to 200 schoolchildren does not strictly reduce the number of lunches being purchased in the market by 200. The fact that aid is targeted to this group suggests that prior to the provision of aid, most, if not all of these children would have gone without lunch. While determining the distinct market effects of such a program is beyond the scope of this study, the supply-based theory assumed here suggests that no free lunch program would have been established had most children had access to lunch. The provision of aid thus implies a prior lack of food security. Additionally, it is assumed that while this program aid significantly affects the target population, it does not affect the larger community to as great an extent.

In cases where habitual aid does affect the purchasing power of the population as a whole, production is assumed to adjust over time. Conflict events are thus expected to be more prevalent in regions receiving emergency aid than those with program aid due to the state of broad food insecurity associated with donor decisions to provide this type of aid. Again, food scarcity creates both a market-based and strategic incentive to gain control of food aid in these situations.

Fungibility

Apart from the distinction in conflict levels expected between program and emergency aid, the level of fungibility of the aid is also expected to have a significant effect. The fungibility of aid is determined by its potential to be diverted and utilized for purposes other than those intended by the donor. Monetary aid is more fungible than food

shipments and the transportation and communication equipment used for food transportation is more fungible than the food being carried. This is because these resources can be more easily turned into cash and used to fund opposition groups, the government or other causes. Therefore, areas receiving food aid and the routes used to transport aid may be targeted by armed factions looking to gain cash and supplies. Although the recipient community may be peaceful, the provision of aid to that area may induce conflict by outside forces. The more fungible the aid, the more desirable it is to gain control over that aid and the more likely conflict is to occur. Evidence suggests that conflict tends to gravitate towards areas with high commitments of fungible foreign aid, suggesting a positive feedback loop between the distribution of aid and the onset of conflict[1] (Findley et al., 2011).

Hypothesis 2b: Conflict is more likely to occur close to aid events consisting of fungible aid rather than those containing material aid.

Distance from the capital

Aid granted to the federal government may be associated with the onset of conflict in regions of the country outside of its capital. Monetary aid to a government can be considered a form of rent, which represents income not generated through taxation. By capturing the state, rebels gain access to aid rents that may be used directly, or diverted

[1] Addison and Murshed (2001) found aid fungibility increased the risk of violence through the government's use of rents for military expenditures. Collier (2009) found that up to 40 percent of African military expenditures are financed by fungible aid.

into private hands to their benefit. If gaining access to the government will increase aid rents to the capturing party by a substantial amount, then potential opposition groups may choose to participate in a rebellion or political coup. This assumes the expected payoff of having access to aid rents outweighs the expected costs of fighting. However, the resources needed to implement a successful coup require opposition groups to build a support base among the population. Doing so is easier in areas in which the government has less control, or which would require more effort for national military forces to quell conflicts or political movements. These regions tend to be those farthest from the government's stronghold, which is typically considered to be the national capital.

A study on the effects of geography on civil conflict by Buhaug et.al. finds that as the distance from the government stronghold increases, the duration of a conflict increases. This is due to the difficulty of transporting troops and supplies long distances, and limited familiarity with local conditions in remote or rural regions (Buhaug et al., 2009). The difficulty associated with sending national troops to locations far from the capital decreases the chances that opposition groups will be attacked in these areas thus increasing the time these groups have to build the trust and support of the local population. Additionally, monitoring the distribution of aid by the government is more difficult as distance from the capital increases. Both of these factors provide incentives for those interested in stealing aid to operate away from the capital.

An increase in monetary food aid or food loans to the federal government is expected to increase the incidence of conflict in outlying areas at a rate faster than in areas in close proximity to the capital city. This is somewhat dependent on the capacity of

domestic institutions and the level of corruption within the government (Findley et al., 2001; Grossman, 1992). As the group's power base grows, conflict is expected to move closer to the capital.

Hypothesis 2c: The number of conflict events observed within 50 km of an aid event increases with the aid's distance from the national capital.

Understanding the Theoretical Arguments in the Context of Existing Literature

The literature reviewed suggests claims of aid-induced conflict have almost entirely been assessed through large-scale, national-level models that relate aggregate levels of conflict to total amounts of aid given (Collier and Hoeffler, 2002; de Ree & Nillesen, 2009; Nunn & Qian, 2012). There is little discussion of how aid influences conflict at a disaggregated level. Existing evidence suggests that differences in access to aid contribute to conflict at the local level, either by motivating activity by rebel groups or by providing access to funding that fuels and sustains conflict. Given that most aid projects are targeted at specific populations and that fighting caused by rebel groups and small armed militias is generally localized within a region or country, studies that use country-level data overlook the location-specific effects of aid on conflict. Findley et al.'s 2011 paper, "The Localized Geography of Foreign Aid..." is a first attempt to use georeferenced data and visual analysis of the locational relationships between specific aid events and armed conflict events. The study conducted by Findley et al. is not limited to food aid, but focuses on all forms of humanitarian aid that are included in the AidData dataset for Sierra Leone, Angola and Mozambique. Additionally, Findley et al. are only concerned with conflict events that lead

to at least 25 battle deaths. Their finding is that a spatial association exists between location of fungible aid and battles. This analysis does not consider differences in aid type or characteristics and does not explicitly consider the level of conflict within an area before and after the receipt of aid. This is not the approach taken here.

The analysis presented in this paper expands upon this work to help fill the hole in the assessment of humanitarian aid's role in conflict. Locational analysis is used with a focus on individual food aid events in Africa and conflict events in the surrounding regions. Limiting the analysis to food aid events focuses the results on the largest form of international humanitarian assistance. This study then acts as narrower look at humanitarian aid than is provided by Findley et al. and much of the existing research, to determine if the allocation of food aid brings different results in recipient regions than does other forms of aid. The purpose of this paper is to address several questions: What is the expected effect of food aid on localized conflict? What physical and regional characteristics make a food aid distribution site most vulnerable to attack? What types of aid are most affected by conflict?

Theoretical Model

Based on the review of literature, the following relationship is suggested as the foundation for the assessment of the impact of food aid on conflict (C) in a specific location:

$$C = f(AID\_AMT, FA, FUN, AID\_DIST, EMER)$$

where AID_AMT refers to the amount of aid, in dollars, granted to each aid event, FA distinguishes between multisector aid projects and those that are purely food aid, and FUN

is the fungibility of that aid. AID_DIST measures the distance between the aid event site and every conflict event within 50 km. EMER distinguishes between emergency and program aid.

To better assess the effects of each of these variables on conflict, several control variables were considered. Given that internal conflict is often tied to tensions created by ethnic divisions within a country, ethnolinguistic makeup is considered in terms of the number of ethnic groups present within the recipient community. The number of ethnic groups is represented by the variable ETH.

Hypothesis 3a: Conflict is more likely to occur in the proximity of an aid event site that contains more than one ethnic group.

Food aid distribution centers are typically located in places where they can be reached by the largest number of residents. They are also often located in close proximity to supply routes. The chances of both desired locational criteria being met increases with population density. Therefore, conflict related to food aid is considered to be more likely in highly populated areas. To account for this possibility, population density of the recipient area is included through the variable POP.

Hypothesis 3b: Conflict is more likely to occur in areas with high population density than in areas with low population density.

Road quality was previously discussed as a significant factor in determining the proportion of aid that reaches its intended target. The distance of an aid event's location from the nearest supply route is a factor also considered because the assumption is made that the closer it is to supply lines, the less chance there is of aid being stolen in transport.

Road density and distance to supply route are considered in the empirical model as individual variables, ROAD and TRANSPORT and then interacted to form an infrastructure variable, INF.

Hypothesis 3c: Conflict is more likely to occur near aid sites that are in close proximity to main supply routes and in those with poor road density than at sites that are far from supply routes or in countries with high road densities.

Lastly, CAP_DIST measures the distance between the given coordinates for the aid event and the country's capital, and DEM is a proxy measure representing government capacity by considering each country's level of political freedom.

Price data are not included. This is due to the disaggregated nature of the model. Prices are assumed to be relatively stable throughout the country in times of peace and prosperity. This means that the incentive for conflict due to food prices is relatively equal across the country at most times and no one region is inherently more likely to experience conflict due to food prices than another. This makes comparison across several regions within the same country viable without having to control for regional differences in food prices.

Areas facing food insecurity due to production shortages may experience price shocks. Price shocks may induce food price related conflict. This effect is captured by the emergency aid provision, EMER. Although external shocks to world prices were shown by Smith (2014) to increase the chance of food insecurity, the earlier assumptions given for this study are that the presence of food insecurity is assumed in areas receiving food aid. Therefore, any effects of price shocks on conflict through food insecurity are accounted for

through the food aid variable. The elements captured in this theoretical framework form the basis of the empirical analysis that follows.

CHAPTER 4

DATA AND METHODS

The analysis was designed to answer the questions: What is the expected effect of food aid on localized conflict? What physical and regional characteristics make a food aid distribution site most vulnerable to attack? What types of aid events are most affected by conflict? This analysis is conducted by testing the analytical hypotheses outlined in Chapter 3. The general model, or conceptual framework for this analysis, is portrayed in more detail by Figure 1.

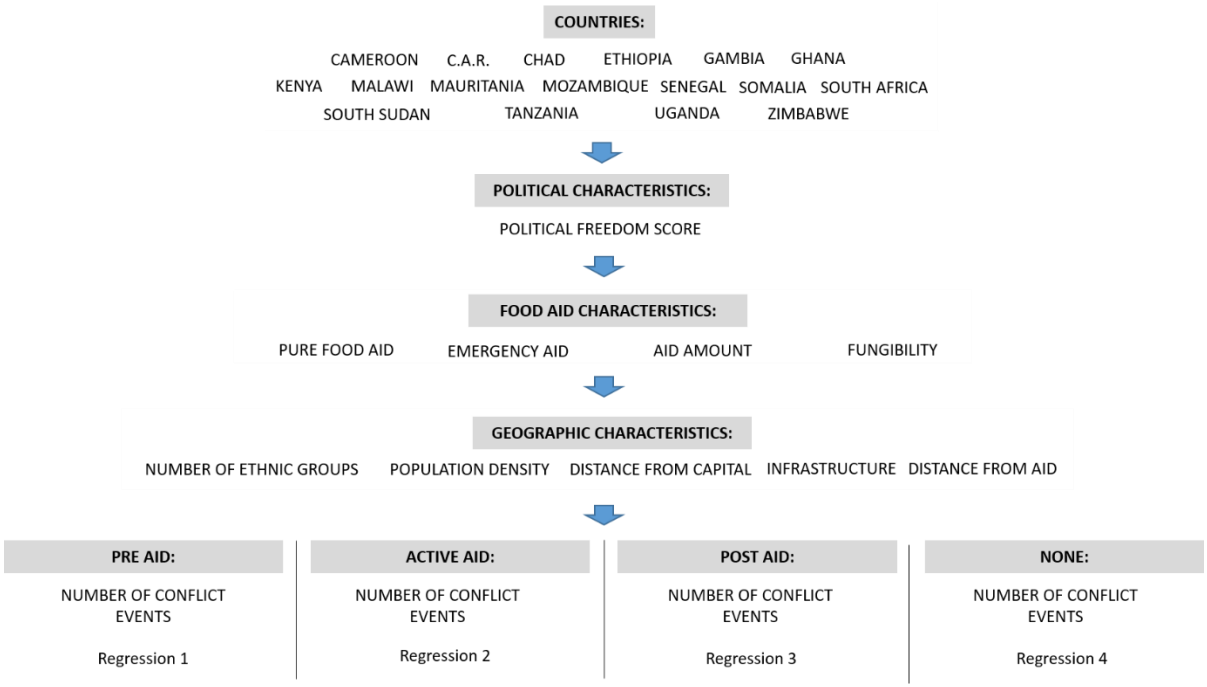


Figure 1. Conceptual Framework

Country Selection Based on Food Aid Events

Adoption of the previously defined theoretical model into a testable empirical form required disaggregated data for each aid event. Necessary information included disbursement amount, geographic information on the recipient area and donation start and end dates for each aid observation. Although data from all African counties were considered, the level of precision required in the data limited the number of food aid donations or aid projects, "aid events", included in the study. The final data set included 346 aid event observations from Cameroon (22)[2], Central African Republic (12), Chad (11), Ethiopia (35), Gambia (4), Ghana (12), Kenya (6), Malawi (28), Mauritania (64), Mozambique (1) Senegal (24), Somalia (45), South Africa (6), South Sudan (8), Tanzania (21), Uganda (44) and Zimbabwe (3). These observations range in donation start date from 1995 to 2016.

As displayed in Figure 2, each aid event was mapped in relation to the corresponding conflict and each country's main aid supply routes to create a visual representation of the geographic relationship between food aid events and conflict. Aid events were represent with orange triangles, while conflict events were depicted with blue circles.

[2] The number in parenthesis indicates the number of aid event observations for that country.

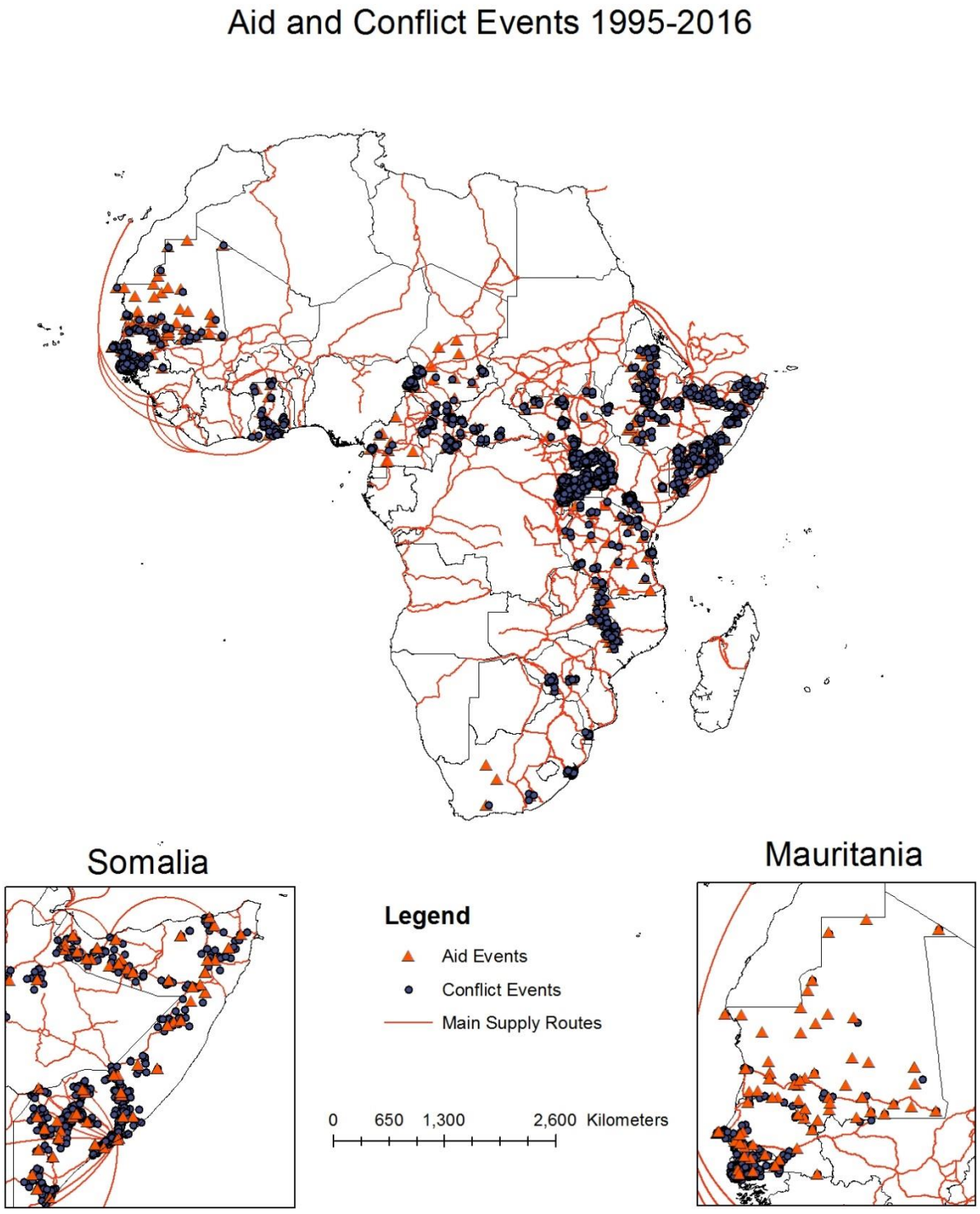


Figure 2. Considered Aid and Conflict Events

Collection and coding of aid events

AidData's subnational, geospatial research data sets for Senegal, Somalia, Uganda, and the World Bank's development projects[3] were used as sources for the aid events. All projects tagged as emergency response, health and nutrition, food aid, or food security in the sector category, or that listed food aid or nutritional support in the project title were included. Aid event observations were also taken from NGO Aid Map. Pre-made, geocoded datasets were not available from this source. Therefore, all projects tagged as food aid within an African country were individually examined and coded. For cases in which a town or region was named specifically as the aid beneficiary, Google Maps was used to assign geographic coordinates to the location. Where no sub-national location was named, the aid project was coded as national and coordinates were assigned for the country's capital. Additionally, only aid events with specified start and end dates and donation amounts were included in the dataset. This excluded approximately 125 potential observations in total. Exclusions were not isolated to one country, nor were they predominately associated with one or more country's data. The full data set was assembled to represent food aid events across Africa from 1995 to the present.

Multisector projects, or those classified generally as emergency response or humanitarian aid, were coded as zero. Although these observations contain food aid

[3] Data from the following AidData datasets were utilized for this research: Somalia Aims, Level 1, Version 1.0; , the Senegal AMP, Level 1, Version 1.4 ; Uganda Aid Management Platform (AMP), Level 1, Version 1.3; World Bank IBRD-IDA, Level 1, Version 1.3; and World Bank, Mapping for Results. Other African datasets, including the Nigeria Development Assistance (DAD), Level 1, and version 1.4 the DRC AMP, Level 1, Version 1.2, were considered for this research. Results from these data sets were excluded from the final study due to data limitations. Meaning, these datasets lacked critical pieces of information necessary to the model or contained an insufficient number of geocoded observations for statistical robustness within the country in question.

elements, there is no way to delineate the proportion of food aid from total aid. Coding these events as zero was done to indicate their difference from events whose purpose was considered to be limited to the provision of food aid. Events with the sole purpose of providing food or financial assistance to improve food security were coded as one. The effects of both types of events were considered in the analysis with the goal of assessing the direct relationship of food aid, versus other types of aid, on conflict. As shown in Table 1, the number of pure food aid and mixed aid events included in the study are nearly identical.

Table 1. Frequency Distribution: Food Aid Event Type

Provision of Pure Food Aid	Frequency	Percent	Cumulative
0	172	49.71	49.71
1	174	50.29	100.00
Total	346	100.00	

Although not included as an explanatory variable in the model presented here, aid events were also coded as to their locational extent. The classification system used is based on the Uppsala Conflict Data Program's georeferencing guidelines and was condensed into five of the eight categories used by Findley et al. (2011).

1: The aid site lies within or near a specific populated place.

2: The aid site georeferenced refers to a district or municipality.

3: The aid is given to a province or is regional in scope.

4: The aid is national in scope.

5: Aid flows directly to a government entity.

These values can then be used for future empirical analysis to judge the relationship between the size of the project and the chance of conflict. Additionally, use of the precision codes allows specific project types to be isolated from the full data set for further examination as desired.

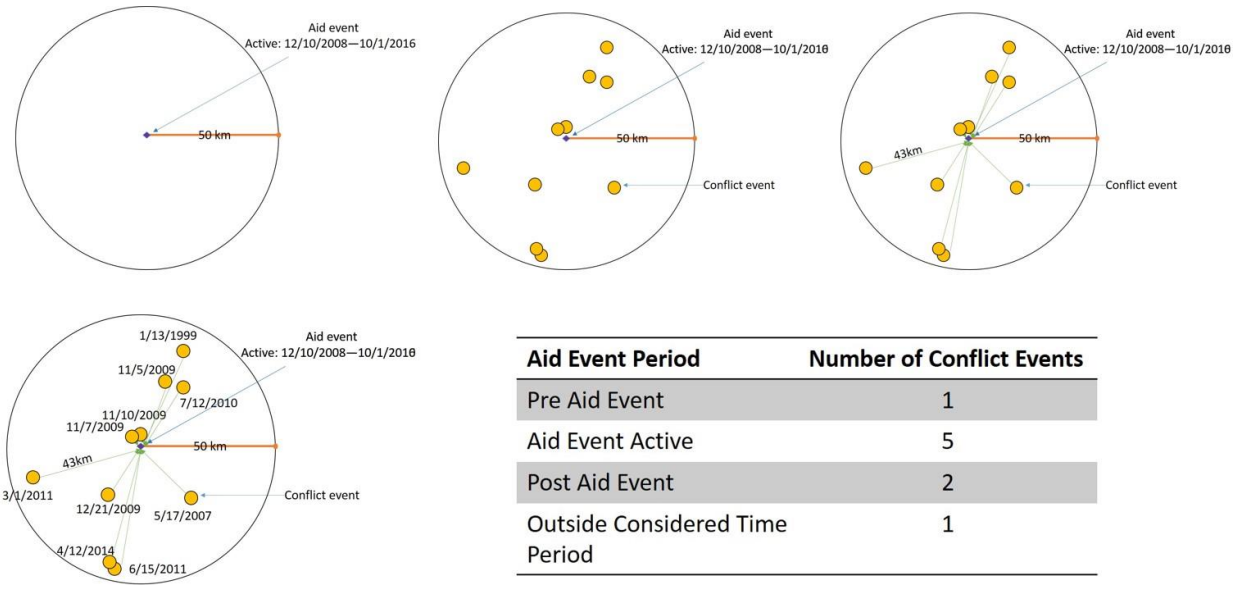
Conflict Event Selection

Conflict data were obtained from the Armed Conflict Location & Event Database (ACLED). This data set contains information on nearly all conflict events in Africa from 1997 to the present. Included events range in scope from armed robberies to battles with change of territory. Events are considered in terms of the number of conflict onset days. For example, if a military campaign in an area started on March 1, 1999, and lasted until March 5, 1999, with violent activity reported on each day, this is coded as five different events in ACLED with a different date for each entry. Dates which may have involved activities leading up to a conflict, but do not exhibit "active conflict", are excluded from this count. Each "conflict event" observation in this study, therefore, represents one day of active conflict.

All conflict events in this dataset are individually, and precisely, geocoded. In order to test the relationships between the structural, locational and demographic factors present in each aid event, and conflict, these data were considered only in terms of their date and geographic relationships to the previously chosen aid events.

Creating the conflict variable

The following procedure was used to quantify the relationship between conflict and aid events. Each aid event was mapped using its geographic coordinates in ArcMap. As displayed in Figure 3, a ring buffer with a radius of 50 km was then created around each aid event. All ACLED conflict events were then mapped on top of the buffered aid sites. For all conflict events mapped within the 50 km buffer, the exact distance (in km) was calculated. This was done using the point distance tool. Conflict events were then individually examined and coded temporally based on the start and end dates of all aid events within 50 km.



Aid Event Period	Number of Conflict Events
Pre Aid Event	1
Aid Event Active	5
Post Aid Event	2
Outside Considered Time Period	1

Figure 3. Coding the Conflict Variable

When an event fell on the 50 km border, it was included in the conflict count if more than 50 percent of its locational marker breached the buffer border.

The 50 km distance was chosen as the upper limit for the analysis as this is near the upper bound of daily walkable distance for a healthy adult. Therefore, it is assumed that an aid event or aid distribution center primarily serves individuals living with a 50 km radius. Limiting conflicts to those within 50 km of each aid event then limits the analysis to the community receiving the aid. This helps to specify the relationship between food aid and conflict at the disaggregated, local level.

Temporal Categorization

Conflict events were considered within three main time ranges: two years prior to the distribution of aid ("pre"), during the time the aid site or individual aid project was in operation ("active"), and within two years after the provided end date for the aid event ("post"). Conflict events occurring outside of these time periods were also recorded in a fourth "outside of time period" category, coded as "none". A total of 19,498 conflict events were coded.

It is important to note that conflict events were not found within 50 km of every aid event. Of the 346 aid events considered, 107 were free from conflict in any of the considered time periods. The number of conflict-free aid events observed in each aid recipient country is noted under the "Zero Conflicts" category in Table 2.

Table 2. Frequency Distribution: Aid and Conflict Events by Country and Time Period

	Temporal Conflict Period					
Aid Recipient Countries[4]	Pre	Active	Post	None	Total Conflicts	Zero Conflicts
Cameroon (22)	0	23	4	483	510	12
Central African Rep. (12)	489	509	0	338	1,336	0
Chad (11)	1	2	0	54	57	5
Ethiopia (35)	76	276	73	383	808	10
Gambia (4)	4	3	0	26	33	0
Ghana (12)	74	68	0	78	220	1
Kenya (6)	77	446	11	774	1,308	0
Malawi (28)	76	194	0	200	470	7
Mauritania (64)	6	34	11	307	358	45
Mozambique (1)	20	44	0	93	157	0
Senegal (24)	14	203	51	616	884	1
Somalia (45)	676	617	997	4,051	6,341	15
South Africa (6)	100	624	0	117	841	3
South Sudan (8)	138	502	0	114	754	1
Tanzania (21)	21	136	40	82	279	7
Uganda (44)	170	2,465	489	1,597	4,721	0
Zimbabwe (3)	61	183	0	177	421	0
Total (346)	2,003	6,329	1,676	9,490	19,498	107

The “pre-implementation” conflict events were considered in order to account for the lag between conflict onset and the provision of aid to the area by foreign donors. Additionally, this produced a baseline for the level of conflict within the area before the food aid was provided. Coding conflict events temporally allowed for a pre-post analysis of the effect of aid on conflict. Looking across time periods also helped with the identification issues previously mentioned.

[4] The number in parentheses represents the number of aid events located in each country.

If an area was conflict-ridden prior to the provision of food aid, it is likely that the need for aid was a result of the conflict. However, if the number of conflict events surrounding an aid site increased once aid was provided, it is possible that the aid itself, or attempts to capture the aid, were the reason for the increased in conflict in the area. This, of course, is not a perfect identification methodology and is not the focus of this paper. The reasons for each conflict event as well as the level of food security within the area both pre- and post- aid would also need to be considered to determine the direction of the relationship between aid and conflict. The "post" category is less crucial to the purpose of this paper, but allows for study of the relationship between the residual effects of aid and local conflict.

Additional Aid Sources and Data Manipulation

To account for demographic and structural factors of the aid site community, data related to population, ethnicity, infrastructure and level of democracy were also collected.

Population Density

FAO Global Population Density Estimates for 1995, 2000, and 2015 (FGGO) were used to estimate the number of persons living within the immediate vicinity of each geocoded aid event. These are raster data layers representing population density in terms of the number of people per square kilometer. Manual coding of each site was required.

As displayed in Figure 4, individual aid sites were mapped on top of the population raster image using ArcMap. The identify tool and attributes table for the aid locations were

then used to locate each aid site and make a visual account of color field on which the site was mapped. Color fields were specified by the FAO to indicate predetermined population levels. The corresponding range was recorded for each aid site and then converted into an ordinal value category for use in the empirical model. These categories are displayed in Table 3.

Table 3. Assignment of Population Density Categories

FAO Population Density Categories (Person/km sq.)	**Assigned Categorical Number**
0-2	1
2-5	2
5-10	3
10-20	4
20-50	5
51-100	6
100-200	7
200-500	8
500-1000	9
>1000	10

National aid projects are coded as population category 11. Utilizing this raster data layer and coding technique allows for a location-specific measure of population, which made possible a more precise analysis of the effects of population on the chance of conflict. This is opposed to using a national or regional estimate for population density that averages across a greater distance, reducing precision in the measure.

Population density was considered in relation to each aid event's start date. Events which started in the years 1995-1998 were coded based on the 1995 population data. Aid events which started in the years 1999-2007 were coded based on the 2000 population data. Aid events that started in the years 2008-2015 were coded based on the 2015 population data. This system of coding was done to help account for population movement over time. Admittedly, the use of three population points to code aid events which occurred over a period of 20 years is not ideal. Population movements which occurred between each population estimate may not be fully captured in the data, creating a bias in the relationship between population density and conflict.

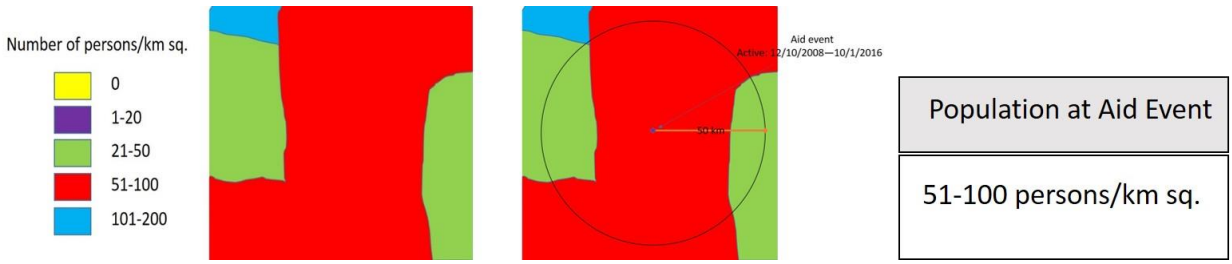


Figure 4. Coding the Population Density Variable

Aid Amount

The amount of aid in dollars, or a dollar equivalent, is used as a proxy for the expected effect of each aid event on the local community. Larger aid events, or those with higher aid amounts, are assumed to have a greater impact than smaller, lesser-funded events. However, the magnitude of aid's effect cannot be accurately estimated through funding alone. Population size at each aid site is also expected to play a key role in determining the magnitude of each aid event. For example, an aid event which is funded with $200,000 of

resources located in a community with 500 residents is able to provide $400 of assistance to each resident, whereas the same aid event in a community of 10,000 is only able to provide $20 of assistance. Such an aid event is therefore assumed to have a larger impact on the smaller community than the larger community. To capture the effects of population on the expected magnitude of each aid event, the population density variable (POP) is used. The aid amount for each event is divided by the population density at that event. This produces a new variable ZAID, which represents the aid amount normalized by population density. Explicitly:

$$(1)\quad ZAID_i = AID\_AMT_i/POP_i$$

where *i* indicates each aid event. The ZAID variable is then used when considering the overall effects of aid on conflict.

Ethnicity

Ethnicity data were obtained in a manner similar to population data. The 2010 Geo-referencing of Ethnic Groups (GREG) data were used to determine the number of ethnic groups within 50 km of each aid site. These data were used because they are one of the most comprehensive geocoded ethnicity datasets available. As displayed in Figure 5, GREG data were mapped categorically by ethnic group name. Aid events were then mapped on top of this layer and individually selected to observe how many ethnic groups were present within the community served by the aid as determined by a 50 km buffer around the aid

site[5]. What the ethnic groups are was not considered in this analysis. The number of ethnic groups within the vicinity of each aid event was then included in the dataset.

A similar temporal mismatch exists in the ethnicity data as in the population density data. GREG data only exist in a 2010 iteration. This provides a single point estimate for the number of ethnic groups. Movement of ethnic groups over the 20-year period of analysis is not captured in the data. This creates a source of bias.

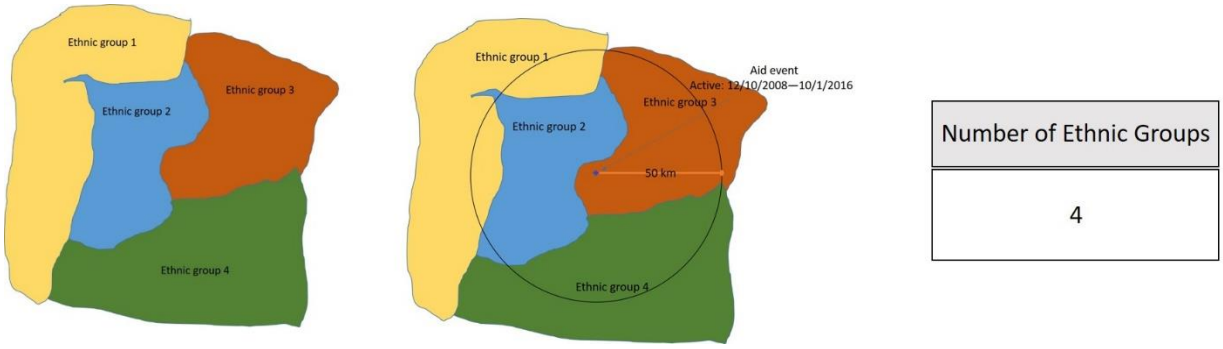


Figure 5. Coding the Ethnicity Variable

Infrastructure

Two additional pieces of gathered data include road density and a shapefile of the global supply routes used to supply aid. These were taken from the 2003 FAO Food Security Indicators dataset and the World Bank's GIS portal, respectively. Road density data were coded in relation to each aid event's start date. All data were given in km/100 sq km. These two data items were considered individually, and were also used to create an interaction variable to assess the effects of road quality and distance of an aid event from a main supply route on the ability of aid to be delivered to the aid event successfully.

[5] See appendix.

To create this variable, the near tool was used with ArcMap to calculate the shortest distance (in km) from each aid event to the nearest supply route. These values were then individually multiplied by the country's road density value to give an estimate of the road infrastructure at each aid event site. Explicitly:

$$(2)\ INF_i = ROAD_i \times TRANSPORT_i$$

where ROAD represents the road density variable and TRANSPORT represents the distance between each aid event site, *i*, and the nearest supply route. This improves the analysis of infrastructure on the incidence of conflict over the use of road density alone by creating a location-specific measure that accounts for proximity to supply lines as well as road quality. Including the effects of road density instead of just using the distance to aid as a measure of infrastructure helps capture the effects of average road quality across the country on the chance of aid reaching the specified recipient location. This is important to consider as countries with low road density values have been shown in the literature to have high incidences of aid being stolen in transport. Additionally, proximity to supply route may increase aid's chances of successful delivery.

Measure of Democracy

Aid events from 17 countries were considered in this analysis. These countries vary in their political regime type, level of political stability, institutional capacity, and type of personal freedoms citizens are allowed. Each of these factors were assumed to affect the prevalence of conflict, donor nation's willingness to provide aid and the effectiveness of the aid provided. To account for these differences, Polity IV values for political regime

characteristics were used. These values were collected from the Center for Systematic Peace's annual, cross-national, data on regime trends and transitions.

Polity IV scores generally range from negative to positive ten where a value of ten indicates "full democracy". Values between six and nine indicate a country under "democracy", values of one to five indicate a country under "open anocracy[6]", values between zero and negative five indicate "closed anocracy", and lastly, values of negative six to negative ten indicate a country under "autocracy". Additionally, values of -66, -77 and -88 are assigned to countries in war or experiencing other types of internal collapse or struggle.

Aid events were then coded with the political freedom value assigned to the recipient country based on the event's start date. These data are represented by the variable DEM.

Dependent Variable

Conflict (C) —the conflict variable is a measure of the number of conflict events, or active conflict days, that have occurred within 50 km of each aid event. As displayed in Table 4, data constructing this variable are delineated into four temporal categories: two years prior to the aid event's start date, "pre"; during the aid event site's operation, "active"; two years following the aid event's end date, "post"; and outside of the aid events' considered time period, "none". The conflict observations are given as numerical values for

[6] The term anocracy suggests a regime with inherent qualities of political instability and ineffectiveness, as well as an incoherent mix of democratic and autocratic traits and practices.

the number of conflicts occurring within 50 km of each aid event and within each time period. The number of conflicts in each temporal category for a given aid event was shown to range from zero to 9,490.

Table 4. Frequency Distribution: Conflict by Temporal Period

Temporal Conflict Period	Frequency	Percent	Cumulative
Pre	2,003	10.27	10.27
Active	6,329	32.46	42.73
Post	1,676	8.60	51.33
None	9,490	48.67	100
Total	19,498	100.00	

Independent Variables

Aid disbursement amount (ZAID) —the amount in dollars of the monetary aid, or a dollar equivalent amount of the material aid provided for each aid event normalized by the population density at each aid event.

Pure food aid (FA) —is a categorization that distinguishes those aid events providing only food assistance from those providing food aid along with other services. Pure food aid events were coded as one. Events with multiple purposes were coded as zero.

Fungibility (FUN) —the fungibility of an aid event was determined by searching the World Bank and other donor websites for descriptions of each donation or project. Aid was coded as 0 if it was given directly in the form of food or material goods. This was considered “not fungible” aid. Aid coded as 0.5 contains a mixture of material and monetary resources and was considered “partially fungible”. Fungible aid was coded as 1

and is aid that is entirely monetary in nature and includes direct cash transfers to the recipient government or subnational entity. As shown in Table 5, the largest numbers of aid events were considered to be not fungible.

Table 5. Frequency Distribution: Fungibility

Fungibility	Frequency	Percent	Cumulative
0	157	45.38	45.38
0.5	106	30.64	76.01
1	83	23.99	100
Total	346	100	

It is expected that the provision of "not fungible" aid and the provision of pure food aid go hand-in-hand. This is based on the assumption that the majority of food aid provided is done so in terms of direct transfers of food supplies from one country to another. However, a cross-tabulation of the pure food aid (FA) and fungibility (FUN) variables as depicted in Table 6, shows that material, pure food aid events account for only 26.88 percent of all considered aid events. While this group represents the most common type of aid event in the sample, the distribution between each fungibility and food aid category is distributed relatively normally. In addition, the correlation coefficient between fungibility and the provision of pure food aid is only found to be -0.113. This correlation, combined with the cross-tabulation distribution, suggests that interaction between the effects of "not fungible" and pure food aid is not significant. An interaction variable for these two factors thus does not need to be included in the model.

Table 6. Cross-Tabulation of Pure Food Aid and Fungibility

	Fungibility			
Pure Food Aid	0	0.5	1	Total
0	64	65	43	172
	18.5	18.79	12.43	49.71
1	93	41	40	174
	26.88	11.85	11.56	50.29
Total	157	106	83	346
	45.38	30.64	23.99	100

Distance to aid site (AID_DIST) —The exact distance (in km) between each aid event site and every conflict event within 50 km. As shown in Table 7, 19,498 conflict events were considered in this analysis. These events occur, on average, 18.98 km from each aid site.

Table 7. Summary of the Distance to Aid Site Variable

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Distance to Aid Site	19,498	18.975	15.660	0	50.193

Emergency aid events (EMER) —an aid event was coded as being emergency aid if it was tagged as emergency in the original AidData dataset or if the project title indicated it was an emergency response action. All other aid events were coded as project aid. A value of 1 indicates an emergency aid event. A value of 0 indicates a project, or planned aid event. As displayed in Table 8, almost all of the events considered were planned or project aid.

Table 8. Frequency Distribution: Emergency Aid

Provision of Emergency Aid	Frequency	Percent	Cumulative
0	292	84.39	84.39
1	54	15.61	100
Total	346	100.00	

Control Variables

Number of ethnic groups (ETH) —the number of ethnic groups present within a 50 km radius of each aid event. As displayed in Table 9, most of the aid events considered were located in areas inhabited by one ethnic group.

Table 9. Frequency Distribution: Number of Ethnic Groups

Number of Ethnic Groups	Frequency	Percent	Cumulative
0	5	1.45	1.45
1	173	50.00	51.45
2	105	30.35	81.79
3	48	13.87	95.66
4	13	3.76	99.45
5	2	0.58	100.00
Total	346	100.0	

Population density (POP) —the number of people/km^2 at the exact location of the aid event. As displayed in Table 10, most aid events were located in areas with permanent populations of 20-50 persons/km^2.

Table 10. Summary of the Population Density Variable

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Population Density Category	346	5.523	2.641	1	11

Road Density (ROAD) —A ratio of the length of the country's total road network to its total land area. All national, regional, and rural roads are included in this calculation. All data are given in km/100 sq km. As displayed in Table 11, the average road density of the 17 countries included in the analysis was found to be 10.56.

Table 11. Summary of the Road Density Variable

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Road Density	346	10.555	11.704	0.02	45.9

Distance to nearest supply route (TRANSPORT) —The exact distance in km between each aid event and the nearest supply route as mapped by the World Bank. As displayed in Table 12, aid events were located, on average, 59.26 km from aid supply routes. However, 29 aid events were located within one km of the nearest supply route and 127 events were located within 5 km of the route.

Table 12. Summary of the Distance to Nearest Supply Route Variable

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Distance to Nearest Supply Route	346	59.255	91.058	0	623.959

Infrastructure (INF) —a measure of the road quality and access to each aid event site. This interaction term attempts to capture the ability of aid to reach its designated

location for the period of transport between the main supply route and the aid site location. The INF variable takes the following form: INF = ROAD X TRANSPORT, where road density is the ratio of the compiled length of the country's total road network to the country's total land area. This ratio is inclusive of all roadway types from national highways to rural passages and is used as a proxy for a measure of the country's total infrastructure quality. Distance to road is the shortest linear distance (in km) between the aid event location and the nearest global supply route.

Distance from the capital (CAP_DIST) —a study on the effects of geography on civil conflict by Buhaug et.al. finds that as the distance from the government stronghold increases, the duration of a conflict increases. This is due to the difficulty of transporting troops and supplies long distances and limited familiarity with local conditions in remote or rural regions (Buhaug et al., 2009). The difficulty associated with sending national troops to locations far from the capital decreases the chances that opposition groups will be attacked in these areas and thus increases the time these groups have to build the trust and support of the local population. Additionally, monitoring the distribution of aid by the government is more difficult as distance from the capital increases. Both of these factors provide incentives for those interested in stealing aid to operate away from the capital.

To account for these findings, the distance from the capital variable was constructed. This value was calculated using a distance formula for GPS coordinates in decimal degrees and the latitude and longitude values for both a country's capital and the aid site in question. This was done for all aid sites included in the study. Distances were calculated in

kilometers. As displayed in Table 13, most aid events were located away from each country's capital, with an average distance of 362.36 km.

Table 13. Summary of the Distance from the Capital Variable

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Distance to the National Capital	346	362.362	257.470	0	1326.639

Measure of Democracy (DEM) —Polity IV scores generally range from negative to positive ten where a value of ten indicates "full democracy". Values between six and nine indicate a country under "democracy", values of one to five indicate a country under "open anocracy[7]", values between zero and negative five indicate "closed anocracy", and lastly, values of negative six to negative ten indicate a country under "autocracy". Additionally, values of -66, -77 and -88 are assigned to countries in war or experiencing other types of internal collapse or struggle. Aid events were then coded with the political freedom value assigned to the recipient country based on the event's start date. These data are represented by the variable DEM.

As displayed in Table 14, the average political freedom score attributed to the 17 considered countries was -1.16. This means that most of the aid events were located in areas under "closed anocracy" conditions.

Table 14. Summary of the Political Freedom Score Variable

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Measure of Democracy	346	-1.185	5.001	-7	9

[7] The term anocracy suggests a regime with inherent qualities of political instability and ineffectiveness, as well as an incoherent mix of democratic and autocratic traits and practices.

Regression Analysis and Hypothesis Testing

The following general equation is fit using ordinary least squares (OLS) in order to determine the effects of each structural, demographic, and locational variable on the number of conflict events observed within 50 km of each aid event and across four temporal categories.

$$(3)\ \ln C_t = \beta_0+\beta_1 \ln ZAID+\beta_2 FA+\beta_3 FUN+\beta_4 \ln AID\_DIST+\beta_5 EMER+\beta_6 ETH+\beta_7 POP$$
$$+B_8 \ln ROAD+\beta_9 \ln TRANSPORT+\beta_{10} INF+\beta_{11} \ln CAP\_DIST+\beta_{12} \ln DEM+\mu$$

where C is evaluated separately for each temporal period (t). This procedure allows each variable to be tested for significance and to evaluate the eight analytical hypotheses resulting from the supply-based theoretical argument presented in Chapter 3.

Considering the unequal aid event distribution

Estimating the model in this manner gives a quantitative estimate of the effects of each locational and demographic factor in predicting the likelihood of conflict in a given area. Fitting separate models for each time period also allows for observation of the effects of an implementation of aid on the onset of conflict. This allows each analytical hypothesis to be tested.

Of the 346 aid events considered throughout this analysis, 109 are located in either Somalia or Mauritania. The remaining 237 aid events are split across the 15 other considered countries. This distribution suggests that the relationship between the demographic and political factors and conflict in Somalia and Mauritania may overshadow the relationships in the remaining countries, biasing the results. To consider the effect of

the unequal aid event distribution in the data, two additional sets of temporal conflict models are fit using OLS. The first set considers only aid events located in Somalia or Mauritania. This set is referred to as the "M&S" temporal models. The second set, referred to as the "-M&S" temporal models, considers events in all countries excluding Somalia and Mauritania. The results of these two models are then compared using the Fisher Transformation to determine if the unequal aid distribution altered the relationship between any of the independent variables and the number of conflict events.

Evaluating temporal effects with a first difference model

To test Hypothesis 1a, a first difference (FD) model is created. This is done using differenced variables that account for the change in the number of conflicts between the pre and active periods in all countries and for the active and post periods in all countries. Differences between periods are represented by the variables FD_PRE_ACTIVE and FD_POST_ACTIVE. Changes in the measure of democracy are also considered between the pre and active periods, and between the active and post periods. Differences in democracy between periods are represented by the variables FD_DEM_PRE_ACTIVE and FD_DEM_POST_ACTIVE.

Changes in the remaining independent variables are also considered. These changes are represented by the variables: FD_ZAID, FD_EMER and, FD_FUN. The POP, ROAD, TRANSPORT, INF and ETH variables corresponding to each aid event are not found to change between periods. These variables are thus excluded from the first difference equation. Explicitly, the FD model is constructed using the following equation:

$$(4)\ C_t - C_{t-1} = ZAID_t - ZAID_{t-1} + FA_t - FA_{t-1} + FUN_t - FUN_{t-1} + EMER_t - EMER_{t-1} + DEM_t - DEM_{t-1}$$

This can also be expressed as:

$$(5)\ \Delta C = \Delta ZAID + \Delta FA + \Delta FUN + \Delta EMER + \Delta DEM$$

where delta represents the change in each variable between two of the temporal periods of analysis. The first difference model to test the difference between the amount of conflict between the pre and active periods is then written as:

$$(6)\ FD\_PRE\_ACTIVE = \beta_0 + \beta_1 FD\_ZAID + \beta_2 FD\_FA + \beta_3 FD\_FUN + \beta_4 FD\_EMER + \beta_5 FD\_DEM\_PRE\_ACTIVE + \mu$$

The first difference equations are then fit using OLS to evaluate the change in conflict occurrence due to the presence of food aid in the active period.

CHAPTER 5

ANALYSIS AND RESULTS

Starting with the full conflict model (equation (3)), a series of OLS regressions was fit using STATA to determine the operational conflict models for all 17 aid recipient countries for each of the four temporal periods. The goal of this procedure was to narrow down the conflict equation from all factors that may affect the onset of a conflict event, to those that have the most statistically significant effect. Standard two-tail t-tests were used to test for each regressor's statistical significance. Specifically, the following hypothesis was tested for each regressor:

$$Ho: \beta_j = 0$$

$$Ha: \beta_j =/= 0$$

where Ho indicated the null hypothesis, Ha indicated the alternative hypothesis, and j represented the regressor or variable name. Rejection of the null hypothesis indicated that the regressor in question was statistically significant from zero. This indicated that this particular variable has explanatory power related to the dependent, conflict variable. Failure to reject the null hypothesis implied that the regressor in question could not be proven to be statistically different from zero. These regressors were considered to lack explanatory power. However, given that the use of these variables was theoretically driven, insignificant regressors were kept in the fitted temporal models.

The aid event-specific variables were not considered for the pre, post, and none periods. This is because no aid was available, so including independent variables which describe the aid event is not consistent with these time periods.

The Fit Temporal Conflict Models for all Countries

As displayed in Table 15, the onset of conflict events in the pre aid event period was found to be best predicted by: the number of ethnic groups, population density, road density, distance to the nearest supply route, infrastructure, distance from the country's capital, and the country's measure of democracy. All of these variables were found to be significant at the 0.001 level. Explicitly, the Fit conflict model for all countries during the pre aid event period was found to be:

(7) $ln C_{Pre} = 4.111 - 0.901ETH + 0.346POP - 0.570 ln ROAD - 0.230 ln TRANSPORT + 0.0008INF - 0.185 ln CAP\_DIST - 0.018 ln DEM + \mu$

An increase in the number of ethnic groups in an area, an increase in road density, an increase in the distance from the nearest supply route, an increase in the distance from the capital, and an increase in democracy were all predicted to decrease the number of conflict events in a particular location. Conversely, increases in population density and infrastructure were predicted to increase the number of conflict events.

Active period

As displayed in Table 15, the onset of conflict events for all countries during the active aid event period was found to be best predicted by: the number of ethnic groups,

population density, road density, infrastructure, distance from the country's capital, the country's measure of democracy, distance from the aid event, the provision of pure food aid, fungibility, the provision of emergency aid, and the amount of aid supplied. All of these variables were found to be significant at the 0.001 level. Explicitly, the fit conflict model for all countries during the active aid event period was found to be:

(8) $ln C_{Active}$= 6.180-0.211*ln*ZAID+0.167FA-0.339FUN-0.114*ln*AID_DIST+0.665EMER
-0.485ETH+0.254POP-0.200*ln*ROAD+0.0959*ln*TRANSPORT+0.001INF
-0.000*ln*CAP_DIST-0.061*ln*DEM+μ

An increase in the amount of aid, an increase in number of ethnic groups in an area, an increase in road density, an increase in distance to the aid site, an increase in the distance from the capital, and an increase in democracy were all predicted to decrease the number of conflict events in a particular location. Conversely, increases in population density, infrastructure, and distance to the nearest supply route were predicted to increase the number of conflict events. The provision of pure food aid and the provision of emergency aid were both predicted to increase the number of conflicts over the provision of combined aid events and project aid events. Fungible, or monetary, aid was predicted to decrease the number of conflicts over non-fungible, or material goods, aid.

Post period

As displayed in Table 15, the onset of conflict events in all countries during the post aid event period was found to be best predicted by: road density, distance to the nearest supply route, infrastructure, distance from the country's capital, and the country's measure

of democracy. All of these variables were found to be significant at the 0.001 level. The number of ethnic groups and population density were not found to be statistically significant predictors of conflict during the post period, however, these regressors remained in the model due to their theoretical significance. Explicitly, the fit conflict model for all countries during the active aid event period was found to be:

(9) $ln C_{Post} = 6.642 - 0.034ETH + 0.00002POP - 0.337 ln TRANSPORT + .001INF - 0.591 ln CAP\_DIST - 0.133 ln DEM + \mu$

An increase in distance to the nearest supply route, an increase in the distance from the capital, and an increase in the measure of democracy were predicted to decrease the number of conflict events in a particular location. Conversely, increases in infrastructure was predicted to increase the number of conflict events. No inference about the effects of the number of ethnic groups or population density can be made due to their lack of significance.

None period

As displayed in Table 15, the onset of conflict events in all countries during the post aid event period was found to be best predicted by: the number of ethnic groups, population density, road density, distance to the nearest supply route, infrastructure, distance from the country's capital, and the country's measure of democracy. All of these variables were found to be significant at the 0.001 level. Explicitly, the fit conflict model for all countries during the active aid event period was found to be:

(10) $ln C_{none}$= 3.516-0.465ETH+0.342POP+0.088ROAD+0.076*ln*TRANSPORT

-0.0007INF-0.237*ln*CAP_DIST-0.120*ln*DEM+μ

An increase in the number of ethnic groups, an increase in infrastructure, an increase in distance to the country's capital, and an increase in democracy were all predicted to decrease the number of conflicts in a particular location. Conversely, increases in population density, road density, and distance to the nearest supply route were predicted to increase the number of conflict events.

Discussion of the Fit Model Results

The number of ethnic groups within 50 km of an aid event was predicted to have a significant negative effect on conflict in every temporal period except post. This effect was found to be the largest during the pre aid period, in which an increase in the number of ethnic groups by one was found to decrease the number of conflicts within the 50 km buffer by -0.901. Therefore, evidence suggests that analytical Hypothesis 3a, which theorizes conflict is more likely in the proximity of aid events surrounded by more than one ethnic group, is not valid. This was an unexpected result as the literature suggests that the more ethnic groups in an area, the higher the chance of ethnic tension and conflict.

The inconsistent significance of the ETH coefficients values is likely a result of bias in the data. As discussed in the data and methodology chapter, one data point was used to code 20 years of data. This meant that there was no variation in the ethnicity data over time. Coding of the data in this manner therefore removed any explanatory power of comparison between temporal periods. However, the ETH variable was still included in each model because of theoretical motivations.

Table 15. The Fit Conflict Models by Temporal Period: All Countries

	(1) lncpre	(2) lncactive	(3) lncpost	(4) lncnone
ETH	-0.901***	-0.485***	-0.034	-0.465***
"Number of Ethnic Groups"	(-72.13)	(-44.30)	(-1.64)	(-39.88)
POP	0.346***	0.254***	0.00002	0.342***
"Population Density Cat."	(73.17)	(52.38)	(0.00)	(69.28)
lnROAD	-0.570***	-0.200***	0.461***	0.088***
"Road Density"	(-70.31)	(-24.04)	(-25.12)	(10.86)
lnTRANSPORT	-0.203***	0.096***	0.337***	-0.076***
"Distance to Nearest Supply Route"	(-21.90)	(9.86)	(-24.26)	(8.06)
INF	0.0008***	0.0011***	0.001***	0.0007***
"Infrastructure"	(35.03)	(55.79)	(42.29)	(-33.44)
lnCAP_DIST	-0.185***	-0.089***	0.591***	-0.237***
"Distance to the National Capital"	(-54.60)	(-25.14)	(-43.17)	(-64.90)
DEM	-0.018***	-0.061***	0.133***	-0.120***
"Measure of Democracy"	(-7.95)	(-26.28)	(-29.36)	(-53.01)
lnAID_DIST		-0.114***		
"Distance to Aid Site"		(-15.28)		
FA		0.167***		
"Provision of Pure Food Aid"		-5.36		
FUN		-0.339***		
"Fungibility"		(-9.77)		
EMER		0.665***		
"Provision of Emergency Aid"		(19.79)		
lnAID_AMT		-0.211***		
"Total Aid Amount ($)"		(-46.37)		
Constant	4.11***	6.180***	6.642***	3.516***
	(78.62)	(67.54)	(61.27)	(66.24)
N	16,332	18,315	13,018	18,940

t statistics in parentheses *p<0.05, **p<0.01, ***P<0.001

The population density at an aid event site was predicted to have a significant positive effect on conflict in every temporal period except post. This effect was found to be the largest during the pre aid period, in which an increase in the population density category number by one was found to increase the number of conflicts within the 50 km buffer by 0.346. Therefore, evidence suggests that the analytical Hypothesis 3b, which theorizes conflict is more likely in the proximity of densely populated areas is valid.

The inconsistent significance of the POP coefficients values is likely a result of bias in the data. As discussed in the data and methodology chapter, three data points were used to code 20 years of data. This meant that there was little variation in the population data over time. Coding of the data in this manner therefore reduced the explanatory power of comparison between temporal periods. However, the POP variable was still included in the post period model because of theoretical motivations.

The road density coefficient for the pre, active, and post temporal categories predicted that an increase in road density by one percent would decrease the number of conflicts by -5.07, -2.00 and -4.61, percent, respectively. The direction of this relationship follows the expectation as discussed in the review of literature. However, the road density variable was found to have a positive effect on conflict in the none period model. This was an unexpected result and is not explained well by the supply-based theory utilized throughout this paper.

The assumptions regarding the effects of road density on the occurrence of conflict made in analytical Hypothesis 3a is not shown to hold in all cases. The number of conflict events was found to be higher in areas with low density rather than high density in most

models, but not all. Therefore, no definitive claim about the relationship between road density and conflict can be made.

The distance to the nearest supply route variable was shown to have an inconsistent effect on the number of observed conflict events. A one percent increase in the distance between each aid event and the main transportation route was found to significantly reduce the number of conflict events by -2.03 and -3.37 percent in the pre and post periods, respectively. The same change was found to increase the number of conflict events by 0.96 and 0.76 percent respectively, in the active and none periods. Given that these two periods consist of the largest number of conflict observations, it is likely that this result represents the "typical" direction of the relationship between distance and conflict onset. However, no statistical claim can be made to this effect.

The portion of analytical Hypothesis 3c which states that conflict is more likely to occur near aid sites that are in close proximity to main supply routes is not shown to be valid. This result, combined with the empirical evidence related to the road density variable, leads to the overall rejection of Hypothesis 3b and suggests that no clear analytical relationship between conflict and these two elements of infrastructure can be made from this set of models.

The infrastructure variable is an interaction term combining the effects of road density and distance to the nearest supply route on conflict. This variable captures the effects of aid's ability to reach its designated location after leaving the main supply route. A higher value for each of these variables is predicted by the literature to have a negative

effect on conflict. Therefore, a negative coefficient value for INF is considered strictly better. This is not the relationship that that was predicted by most of the temporal models.

INF was shown to have a small positive effect on the pre, active and post temporal models. INF was shown to have a small negative effect on the none model. Although this effect was unexpected, the small coefficient values indicate that the overall effect between INF and the number of conflict events was small. This reduces the impact of the coefficient's sign on the overall relationship with conflict.

The literature suggested a positive relationship between distance from the country's stronghold and the number of conflict events. The logic behind this relationship was that as distance increased, the government's ability to quell conflict decreased, causing more conflict to occur and persist in areas were governmental control was least. However, the opposite relationship was predicted in all of the temporal models. Increasing distance was found to decrease conflict events by -1.85, -0.90, -5.91 and -2.37 percent in the pre, active, post and none periods, respectively. This suggests that either the government's stronghold in each of these countries is not the capital, or that incentives to attack either within, or near, the capital outweighed those of attacking outlying regions. As rebel groups are thought to build up their power base rurally, before moving efforts toward the government's powerbase, this result may also suggest that many of the actors in each conflict event within the considered countries already had a strong position within their respective countries. Based on the findings in the empirical models, Hypothesis 2c, which predicts larger numbers of conflict events far from the capital does not hold.

On average, each of the recipient countries was found to be in “closed anocracy” at the onset of each aid event. This suggests that the governments of each of the recipient nations are fairly ineffective, disorderly, and potentially not in a position to provide protection or services to their citizens. As the measure of democracy increased by one number, the number of conflict events was found to decrease anywhere between -0.018 in the pre period model and -0.133 in the post period model. Negative relationships between democracy and conflict were also found for the active and none periods. This suggests that as democracy increases and governments are in a better position to provide for and protect their citizens, the number of conflict events, or days with conflict, decreases.

The magnitude of this relationship was predicted to be considerably larger than in the post and none periods than in the pre or active periods. This change in magnitude is likely because many development agencies make the provision of aid dependent on the government’s willingness to democratize. As aid is provided and political freedoms then grow, the formerly repressed citizens may have more ability to react publically to injustices, inducing more conflict events.

The total amount of aid distributed was shown to exhibit a negative relationship with conflict events. For the active period, as the amount of aid provided increases by one percent, the number of conflict events was predicted to decrease by -2.11 percent. On the surface, this relationship appears to contradict the supply-based argument made in this paper. This argument suggested that the larger the aid, the greater the incentive to gain control over the aid, and the larger the number of conflict events that are observed surrounding the aid event. However, this relationship may capture an unobserved effect.

The largest provisions of aid are typically given in the form of monetary assistance. This is fungible aid. As shown by the FUN coefficient value, of -0.339, fungible aid is associated with fewer conflicts than is aid that is given directly in the form of material goods. Therefore, the increase in the ZAID variable is thought to increase the chances that the aid is provided in a fungible form, thus decreasing the number of associated conflicts.

These results dispute the claims of analytical Hypothesis 2b which suggests fungible aid is associate with more conflict events than material aid. This conclusion works against the supply-based argument that the more easily the aid source can be converted to cash, the greater the attempt for capture. However, this result is assumed to capture the effects of the provision of fungible aid directly to government entities, which reduces the ability of third-party capture through direct conflict. This difficulty then reduces incentives to attack and the number of conflict events associated with fungible aid.

Each of the other independent variables was shown to exhibit the expected relationship with conflict. The number of conflict events was found to decrease by -1.14 percent as the distance from the aid event increased by one percent. This suggests that conflict events during the active period are more likely to occur close to the aid event rather than farther away. This result supports the supply-based argument used in this paper as well as analytical Hypothesis 1b. Attacking close to, or near, an aid site indicates that the aid itself has value, and that the value of this aid induces conflict. However, the significance of the AID_DIST variable is not enough to determine a causal relationship between the provision of aid and the onset of conflict.

The provision of emergency aid was predicted to increase the number of conflicts by 0.665 more than the provision of project aid. This relationship follows expectations, as emergency aid is thought to be provided to communities suffering a widespread severe, acute hardship, whereas project aid is typically targeted to assist particular segments of the population. This suggests that emergency aid has a higher value to more people than project aid. The inflated value of emergency aid over project aid increases the incentives to attack emergency aid events over project events. These results support analytical Hypothesis 2a.

Finally, the provision of pure food aid was shown to have a significant positive relationship with conflict. The addition of one food aid event was predicted to increase the number of conflict events within 50 km by 0.167. Although this result strongly supports analytical Hypothesis 1a, further support from the first difference model is needed before any claims as to the causality between food aid and conflict onset can be made.

The Effects of Somalia and Mauritania on the Fit Conflict Models

Observations from Mauritania and Somalia composed approximately one third of the total aid events evaluated from the 17 aid recipient countries in this analysis. Polarization in the distribution of aid events of this magnitude had the potential to significantly bias the Fit conflict model for all countries and keep it from accurately representing the effects of each political, demographic and aid characteristic variable on the number of conflicts predicted in each temporal period.

To consider the effect of the unequal aid event distribution in the data, two additional sets of temporal conflict models were fit using OLS[8]. The first set considered only aid events located in Mauritania and Somalia. This set was known as the "M&S" temporal models. The second set was referred to as the "-M&S" temporal models, and considered events in all countries excluding Mauritania and Somalia. The sign and magnitude of each coefficient value were then compared to determine if the unequal aid distribution altered the relationship between any of the independent variables and the number of conflict events.

To test for statistical significance between the correlation coefficient values of the same variables across the two models, the Fisher Transformation was used. Specifically, Z-score values for each set of variables was constructed using the following formulas:

$$r' = (0.5)\ln\left(\frac{1+r}{1-r}\right)$$

$$z = \frac{r_1' - r_2'}{\sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}}$$

where r_1 indicates the variable correlation coefficient value from the M&S model, and r_2 represents the variable correlation coefficient value from the -M&S model. N then represents the number of observations of each of the corresponding models.

Each set of correlation coefficients were then tested using the following hypothesis:

Ho: $r_1=r_2$

[8] See Appendix for regressions results.

Ha: $r_1 =/= r_2$

where Ho indicated the null hypothesis and Ha indicated the alternative hypothesis. Rejection of the null hypothesis indicated that the correlation coefficient values across the two models were statistically different, indicating that the independent variable in question had a different effect on the two models. Failure to reject the null hypothesis implied that the two coefficient values were statistically equivalent across the two models, indicating that the variable in question had a statistically similar effect on the two models.

At the 95 percent significance level, the Z-critical value was 1.96. The null hypothesis was rejected with 95 percent confidence for all Z-score values that fell above this threshold. All Z-score values that fell below this threshold indicated that the null hypothesis could not be rejected. Data were tested for the active period in both models, as this period contains all of the explanatory variables that were found to be statistically significant.

The magnitude and sign of at least one of the ETH, POP, lnROAD, lnTRANSPORT INF, DEM, and EMER variables differed between the two models. This suggests that these variables have different effects on the number of conflict events predicted depending on the inclusion of Somalia and Mauritania. Statistically, the null hypothesis was rejected for each pair of correlation coefficients. This suggests that the independent variables are correlated differently with the dependent conflict variable depending on the inclusion of Somalia and Mauritania. For all variables excluding ETH, correlation with the dependent variable was found to be stronger when only Somalia and Mauritania were considered than when they were excluded. These results suggest that the unequal distribution of aid events

across countries affected the overall conflict model for all countries. The effects of this distributional bias must be considered when evaluating the results of the all countries model.

Table 16. Testing the Strength of Correlation and the Effects of Mauritania and Somalia

Variable Name	Correlation Coefficient: M&S Model	Correlation Coefficient: -M&S Model	Z-Score	Decision
ETH	-0.06	-0.158	7.39	Reject Ho
POP	0.879	0.169	89.39	Reject Ho
lnROAD	0.312	-0.051	27.83	Reject Ho
lnTRANSPORT	-0.623	-0.011	-53.52	Reject Ho
INF	-0.488	0.161	-51.8	Reject Ho
lnCAP_DIST	-0.868	-0.268	-78.18	Reject Ho
DEM	-0.569	0.086	-54.51	Reject Ho
lnAID_DIST	-0.542	-0.161	-33.1	Reject Ho
FA	0.332	0.178	12.3	Reject Ho
FUN	-0.611	-0.185	-38.96	Reject Ho
EMER	-0.381	0.04	-27.5	Reject Ho
lnZAID	-0.845	-0.382	-62.24	Reject Ho
Observations (N)	**10,413**	**11,855**		

Results of the First Difference Model

To test Hypothesis 1a, a first difference (FD) model was created. This was done using differenced variables which accounted for the change in the number of conflicts between the pre and active periods in all countries and for the active and post periods in all countries. Differences between periods were represented by the variables FD_PRE_ACTIVE and FD_POST_ACTIVE. Differences in democracy between periods are represented by the variables FD_DEM_PRE_ACTIVE and FD_DEM_POST_ACTIVE. Changes in each independent variable were also considered. These changes were represented by the variables: FD_ZAID, FD_EMER and FD_FUN. The POP, ROAD, TRANSPORT, INF and ETH variables corresponding to each aid event were not found to change between periods. The first difference equations were then fit using OLS to evaluate the change in conflict occurrence due to the presence of food aid in the active period.

Pre versus active

As displayed in Table 17, the first difference model to test the statistical difference between the number of conflicts between the pre and active periods was found to be:

(1) $$FD\_PRE\_ACTIVE = 19.53 - 2.72E{-}7 FD\_ZAID - 7.043 FD\_FA - 5.292 FD\_FUN - 9.133 FD\_EMER + 0.877 FD\_DEM\_PRE\_ACTIVE + \mu$$

Neither the provision of food aid, nor its corresponding descriptive variables were found to significantly affect the difference in the number of conflict events between the pre and active periods. Changes in democracy were also found to have an insignificant effect. These results indicate that analytical Hypothesis 1a cannot be considered to be valid, and

that the provision of pure food aid is not shown to significantly increase the number of conflict events within 50 km of the aid.

Post versus active

As displayed in Table 17, the first difference model to test the statistical difference between the number of conflicts between the post and active periods was found to be:

(1) FD_POST_ACTIVE= 19.79-3.80E-8FD_ZAID-0.2.562FD_FA-7.387FD_FUN +0.3115FD_EMER+0.101FD_DEM_POST_ACTIVE+μ

Neither the provision of food aid nor its corresponding descriptive variables were found to significantly affect the difference in the number of conflict events between the active and post periods. Changes in democracy were also found to have an insignificant effect. These results indicate that analytical Hypothesis 1a cannot be considered valid, and that the removal of pure food aid is not shown to significantly change the number of conflict events within 50 km of the aid.

Table 17. First Difference Results

	(1)	(2)
	Difference Between Pre and Active Periods	Difference Between Post and Active Periods
fd_FA	-7.043	-2.562
"Difference in Provision of Food Aid"	(-1.02)	(-0.32)
fd_ZAID	-2.72E-07	-3.80E-07
"Difference in Total Aid Amount"	(-1.09)	(-1.34)
fd_EMER	-9.133	9.343
"Difference in Provision of Emergency Aid"	(-0.95)	(0.65)
fd_FUN	-5.292	-12.86
"Difference in Provision of Fungible Aid"	(-0.65)	(-1.08)
fd_dem_pre_active	0.877	
"Difference in Democracy Between Pre and Active Periods"	(0.73)	
fd_dem_post_active		6.670*
"Difference in Democracy Between Post and Active Periods"		(2.20)
constant	19.53***	26.46**
	(3.15)	(2.79)
N	342	265

t statistics in parentheses * p<0.05, **p<0.01, *** p<0.001

CHAPTER 6

CONCLUSIONS AND CALL FOR FUTURE RESEARCH

The analysis conducted for this paper considered the relationship between 346 aid events and 19,498 conflict events that occurred between January 1995 and February 2016. The nature of this relationship was tested using OLS regressions. The effect of food aid on the change in the number of conflict events between each period was then examined more closely using a first difference model. The overall findings of the empirical analysis are summarized below, followed by resulting policy recommendations.

Food aid and conflict

The provision of pure food aid was found to be significantly associated with the number of recorded conflict events during the active aid period for all countries. In this model, the addition of one pure food aid event was predicted to increase the number of conflict events by 0.167. However, when only aid events from Mauritania and Somalia were considered, the same provision of pure food aid was predicted to significantly decrease the number of conflict events by -0.158. This result was similar to that found when all countries excluding Mauritania and Somalia were considered. In this case, each pure food aid event was shown to decrease conflict by -4.260 events. Given that this -M&S model displays the most even distribution of aid across countries, this third result is considered the most representative of the typical association between food aid and conflict. The provision of

food aid is therefore considered to have a greater potential to reduce conflict during the active aid period instead of increasing conflict.

These results were supported by the first difference model that predicted no significant change in the number of observed conflict events between periods of active aid and those without aid. These results suggested that the food aid can be distributed in good conscience to those in need, without the fear of increasing local conflict.

Aid characteristics and conflict

The total amount of aid distributed was shown to exhibit a negative relationship with conflict events in all cases. On the surface, this relationship appears to contradict the supply-based argument made in this paper. This argument suggests that the larger the aid, the greater the incentive to gain control over the aid, and the larger the number of conflict events that are observed surrounding the aid event. However, this relationship may capture an unobserved effect.

The largest provisions of aid are typically given in the form of monetary assistance. This is fungible aid. In the all countries model, fungible aid is associated with fewer conflicts than aid that is given directly in the form of material goods. Therefore, the increase in the ZAID variable is thought to increase the chances that the aid is provided in a fungible form, thus decreasing the number of associated conflicts. However, in the M&S and -M&S models, fungible aid was associated with more conflicts than material aid. This was the expected relationship. Given that the -M&S model displays the most even distribution of aid across countries, the result for this model is considered the most representative of the

typical association between fungible aid and conflict. Analytical Hypothesis 2b could not be proven valid in all cases, and no consistent causal relationship between fungibility and conflict was determined from this analysis.

The provision of emergency aid was predicted to increase the number of conflicts more than the provision of project aid in the all countries and -M&S models. The provision of emergency aid was conversely predicted to decrease the number of conflict events in the M&S model. The all countries and -M&S relationships follows expectations, as emergency aid is thought to be provided to communities suffering a widespread severe, acute hardship, whereas project aid is typically targeted to assist particular segments of the population. This suggests that emergency aid has a higher value to more people than project aid. The inflated value of emergency aid over project aid increases the incentives to attack emergency aid events over project events. These results support analytical Hypothesis 2a.

The M&S relationship with conflict is opposite of the expected result, but is presumed to be a result of the overwhelming number of conflicts in Somalia. Therefore, in cases in which a country is in a constant state of conflict, the provision of emergency aid may work to quell fighting. However, the statistical evidence from this analysis is not strong enough to make that claim.

Geography and conflict

As one moved farther away from the aid event location, the number of observed conflict events was found to decrease significantly. This result was found in all cases,

including the M&S and -M&S models. These findings supported the supply-based argument used in this paper as well as analytical Hypothesis 1b. The prevalence of attacks close to, or near, an aid site indicated that the aid itself has value, and that the value of this aid induces conflict. However, the significance of the AID_DIST variable was not enough to determine a causal relationship between the provision of aid and the onset of conflict.

The literature suggested a positive relationship between distance from the country's stronghold and the number of conflict events. The logic behind this relationship was that as distance increased, the government's ability to quell conflict decreased, causing more conflict to occur and persist in areas were governmental control was least. However, the opposite relationship was predicted in all of the temporal models in the all countries, M&S and -M&S sets.

These results suggest that either the government's stronghold in each of these countries is not the capital, or that incentives to attack either within or near the capital outweigh those of attacking outlying regions. As rebel groups are thought to build up their power base rurally, before moving efforts toward the government's powerbase, this result may also suggest that many of the actors in each conflict event within the considered countries already had a strong position within their respective countries. Based on the findings in the empirical models, Hypothesis 2c, which predicts larger numbers of conflict events far from the capital does not hold.

Demographics and Conflict

The number of ethnic groups within 50 km of an aid event was found to have an inconsistent effect on conflict across temporal periods, and across the all countries, M&S and -M&S sets. For example, an increase in the number of ethnic groups was predicted to increase the number of conflict events in all of the M&S models and the -M&S post and none models. However, the same change was predicted to decrease conflict in the all of the all countries temporal models and the -M&S pre and active models. Therefore, evidence suggests that analytical Hypothesis 3a, which theorizes conflict is more likely in the proximity of aid events surrounded by more than one ethnic group, is not valid in all cases. This was an unexpected result as the literature suggests that the more ethnic groups in an area, the higher the chance of ethnic tension and conflict.

The inconsistent significance of the ETH coefficients values is likely a result of bias in the data. As discussed in the data and methodology chapter, one data point was used to code 20 years of data. This meant that there was no variation in the ethnicity data over time. Coding of the data in this manner therefore removed any explanatory power of comparison between temporal periods. However, the ETH variable was still included in each model because of theoretical motivations.

The population density at an aid event site was predicted to have a significant positive effect on conflict in all cases excluding the all countries and -M&S post period models. Therefore, evidence suggests that analytical Hypothesis 3b, which theorizes conflict is more likely in the proximity of densely populated areas is valid in most, but not all cases.

The inconsistent significance of the POP coefficients values is likely a result of bias in the data. As discussed in the data and methodology chapter, three data points were used to code 20 years of data. This meant that there was little variation in the population data over time. Coding of the data in this manner therefore reduced the explanatory power of comparison between temporal periods. However, the POP variable was still included in the post period model because of theoretical motivations.

Infrastructure and conflict

The road density coefficient was shown to have an inconsistent effect on conflict across temporal periods and model sets. For the all countries pre, active, and post temporal models and the -M&S pre and active temporal models, road density was predicted to have a significant negative effect on conflict. The direction of this relationship follows the expectation as discussed in the review of literature. However, the road density variable was found to have a positive effect on conflict across all of the M&S temporal models as well as the all countries none, and the -M&S post and none models. This was an unexpected result and is not well explained by the supply-based theory utilized throughout this paper.

The assumptions regarding the effects of road density on the occurrence of conflict made in analytical Hypothesis 3a are not shown to hold in all cases. The number of conflict events was found to be higher in areas with low density than high density in most models, but not all. Therefore, no definitive claim about the relationship between road density and conflict can be made.

The distance to the nearest supply route variable was also shown to have an inconsistent effect on the number of observed conflict events. A one percent increase in the distance between each aid event and the main transportation route was found to significantly reduce the number of conflict events in the all countries pre and post periods, the M&S pre, post, and none and the -M&S pre, post, and none temporal models. The same change was found to increase the number of conflicts in active periods of all model sets. This result suggested that the provision of aid was the driving factor behind the observed conflicts and not the distance to the nearest supply route.

The observed active period relationships supported the supply-based argument utilized throughout the paper, which posits that the incentives to capture aid induce conflict surrounding aid sites. Given that a negative relationship between the TRANSPORT variable and conflict was observed in most cases, this is likely the "typical" direction of the relationship between distance and conflict onset. However, no statistical claim can be made to this effect.

The portion of analytical Hypothesis 3c which states conflict is more likely to occur near aid sites that are in close proximity to main supply routes is not shown to be valid in all cases. This result, combined with the empirical evidence related to the road density variable, leads to the overall rejection of Hypothesis 3b, and suggests that no clear analytical relationship between conflict and these two elements of infrastructure can be drawn from this set of models.

The infrastructure variable is an interaction term combining the effects of road density and distance to the nearest supply route on conflict. This variable captures the

effects of aid's ability to reach its designated location after leaving the main supply route. A higher value for each of these variables is predicted by the literature to have a negative effect on conflict. Therefore, a negative coefficient value for INF is considered strictly better. This is not the relationship that that was predicted by most of the temporal models.

INF was shown to have a small positive effect on the pre, active and post temporal models in the all countries and -M&S sets. INF was shown to have a small negative effect on all set's none models as well as the M&S pre and post models. Although this effect was unexpected, the small coefficient values indicate that the overall effect between INF and the number of conflict events was small. This reduces the impact of the coefficient's sign on the overall relationship with conflict.

Democracy and conflict

On average, each of the recipient countries was found to be in "closed anocracy" at the onset of each aid event. This suggests that the governments of each of the recipient nations are fairly ineffective, disorderly, and potentially not in a positon to provide protection or services to their citizens. For all countries, as the measure of democracy increased by one number, the number of conflict events was found to decrease anywhere between -0.018 in the pre period model and -0.133 in the post period model. Negative relationships between democracy and conflict were also found for the active and none periods. This suggests that as democracy increases and governments are in a better position to provide for and protect their citizens, the number of conflict events or conflict days decreases.

The magnitude of this relationship was predicted to be considerably larger than in the post and none periods than in the pre or active periods. This change in magnitude is likely because many development agencies make the provision of aid dependent on the government's willingness to democratize. As aid is provided and political freedoms then grow, the formerly repressed citizens may have more ability to react publically to injustices, inducing more conflict events.

Policy Recommendations

The provision of food aid in itself was not found to induce an increase in the number of conflicts events in the aid recipient area. Food aid should therefore be considered a viable way to assist hungry people across the globe. However, this aid is considered to be most beneficial when it reaches the target population and is used for the intended purposes. The way in which the aid is administered and the characteristics of the aid provided play a key role in determining the success of an aid project. The findings of this study help to determine which aid characteristics and locational aspects allow food aid to be distributed in the most beneficial manner.

Whenever possible, project aid should be provided to struggling segments of the population. Project aid can help hungry individuals as well as struggling sectors of the economy before widespread crisis occurs. By providing agricultural assistance or education to farmers, widespread crop failure and famine due to low levels of agricultural inputs or poor cultivation techniques may be avoided. By providing nutritional assistance to expectant mothers and young children, the overall population may grow healthier and more

prosperous. Addressing issues as soon as they arise is thought to reduce the need for emergency aid and thus reduce conflict events.

When providing food aid it is important that the distribution sites be located in the most secure locations possible. This typically means away from main supply routes and in areas with developed road networks that allow for quick passage and several delivery routes. Adhering to these locational qualifications will reduce the frequency by which aid is stolen in transport, and increase the likelihood that the aid will assist the target population.

The last two factors that increase aid's potential to be utilized in the intended manner are that the aid be distributed directly to the needy population, and, that the aid be distributed by politically neutral organizations. Providing aid through national or regional governments increases the chance of misappropriation. Donating material goods instead of money is one way to reduce the chance of unintentionally funding government officials and to increase the number of citizens fed. Additionally, ensuring that all local residents have equal access to aid despite race, ethnic origin or political affiliation is absolutely necessary to avoid local conflict. This is best done by ensuring the distributing agents have no affiliation with a specific political or ethnic group and that these agents are not working to promote an underlying agenda. This may be done by using aid distribution agents with no previous connection to the recipient area, and by frequently rotating agents between aid events to prevent the formation of local alliances.

Need for Future Research

The number and distribution of the aid events was a limiting factor of this data set. Complete, geocoded aid data were only available for 17 of the 54 countries in Africa. This greatly reduced the ability to generalize the results to the entire continent. The fact that data were only available for selected countries suggests the presence of an inherent selection bias. These are the countries which likely receive the most aid. Therefore, by using this data, the effects of aid on the incidence of conflict may be overestimated for Africa as a whole. The ability to generalize the temporal conflict models for all countries could thus be improved with the addition of additional aid event observations and the inclusion of more recipient counties.

Limited data points for population density and number of ethnic groups were also limiting factors of this data. The use of three population point estimates and one ethnicity estimate allowed for little-to-no variation in these parameters over time. This biased the relationship between the provision of aid and conflict portrayed in all of the temporal models. Additional population density and ethnicity data could greatly improve the analysis.

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APPENDIX
ADDITONAL REGRESSION RESULTS

Table 1. The Fit Conflict Models by Temporal Period: Mauritania and Somalia

	(1) lncpre	(2) lncactive	(3) lncpost	(4) lncnone
ETH	3.605***	0.156*	0.0435*	-0.576***
"Number of Ethnic Groups"	(10.79)	(2.27)	(2.27)	(-51.02)
POP	0.150***	0.278***	0.062***	0.252***
"Population Density Cat."	(19.22)	(26.48)	(-9.46)	(55.94)
lnROAD	4.309***	5.824***	0.512***	0.026***
"Road Density"	(108.30)	(47.50)	(-30.31)	(3.33)
lnTRANSPORT	0.185***	0.696***	0.503***	-0.162***
"Distance to Nearest Supply Route"	(-18.25)	(22.99)	(-63.75)	(-25.08)
INF	0.005***	0.004***	0.001***	-0.0005***
"Infrastructure"	(-7.56)	(7.76)	(63.45)	(-26.95)
lnCAP_DIST	0.514***	-0.629***	0.662***	-0.191***
"Distance to the National Capital"	(-42.70)	(-40.67)	(-60.36)	(-59.22)
DEM	0.054***	-0.004	0.041***	-0.061***
"Measure of Democracy"	(18.73)	(-1.25)	(-12.82)	(-36.07)
lnAID_DIST		-0.041***		
"Distance to Aid Site"		(-8.69)		
FA		-4.323***		
"Provision of Pure Food Aid"		(-37.28)		
FUN		0.128*		
"Fungibility"		(2.27)		
EMER		-0.671***		
"Provision of Emergency Aid"		(-14.19)		
lnAID_AMT		-0.199***		
"Total Aid Amount ($)"		(-9.90)		
Constant	3.181***	3.448***	8.039***	4.938***
	(-9.20)	(8.66)	(104.77)	(109.24)
N	10,413	6,460	10,438	10,737

Table 2. The Fit Conflict Models by Temporal Period: Excluding Mauritania and Somalia

	(1) lncpre	(2) lncactive	(3) lncpost	(4) lncnone
ETH "Number of Ethnic Groups"	-0.712*** (-54.09)	-0.535*** (-40.03)	0.028 (1.37)	0.121*** (10.73)
POP "Population Density Cat."	0.221*** (38.57)	0.226*** (35.07)	-0.221*** (-19.56)	0.187*** (34.67)
lnROAD "Road Density"	0.221*** (38.57)	-0.149*** (-13.48)	0.160*** (5.02)	0.212*** (30.15)
lnTRANSPORT "Distance to Nearest Supply Route"	-0.325*** (-34.19)	0.114*** (9.73)	-0.213 (-13.48)	-0.012*** (-1.26)
INF "Infrastructure"	-0.001*** (45.22)	0.0009*** (40.61)	0.0007*** (23.94)	-0.0004*** (-21.56)
lnCAP_DIST "Distance to the National Capital"	-0.139*** (-41.21)	-0.084*** (-20.40)	-0.290*** (-20.28)	-0.132*** (-39.18)
DEM "Measure of Democracy"	0.047*** (18.02)	-0.055*** (-16.53)	-0.035*** (-4.48)	-0.016** (-6.29)
lnAID_DIST "Distance to Aid Site"		-0.105*** (-9.99)		
FA "Provision of Pure Food Aid"		-0.160*** (-3.57)		
FUN "Fungibility"		0.130* (2.44)		
EMER "Provision of Emergency Aid"		1.298*** (23.63)		
lnAID_AMT "Total Aid Amount ($)"		-0.265*** (-48.51)		
Constant	-0.147 (-1.25)	7.623 (65.09)	4.953*** (39.16)	2.634*** (47.80)
N	9,923	11,855	6,582	12,261
t statistics in parentheses	* p<0.05, **	p<0.01, ***	p<0.001	