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ABSTRACT

Food Aid and Violent Conflict: A Review of Literature*

We decompose the relationship between food aid and conflict into the channels through which food aid can affect conflict. We address questions of methodological choice and estimation techniques for empirical studies. Our review of the empirical evidence on the effect of food aid on conflict shows that none of the previous studies proposes a compelling identification strategy. While existing research shows promising approaches in terms of econometric methods, i.e., instrumental variables estimation, they have not succeeded in i) using instruments that pass the necessary tests of instrumental variable estimation and ii) identifying the channels through which food aid influences conflict. We argue that future work should contain a rigorous identification strategy with a stricter focus on the impact of food aid on conflict intensity, empirically examine the conceptual channels through which food aid affects conflict, and the need for data at a more disaggregated level to achieve both objectives.

JEL Classification: F35, Q18, D74

Keywords: conflict, literature review, endogeneity, humanitarian aid, food security

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Introduction

Food aid presents a core component of humanitarian support for people incapable of meeting basic human needs. It aims to bolster food security and contribute to civil peace in the destination countries (Tranchant et al., 2019). However, studies in the field of economics and politics discussing the relationship between food aid and conflict reach different conclusions (Mary, 2022). For instance, Nunn and Qian (2014) find that food aid may prolong armed inter- and intra-country conflicts, whereas Mary and Mishra (2020) conclude that food aid reduces the incidence and length of conflicts. The contradictory evidence points to a complex relationship between food aid and conflict. In addition, Christian and Barrett (2017) and Christian and Barrett (2021) identify shortcomings in the econometric design in one of the most prominent studies on food aid and conflict, which raises concerns with respect to the validity of the results (Nunn and Qian, 2014).

In this article, we provide an overview of what we know and, more importantly, what we do not know about the impact of food aid on conflicts. Conflicts are complex in nature, and so is their relationship with food aid. We decompose this relationship into its components and illustrate the theoretical channels through which food aid influences conflict depending on the timing of food aid and the nature of the conflict. We review the empirical evidence on the effect of food aid on conflict and discuss their strengths and weaknesses incorporating the results of Christian and Barrett (2017, 2021). We address questions of methodological choice and estimation techniques for studies on food aid and conflict. We elicit problems that deserve attention in future research to understand the impact of food aid on conflict. We restrict ourselves to food aid as analyses of aggregate assistance may lead to the wrong conclusion since the effects of individual forms of aid on recipient countries may cancel out (Qian, 2015).

Violent conflicts within and between civilizations are as old as the history of humankind. Extreme weather events and global warming may increase the future potential for conflicts due to a

decline in livable areas on a global scale (Barnett and Adger, 2007; Burke et al., 2009; Harari and La Ferrara, 2018; Hsiang et al., 2013; Mach et al., 2019). Humanitarian support and food aid, in particular, will become even more critical with decreasing availability of natural resources in large parts of the world. Therefore, understanding the link between food aid and conflict is of utmost importance to avoid undesired consequences, e.g., prolonging conflicts, and maximize the effectiveness of food aid.

We define food aid as a measure by one country to provide food in the form of in-kind food, food vouchers, or cash transfers to a recipient country without any reimbursement from the recipient country. Food aid does not entail any obligations by the recipient country. A conflict is an incompatibility between at least two parties involving armed forces, resulting in at least 25 battle deaths per year (Mary and Mishra, 2020; Nunn and Qian, 2014). In 2021, more than 190 million people worldwide suffered from hunger (Food Security Information Network, 2022). This equals an increase of approximately 40 million people compared to 2020 (Food Security Information Network, 2022). To tackle food insecurity in other countries, the U.S. alone has spent \$4.9 billion on food aid in 2021 (USAID, 2022b). The aid included cash, food vouchers, and approximately 2.5 million tons of in-kind food. Recipients consisted of peaceful countries such as Kenya and countries with violent conflicts such as Afghanistan. According to USAID (2022b), conflicts have been the most important driver of food insecurity in 2021. More than 850 million people in 23 countries have been affected by medium- and high-intensity conflicts, doubling within the last decade (World Bank, 2022). Hence, the relationship between food aid and conflict becomes even more important over time due to the increasing number of conflicts and affected population.

We contribute to the literature on the impact of food aid on the conflict in various ways. First, we present a conceptual framework for the channels through which food aid influences conflict. Most previous studies contain arguments about why food aid may prolong or prevent conflict but not in a systematic way. Second, we review existing empirical studies on the effect of food aid on conflict. We

identify the strengths and weaknesses of these studies. We focus on the empirical strategies used to estimate the impact of food aid on conflict and the econometric challenges to be addressed when estimating the causal relationship. Third, we propose identification strategies to identify the impact of food aid on conflict onset/continuation and intensity, where we also discuss suitable instruments for food aid. Fourth, we discuss the types of analysis and the corresponding data requirements for future research to understand the channels through which food aid affects conflict.

A conceptual decomposition of the impact of food aid on conflict

The emergence and continuation of conflict are complex in nature. It is, however, widely acknowledged that economic shocks, e.g., food price shocks, may favor conflict (Blattman and Miguel, 2010; Fjelde, 2015; Winne and Peersman, 2021). In a broad sense, food aid represents a measure potentially causing economic shocks in the destination country (Blattman and Miguel, 2010). For instance, large shipments of wheat to conflict affected areas will induce a decrease in local wheat prices, if local markets are not integrated in world markets. Beyond its impact on local economies, food aid affects the people's perception of local governments and/or rebellious groups (Berman et al., 2011; Findley, 2018). The effects of food aid in destination countries are therefore multi-faceted and more complicated than a simple economic shock.

Something that has been acknowledged in prior studies is that the mechanisms by which food aid influences conflict differ for the onset and continuation of conflict (Mary and Mishra, 2020; Nunn and Qian, 2014). In this Section, we elaborate on the underlying channels through which food aid affects conflict for the two scenarios: conflict onset and conflict continuation. We finally discuss the influence of the modalities of food aid, i.e., how the impact of food aid on conflict may differ for in-kind aid versus cash transfers.

2.1 The role of food aid for the onset of conflicts

Food aid aims at promoting food security in countries where people lack access to sufficient amounts of food (USAID, 2022a). This involves countries without conflict. Regions where natural disasters happen¹ or natural resources are (temporarily) insufficient to cover domestic food demand represent typical targets of food aid without a necessary existence of a conflict. Recent examples (2021) receiving support from USAID are Haiti for the earlier (earthquake) and Madagascar for the latter (drought) (USAID, 2022b). In cases where countries provide food aid without conflict, food aid cushions the impact of natural disasters by promoting food security (Annen and Strickland, 2017). Thereby, food aid contributes to preserving social peace in various ways (Collier and Hoeffler, 2004, 1998a; Nunn and Qian, 2014).

The *food security* channel is the first channel (1) through which food aid reduces conflict risk. People are rather willing to take violent action when they cannot ensure sufficient food consumption as one of the basic human needs (Blattman and Miguel, 2010; Koren and Bagozzi, 2016). This may be due to i) their own food production being insufficient and/or ii) a lack of access to affordable food through markets. Given that at least one of the conditions is fulfilled, food aid will increase access to food, remedy food scarcity, and reduce the risk of conflict onset (Zürcher, 2017).^{2 3} We would further expect that this risk-decreasing effect of food aid is stronger when both conditions are fulfilled, e.g.,

¹ In 2021, the Center for Research on the Epidemiology of Disasters (CRED) recorded 432 disastrous events involving more than 10,000 deaths and \$250 billion damage globally (CRED 2022).

² That does not imply that poverty of single people is a predictor of conflict, but food insecurity increases peoples' willingness to take violent action to fulfill nutritional needs (Blattman and Miguel, 2010; Justino, 2009). Instead, rather societies that are poor in general are prone to conflict once a negative economic shock appears (Blattman and Miguel, 2010; Fearon and Laitin, 2003; Hegre and Sambanis, 2006). Note that Verwimp (2005) for instance finds that gross household income has a weakly positive but significant impact on becoming a perpetrator in the Rwandan conflict in the 1990s. His results are, of course, not generalizable as his research is done on a case where the government had accused a minority (the Tutsis) to be blamed for a general economic downturn of the rural population (Humphreys and Weinstein, 2008; Verwimp, 2005).

³ The effectiveness in supporting food security in recipient countries is also controversially discussed. Some studies find a positive impact (Barrett and Heisey 2002; Tusime et al. 2013; Yamano et al. 2005), some studies find mixed results (Del Ninno et al., 2007; Gilligan and Hoddinott 2007) and some studies find no impact of food aid on food security, e.g., Barrett (2001); Clay et al. (1999). Lentz and Barrett (2008) and Lentz et al. (2013) point out that food aid measures have to be tailored to each specific context in the recipient country to be effective.

after an earthquake that has destroyed the people's own food production and infrastructure interrupting access to markets.

The second channel (2) is the *hearts and minds* channel (Findley, 2018). Food aid in collaboration with the government of the country in need may enhance the popularity of the respective government (Berman et al., 2011; Beath et al., 2018; Narang and Stanton, 2017; Zürcher, 2017). This leads to a lower likelihood of intra-country conflict due to insurgents. On the other hand, there are cases where the *hearts and minds* channel may also increase conflict. Imagine a scenario in which the government intends to fight a rebellious group. Food aid provided by/in collaboration with the government could increase peoples' willingness to join the military, increase the state's combat capacity, and thus the likelihood of conflict.

The third channel (3) is the *opportunity cost* channel (Berman et al., 2017; Strandow et al., 2016). (Food) aid can enhance economic growth and development (Kaila et al., 2020, Nunn and Qian, 2014). Abdulai et al. (2005) find that food aid in sub-Saharan Africa stimulates labor supply to agriculture, wage work and own business activities. It must, however, be targeted effectively (Barrett and Maxwell, 2005; Gilligan and Hoddinott, 2007; Qian, 2015). Improved income possibilities increase the opportunity cost of joining a rebellion, thereby decreasing the likelihood of conflict onset (Collier and Hoeffler, 1998a; Collier and Hoeffler, 2004; Fjelde, 2015; Winne and Peersman, 2021).

Food aid may also cause conflicts, i.e., increase the probability that a conflict emerges. First, the distribution mechanism of the delivered food can cause discontent in groups of the population that feel disadvantaged, encouraging them to react with violence ((4) the *distributional* channel) (Martínez and Eng, 2016). This is particularly important as food aid does not always arrive in the regions of a country where it is most needed (Clay et al., 1999; Jayne et al., 2002; Yamano et al., 2005).

Second, the politicization of food assistance may also add to local resentment (Hoelscher et al., 2017; Mary and Mishra, 2020; Messer et al., 1998). Suppose certain groups within a country are

hostile towards the government/country where the food aid stems from. These groups may react with insurgence to the aid as they perceive its use from the providing country as unacceptable or unethical (Croft et al., 2014; Narang and Stanton, 2017; Wood and Sullivan, 2015). We call this the *sabotage* channel (5) (Croft et al., 2014; Zürcher, 2017).

Third, the volatility of foreign (food) aid presents another channel through which food aid may increase the likelihood of conflict (Nielsen et al., 2011). Deliveries of food aid vary over time even though the need in the recipient country may remain constant. The dependency on volatile food aid can cast doubt on the recipient country's government to ensure food security independently from donors (Sheppard, 2021). In addition, potential rebels are often "*bought out*" (Nielsen et al., 2011, p. 221) of initiating a conflict with government side payments. Food aid contributes to governmental financial resources. The government's financial resources will be volatile with volatility of food aid, and so will the government's capability to maintain peace (Dal Bó and Powell, 2009; Findley, 2018; Nielsen et al., 2011). The channel can be of particular importance when the aid is provided by few or single donors as the risk of discontinuation increases (Burnside and Dollar, 2000; Gutting and Steinwand, 2017) and the dependency on aid increases (Knack, 2001; Tahir, 2017). Several studies point to the problem of volatile foreign aid from donors (Agénor and Aizenman, 2010; Celasun and Walliser, 2008; Pallage and Robe, 2001; Taylor and Byerlee, 1991). We refer to this channel (6) as the *volatility* channel.

2.2 *Food aid in times of conflict*

The channels through which food aid influences conflict in times of conflict differ depending on whether the conflict happens within a country (i.e., intra-country) or between two or more countries (i.e., inter-country) (Mary and Mishra, 2020; Nunn and Qian, 2014). We discuss the mechanisms by which food aid influences inter- and intra-country conflicts separately.

2.2.1 *Food aid in inter-country conflicts*

An inter-country conflict consists of two or more countries engaging in an armed conflict. Usually, an aggressor (country) causes the conflict to evolve by attacking another country. In most cases, food aid donating countries support the country under attack where the donor and the recipient have an established political relationship. For instance, the NATO supported Ukraine after the Russian invasion at the beginning of 2022 (The White House, 2022).

The effect of food aid on the conflict in such situations depends on the balance of power of the two parties in conflict. We refer to this channel (1) as the *power* channel. When the recipient of food aid represents the stronger power in the conflict, food aid will most likely accelerate the conflict and lead to a faster end.⁴ When the recipient of food aid represents the weaker power in the conflict, food aid will most likely decelerate the conflict. The recipient will have more resources to resist the more powerful party. Food aid will then prolong the conflict.⁵

Whether the aid arrives at the targeted recipients presents another channel through which food aid may impact conflict. If the hostile party of the conflict is able to bring the food aid delivery under their control, the impact of food aid on conflict will likely change in the negative direction (from the intended recipient's point of view) (Hirshleifer, 1991; Mary and Mishra, 2020; Nunn and Qian, 2014). We call this channel (2) the *predatory* channel (Zürcher, 2017). However, there are clearly defined fronts in most inter-country conflicts which makes the danger of theft by the hostile party less likely. The

⁴ The same applies to the provision of other forms of aid, e.g., military aid.

⁵ As suggested by a referee, aid to the weaker party in the conflict may also lead to a quicker end of conflict, if the aggressor concludes that the aid leads the weaker party to resist indefinitely longer against the aggressor such that the aggressor ends the conflict. This does, however, depend on at least two prerequisites. First, the aggressor had not anticipated the support by third parties. If the decision makers of the aggressor party had anticipated the support for the hostile party and still attacked the other party, the decision makers of the aggressor party still perceived their chances of victory as sufficiently high to risk an attack (Blattman and Miguel, 2010). Second, if the support was unanticipated, the decision makers of the aggressor party must be rational in the sense that they would decide to end the conflict, if they concluded that the conflict will consume much more resources than anticipated (Blattman and Miguel, 2010) due to the support by third parties. This second condition is quite unlikely to be fulfilled as the history of inter country conflicts has taught us.

Vietnam War, including the guerilla fighters, is an example where the fronts have not been defined clearly and food aid has been prone to theft (Anderson, 2002; Blumenthal, 1971).

2.2.2 *Food aid in intra-country conflicts*

Two or more parties are also involved in intra-country conflicts. In contrast to inter-country conflicts, the parties are often more challenging to define and do not consist of entire countries. Civil wars and violence by terroristic organizations comprise typical cases of intra-country conflicts. Often, a group or an organization fights against the domestic military in intra-country conflicts. The ultimate goal of such groups may consist in overturning the local government and taking over the power in the country (or parts of the country). The majority of conflicts globally belongs to the group of intra-country conflicts (Nunn and Qian, 2014).

Food aid by donor countries aims to provide food security to the people who are not able to feed themselves. Hence, it may reduce conflict through the (1) *food security* channel as well as the (2) *hearts and minds* channel (Böhnke and Zürcher, 2013; Crost et al., 2016; Findley, 2018; Mary and Mishra, 2020). The attraction of food aid by the government of the country in need signals the ability to manage crises which increases the popularity within the population of the recipient country (Berman et al., 2011; Beath et al., 2018; Zürcher, 2017). Therefore, people may tend to end civil unrest.

Aid theft by anti-governmental groups poses a much more severe danger in intra-country conflicts compared with inter-country conflicts (Kemmerling et al., 2023; Nunn and Qian, 2014; Polman, 2010). The core issue with food aid (and aid in general) in intra-country conflicts consists of the local government's limited controllability of large regions in the recipient country (Anderson, 1999; Polman, 2010; Strandow et al., 2016; Waal, 1997; Wood and Sullivan, 2015). The risk of theft increases with the distance over which the aid is transported (Aker, 2017; Nunn and Qian, 2014). The rebellious groups benefit from the food aid that is actually supposed to support local civilians in need of food. The vehicles transporting the food constitute even more valuable assets for the rebels than the food

itself (Polman, 2010). Food aid prolongs conflict in such situations through the (3) *predatory* channel (Berman and Matanock, 2015; Findley, 2018; Mary and Mishra, 2020; Nunn and Qian, 2014).

In other cases where the government possesses limited control over the routes on which food aid is transported, the government opponents charge aid organizations for safe passage (Barnett, 2011; Nunn and Qian, 2014). For instance, between 20 and 80 percent of food aid was lost in Somalia during the early 1990s (Barnett, 2011) and later traded for weapons (Perlez, 1992). Even if food aid arrives at the intended recipients, armed factions may confiscate the aid after arrival (Nunn and Qian, 2014). The group of people eligible for food aid may also include members of a local militia or recipients who support rebellious groups (Kemmerling et al., 2023; Nunn and Qian, 2014). The supporters of the rebellious groups may transfer the aid to the rebellious group (Martin-Shields and Stojetz, 2019). The government of the country in conflict may also appropriate food aid which fuels social unrest and prolongs an intra-country conflict (Nunn and Qian, 2014). At the beginning of the 1990s, the government of Rwanda had stolen so much of the food aid that the shipments ceased (Uvin, 1998). We refer to this channel (4) as the *tax* channel.⁶

Something inherent to the impact of food aid on conflict for intra- and inter-country conflicts are accompanying measures by donors. Food aid donors often ship military aid to recipient countries (Nunn and Qian, 2014). Accompanying assistance, and military aid, in particular, will moderate the effect of food aid on conflict. Suppose that military resources and food resources are scarce in a conflict. The provision of both resources will prolong the conflict. In contrast, the provision of one resource without the other probably has a weaker impact on the duration of the conflict. Therefore, accompanying aid measures moderate the effect of food aid on conflict. The same applies to the reason for the conflict. Suppose a natural disaster or natural constraints lead to hunger in a country.

⁶ Crost et al. (2016) argue that aid may also decrease violent conflict against civilians through the tax channel. Cash transfers enable civilians to pay taxes to the insurgents which they would otherwise not have been able to pay and thus would have led to violence against civilians.

Hunger in large shares of the population may cause civil unrest. Food aid can alleviate hunger and restore civil peace (Nunn and Qian, 2014). It will lead to an earlier end of the conflict. If the reason for conflict differs from hunger, food aid may not necessarily solve the problem. These variables are important to take into consideration in every analysis. In the next section, we discuss the role of confounders as control variables for the impact of food aid on conflict.

2.3 *The modality of food aid*

From a theoretical point of view, the impact of food aid may differ across modalities through the different channels we depict above. In-kind aid/food vouchers may interact differently with the markets compared with cash transfers.⁷ We discuss the potential differences based on the channels for conflict onset, and conflict continuation below.

2.3.1 *Conflict onset*

Prior studies find that in-kind aid and cash transfers both successfully promote food security to a very similar extent (e.g., Aker, 2017; Schwab, 2019; Schwab, 2020). Even though Kurdi (2021) and Schwab (2020) find that cash aid enhances dietary diversity compared to in-kind aid, both forms of aid lead to a similar caloric uptake and should thus reduce the likelihood of conflict emergence through the *food security* channel (Gentilini, 2016; Schwab, 2020). However, this depends on the availability of food products in local markets. Without food availability in local markets, cash transfers will not help increase food security. Another issue to consider regarding the *food security* channel are price effects. Cash provisions may cause food price spikes leaving recipients worse off compared to in-kind aid (Barrett, 2006; Cunha et al., 2019; Del Ninno et al., 2007; Gentilini, 2016).

Whether in-kind aid or cash transfers have different outcomes for the popularity of the local government, i.e., the *hearts and minds* channel, has not been studied. However, aid agencies often intend

⁷ Note that we do not differentiate between in-kind aid and food vouchers since vouchers can be exchanged against food at organized markets of aid organizations. The interaction of in-kind aid and food vouchers with local markets should thus be the same.

to increase the consumption of particular food items when providing in-kind aid (Aker, 2017). This is not the case for cash transfers which aid recipients can allocate based on their preferences (Maxwell et al., 2013). Therefore, cash transfers may have a stronger positive impact on conflict mitigation through the *hearts and minds* channel than in-kind aid. However, price effects may also be visible through the *hearts and minds* channel. Given that cash provisions result in short-term food price spikes, the government's popularity may decrease and conflict becomes more likely. On the other hand, in-kind aid can result in short-term price declines due to increased local food supply (Barrett, 2006). This may decrease net food producing households' income and so the government's popularity. The ultimate effect of either modality through the *hearts and minds* channel depends on the local food system, i.e., availability of food and the contribution of food production to the respective economy.

Concerning the *opportunity cost* channel, similar tendencies are likely to occur as for the *hearts and minds* channel. In the short-term, cash can cause food price spikes potentially leaving households with less money for non-food items than without aid.⁸ This decreases the opportunity costs of joining a rebellion and conflict becomes more likely. Short-term price declines caused by in-kind aid (Barrett, 2006) may decrease net food producers' income and reduce the opportunity costs of joining a rebellion. In the long-term, Schwab (2019) observes that in-kind aid entails increments in the production of non-food cash crops in Yemen because in-kind aid functions as a kind of insurance against volatile food prices. Cash programs lead to investments in livestock production and irrigation systems (Schwab, 2019). Thus, both measures enhance household income in the long-term (Schwab, 2019). The opportunity cost of joining a rebellion thus rises in both cases and makes conflict less likely in the long-term.

⁸ This depends on the price elasticity of demand.

Distributional questions, i.e., how to allocate aid (*distributional* channel), arise for both forms of aid. The same applies to the *sabotage* channel, i.e., resentment of local groups against the donating country. For the *volatility* channel, aid in the form of both modalities is prone to vary over time even though issues of food insecurity prevail over time. One may, however, argue that cash could be distributed more steadily over time compared with in-kind food since cash can be stored easily. Cash may consequently be less likely to lead to conflict onset through the *volatility* channel compared with in-kind aid/vouchers.

2.3.2 *Conflict continuation*

During a conflict, aid in both modalities mitigates food insecurity (Aker, 2017; Schwab, 2019; Schwab, 2020). Both alternatives will therefore decrease the likelihood of conflict continuation through the *food security* channel. However, the effect of both forms may be highly contextual (Gentilini, 2016). First, cash transfers may be advantageous since they allow households to engage in arbitrage, i.e., households can freely choose the location and time to buy their goods (Aker, 2017). Arbitrage allows households to buy at lower prices and, thereby, increase their utility compared to in-kind aid/voucher recipients (Aker, 2017; Kurdi, 2021). This is particularly relevant since Adong et al. (2021) find that households increase their reliance on markets to purchase food and reduce their agricultural activities when they are affected by conflict. Hence, functioning local markets is a precondition for the aforementioned mechanisms (Del Ninno et al., 2007; Gentilini, 2016; Kurdi, 2021). Yet, local food supply is often absent in conflict areas (Kemmerling et al., 2023; Schwab, 2020; Tranchant et al., 2019), and recipients' mobility decreases in conflict areas (Tranchant et al., 2019). In addition, conflict affected households shift their agricultural activities from capital intensive (requiring high investments) but profitable practices to lower yield and less profitable practices which reduces the availability of food at the local market level as well as household income (Arias et al., 2019; Rockmore, 2020). In-kind aid will then

increase the local supply of otherwise unavailable food items in conflict areas (Aker, 2017; Schwab, 2020).

While the *hearts and minds* is likely to be unaffected by the modality of aid during a conflict, this may not hold for the *predatory* and the *tax* channels (Aker, 2017; Angrist and Kugler, 2008). Aker (2017) stresses the riskiness of cash compared to in-kind transfers for recipients when cash is easier to steal. This is particularly true for areas highly affected by conflict (Aker, 2017). However, the program participants in her study reported that cash was easier to hide and therefore the safer option compared to in-kind transfers (Aker, 2017). She observed that in-kind recipients preferred storable goods, e.g., salt, which they could resell. Physical goods are more dangerous to transport, and thus more prone to theft compared with cash. An issue that has not been addressed in the literature regarding the advantages of in-kind aid is the convertibility of the physical goods to cash. When rebellious groups charge “taxes” at check points or steal in-kind food, they have to convert the items to cash before they can use it for other purposes, e.g., buying arms and other military equipment. Cash on the other hand can be directly allocated by violent groups (Strandow et al., 2016). Commodity/food prices vary such that the value of the loot varies for in-kind aid, i.e., cash may be more attractive than in-kind aid to violent groups (Angrist and Kugler, 2008).

Overall, the modality of food aid may impact the relationship between food aid and conflict across the different channels. There is considerable need for future research to understand the consequences of either modality in various socio-economic dimensions (Jeong and Trako, 2022). Schwab (2019) stresses that the effect of humanitarian aid on production depends on the context. Tandon and Vishwanath (2021) point out that high-frequency surveys could help to better understand how in-kind food assistance, cash transfers, and other types of humanitarian assistance might impact household well-being during humanitarian crises.

Empirical evidence on food aid and conflict

We now turn to a discussion of the empirical evidence on the impact of food aid on conflict. Starting with the seminal work of Nunn and Qian (2014), a controversy has begun with several studies estimating the impact of food aid on conflict. We review these empirical studies and contrast their assumptions and findings. We start with the discussion of studies which estimate the relationship between food aid and conflict in cross-country panel data sets.⁹ We follow Zürcher (2017) and focus on studies that attempt to account for endogeneity of food aid to make causal inference. We identify issues in the identification strategies of earlier studies incorporating the critique raised by Christian and Barrett (2017) and Christian and Barrett (2021) in these studies. We finally also discuss correlational evidence on the relationship of food aid and conflict, and humanitarian aid and conflict more broadly. We close the Section by depicting how experimental studies in the context of (food) aid and conflict may enrich our understanding of the relationship between the two.

Nunn and Qian's (2014) work presents the first paper that investigates the impact of food aid on conflict. They use data on 125 non-OECD countries from 1971 to 2006 and estimate the impact of U.S. food aid on the existence of a conflict, i.e., conflict is measured as a binary variable. The authors develop an IV identification strategy based on lagged U.S. wheat production and the share of the number of years a country has received food aid from the U.S. to account for the endogeneity of food aid. Their key finding is that food aid increases the likelihood of conflict. Using their sample mean of food aid, an increase in U.S. food aid by ten percent increases the incidence of conflict by 0.7 percentage points.

Nunn and Qian (2014) undertake several robustness checks to support the validity of their results and identify variables that moderate the relationship between food aid and conflict. First, they

⁹ Note that we refrain from using the terms macro and micro studies as is often done in the literature. So-called macro studies are studies that are usually using country-year observations in regression analysis to, e.g., identify determinants of conflict. Micro studies focus on the sub-national, i.e., regional, village- or individual level within one country (Balcells and Stanton, 2021). However, with increasing availability of cross-country data sets on disaggregated levels such a distinction becomes obsolete (Balcells and Stanton, 2021).

divide their sample into intra- and inter-state conflicts. The effect of food aid on conflict vanishes for inter-country conflicts and is robust for intra-country conflicts. Second, they control for lagged conflict, i.e., whether a country experienced a conflict in the previous year. The results are similar to those obtained when not controlling for lagged conflict. Third, Nunn and Qian (2014) divide their sample into conflicts with 1,000 or more deaths per year and less than 1,000 deaths per year to identify a potential moderating effect of conflict intensity on the relationship between food aid and conflict. They do not find a significant effect for large conflicts (neither inter- nor intra-state), while the effect for small conflicts is positive and significant for intra-state conflicts but not for inter-state conflicts. Fourth, the authors analyze the role of food aid for the onset of a conflict. They do not find any significant impact of food aid on the beginning of conflicts in any of their specifications.

Nunn and Qian (2014) also investigate contexts in which food aid may influence conflict, i.e., examine the existence of context-related variables moderating the impact of food aid on conflict. The authors test whether U.S. food aid crowds out other countries' food aid leading U.S. food aid to increase the likelihood of conflict. They do not find evidence for this mechanism. The same applies to a potential crowd out of domestic production in the recipient country. Including an interaction term of recent conflict history, i.e., whether a country has experienced conflict in the past 5, 10, 15, or 20 years, shows that food aid does not impact conflict in recently peaceful countries. In addition, their results indicate that the impact of food aid on conflict i) increases with the income of the recipient country, ii) is independent of the natural resource endowment of the recipient country, iii) is not different for democratic recipient countries compared to other forms of government, iv) does not vary for ethnic fractionalization of the recipient country, and v) is independent of the infrastructure of the recipient country. Last, Nunn and Qian (2014) do not find significant differences in the impact of food aid between political allies of the U.S. and non-allies.

The study has initiated an academic and political debate on food aid. Chu et al. (2017) successfully replicate the results of Nunn and Qian (2014) and perceive them as valid. Sheppard (2021) uses the same data and methodology as Nunn and Qian (2014) but divides the sample into a Cold War and a Post-Cold War era. His analysis reveals a positive impact of food aid on conflict (onset and duration) during the Cold War era. In contrast, there is no significant relationship between food aid and conflict in the Post-Cold war era.

However, severe criticism has been raised against the validity of the identification strategy applied in these papers. Christian and Barrett (2017) show that the instrument for food aid in the aforementioned studies suffers from spurious correlation and the coefficient estimates are biased. Their “Monte Carlo simulations show that this [...] bias can even be consistent with a data generating process in which food aid shipments prevent conflicts [...]” (Christian and Barrett, 2017, p. 3). In fact, the incidence of conflict and U.S. wheat production share common non-linear trends (Christian and Barrett, 2017; Christian and Barrett, 2021). These trends are not properly accounted for by Nunn and Qian (2014), so we cannot decide whether the parameter estimate is causal or caused by the spurious correlation between U.S. wheat production and conflict. Nunn and Qian (2014) attempt to avoid this by introducing a cross-sectional part to the creation of the instrument which allows the introduction of year dummies to account for (non-linear) trends. The inclusion of year dummies indeed captures some of these trends but implies parallel trends in the cross-sectional dimension of the sample, i.e., the trends in conflict and received food aid are the same across recipients. Christian and Barrett (2021) show that the parallel trend assumption is ill-advised in the Nunn and Qian (2014) case. On top of that, it is questionable why the mean of an endogenous variable should be exogenous. The first part of the Nunn and Qian (2014) instrument is wheat production. The second part is the average of a binary variable indicating whether a country has received food aid from the U.S. Since the binary

variable, i.e., whether a country received food aid or not, is endogenous, its mean should also be endogenous (Ambaw, 2018).¹⁰

Ambaw (2018) analyzes the effect of food aid from non-U.S. countries on conflict in sub-Saharan countries. He attempts to overcome the weaknesses of Nunn and Qian’s (2014) instrument using the occurrence of natural disasters in other sub-Saharan countries to instrument food aid. His results suggest that food aid from non-U.S. countries does not affect conflict. However, the problem with his instrument is that it unlikely fulfills the exclusion restriction. Natural disasters in neighboring countries are usually correlated. Since he uses the occurrence of natural disasters in other sub-Saharan countries to instrument for food aid, his instrument will not only affect conflict via food aid, but natural disasters also have a direct impact on conflict (see Section 2).¹¹

Mary and Mishra (2020) estimate the impact of humanitarian food aid on conflict for a sample of 79 food aid recipient countries for the period 2002-2017. They do not analyze the impact of overall food aid on conflict but only food aid provided as means of disaster relief, i.e., humanitarian food aid. In contrast to Nunn and Qian (2014), they motivate their instrument based on the fact that “louder” food crises receive more humanitarian food aid, i.e., food crises that are more present in the media are more likely to attract humanitarian food aid. The instrument entering the first stage of regression is constructed as:

$$S_{it} = \frac{1}{N-1} \frac{FAID_t - FAID_{it}}{TOTAID_t - TOTAID_{it}} \quad (5)$$

where S_{it} is the instrument for country i in year t . N denotes the number of countries receiving food aid in year t , $FAID$ denotes the amount of humanitarian food aid, and $TOTAID$ denotes the amount of total aid (Mary and Mishra, 2020). They assume that donor countries will shift away food aid from

¹⁰ We simplify the issue of this type of instrument. For an in-depth discussion of the so-called Bartik type of instrument, we refer the reader to Goldsmith-Pinkham et al. (2020) and Christian and Barrett .

¹¹ See Kelly (2019) for a discussion of spatial correlation in panel data models and tests to detect spatial correlation.

the country under consideration (country i) to countries with “louder” conflicts (Mary and Mishra, 2020). Therefore, they expect the coefficient of the first-stage regression for the instrument S_{it} to be negative. The authors find that humanitarian food aid has a negative and significant impact on conflict. For an increase in humanitarian food aid of ten percent, the incidence of conflict decreases by 0.018 percentage points (Mary and Mishra, 2020).

Mary and Mishra (2020) conduct several robustness checks to test the validity of their results and different contexts in which the impact of humanitarian food aid on conflict may differ from each other. First, they use lagged (Abdulai et al., 2005) humanitarian food aid instead of current humanitarian food aid. They find that humanitarian food aid has a short-lived impact on conflict since the coefficient of lagged humanitarian food aid is not significantly different from zero. Second, they estimate the effect of humanitarian food aid on large and small conflicts separately, where the effect remains negative and significant for both types of conflict. Third, they use the logged number of battle deaths as the dependent variable, showing a negative and significant coefficient estimate for humanitarian food aid. However, the authors do not find evidence for the effect of humanitarian food aid on civilian fatalities. Fourth, humanitarian food aid does not impact the onset or offset of conflicts as the p-values of the respective coefficients exceed every standard level of significance (Mary and Mishra, 2020).

For the contextual factors affecting the impact of humanitarian food aid on conflict, Mary and Mishra (2020) divide their sample into subsamples, once including only observations above the mean and once including only observations below the mean for the variables ethnic tension, inflation rate and precipitation. The results indicate that humanitarian food aid has a significant and negative impact on conflict in the subsample of above-average ethnic tensions, below-average inflation and below-average precipitation. For environments of below-average ethnic tensions, above-average inflation and above-average precipitation, the impact of humanitarian food aid on conflict is not significantly

different from zero. Last, the authors test for differences in the effect of humanitarian food aid on conflict across continents. The estimate for the coefficient of humanitarian food aid for the subsample of African countries amounts to -0.03 ($p < 0.05$) and for the subsample of Asian countries to -0.084 ($p < 0.05$).¹²

Mary and Mishra (2020) emphasize the validity of their instrument for humanitarian food aid. They follow Brückner (2013) to show that their instrument, i.e., the displacement variable S_{it} , is only correlated with conflict via humanitarian food aid. First, the authors regress conflict on S_{it} (not on food aid (\widehat{F})) and the other explanatory variables of the second stage regression. The model yields a positive and significant coefficient for S_{it} showing that the instrument has an effect on conflict.¹³ Second, they include S_{it} and six-year lagged humanitarian food aid, i.e., the sixth lag of the endogenous variable, in the second stage regression instead of \widehat{F} . The sixth lag of humanitarian food aid is supposed to instrument humanitarian food aid (\widehat{F}) in t . The coefficient of S_{it} is not significantly different from zero which leads the authors to conclude that the instrument S_{it} does not have an impact on conflict other than through humanitarian food aid. According to Mary and Mishra (2020, p. 8), “this intuitive check, therefore, provides reassuring evidence for the exclusion restriction”. We discuss the validity of this test below.

The authors stress the importance of including non-linear country-specific time trends. They use a cubic term specific to each recipient country and identify that the use of lower-order terms leads the impact of humanitarian food aid to vanish. This issue is also part of the criticism of Nunn and

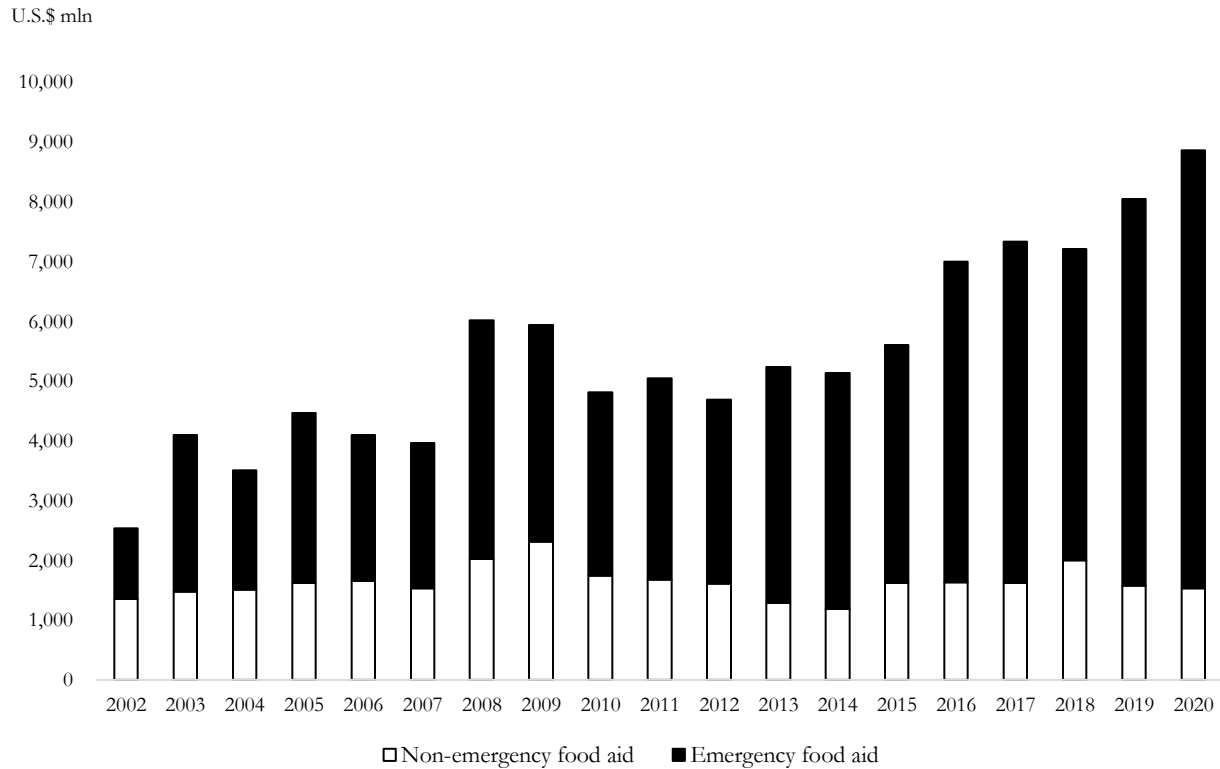
¹² The authors state that they do not perform the regressions for other continents since they do not have enough countries per region or the instruments are weak (Mary and Mishra 2020).

¹³ Note that this is consistent with the way the instrument is constructed. The instrument represents the share of food aid received by all other countries than i in total aid received by all other countries than i . Therefore, a positive coefficient is to be expected, i.e., increasing shares of food aid in other countries than i increase conflict incidence in country i .

Qian's (2014) difference-in-difference estimator assuming parallel trends across recipient countries (Christian and Barrett, 2017).

The results of Mary and Mishra (2020) and Nunn and Qian (2014) are in accordance with a few aspects and contradict each other in many aspects. Both studies yield that food aid does not significantly impact the onset of a conflict. For the remaining part, Nunn and Qian (2014) find that food aid tends to increase the likelihood of conflict, whereas Mary and Mishra (2020) find that food aid tends to decrease the likelihood of conflict.

The first question is why the studies deliver results that could hardly be more different from each other. Mary and Mishra (2020) offer some reasons for this. First, Mary and Mishra (2020) account for non-linear country-specific time trends in contrast to Nunn and Qian (2014). Second, Mary and Mishra (2020) argue that Nunn and Qian's (2014) study period is much longer, the sample countries are different and the food aid data stem from different sources. Third, most of the food aid during Nunn and Qian's (2014) study period consisted of in-kind food, and the period in Mary and Mishra (2020) "has seen dramatic changes in the modality structure of humanitarian food aid (towards cash and vouchers)" (Mary and Mishra, 2020, p. 7).



Source: Own illustration based on OECD (2022)

Figure 1. Worldwide emergency and non-emergency food aid (2002-2017)

Except for the first, however, we provide more plausible reasons that explain the differing results between the two studies. First, the variables and instruments used in the two studies are very different. Second, Nunn and Qian (2014) only look at U.S. food aid, and Mary and Mishra (2020) look at food aid from all countries. The overall impact of food aid on conflict likelihood may indeed be negative and the effect of U.S. food aid on the likelihood of conflict may be positive. Since the U.S. is a polarizing country in international politics, some rebellious groups who despise the U.S. and their values may feel provoked by U.S. food aid, which does not apply to food aid from other countries. Third, Nunn and Qian (2014) use overall food aid while Mary and Mishra (2020) only use humanitarian, i.e., emergency, food aid. Figure 1 illustrates the amount of non-emergency and emergency food aid provided by all countries worldwide from 2002 to 2020. We see that non-

emergency aid tends to vary little in most years such that the majority of variability in overall food aid (used by Nunn and Qian (2014)) is caused by variation in emergency food aid (used by Mary and Mishra (2020)). We do, however, observe considerable variation in non-emergency food aid in some periods, such as 2007-2010 or 2012-2015 (cf. Figure 1). This will also entail variation in overall food aid which is not necessarily correlated with variation in emergency food aid. For the study period of Mary and Mishra (2020), the correlation coefficient between emergency (humanitarian) and non-emergency food aid amounts to 0.19 (2002-2017). Given that overall food aid (used by Nunn and Qian (2014)) and emergency food aid (used by Mary and Mishra (2020)) are not perfectly correlated, the definition of food aid may contribute to the discrepancy between the results of Mary and Mishra (2020) and Nunn and Qian (2014).

The second question is whether the results of Mary and Mishra (2020) can be trusted more than those of Nunn and Qian (2014). The unsatisfactory answer is probably no. Despite their elaborate testing of their instrument's validity, the identification strategy of Mary and Mishra (2020) bears its own issues. Their instrument builds on the intuition that "louder" food crises elsewhere cause shifts in the distribution of emergency food aid. Put differently, more severe food crises receive more emergency food aid. That is, food crises, which are often caused by conflicts (Food Security Information Network, 2022; World Bank, 2022), determine the share of emergency food aid in total aid of all other countries as well as for country i . This raises endogeneity issues due to reverse causality and omitted variable bias since the causes of the food crises are ignored and often involve conflict. These causes affect the share variable S_{it} as well as conflicts. In addition, it is impossible to test whether the exclusion restriction holds (van Kippersluis and Rietveld, 2018; Kiviet, 2020; Mellon, 2022; Yang et al., 2014). Their test that aims to test the exclusion restriction uses a lag of the original independent variable, which they state themselves as being inappropriate earlier in the manuscript (Mary and Mishra, 2020, p. 3). Bellemare et al. (2017) and Reed (2015) show that using lagged

endogenous variables will only alleviate the issue of endogeneity, if specific assumptions are met. For instance, the independent variable may not be serially correlated which is unlikely fulfilled for food aid flows (Nunn and Qian, 2014). Besides, their reported first-stage F-statistics are much smaller than current guidelines suggest (Lal et al., 2021), which questions the strength of the instrument.

Mary and Mishra (2020) also include several control variables such as the conflict in neighboring countries, non-emergency food aid, other aid than food aid, ethnic tensions, gross domestic product per capita, and the inflation rate. These variables represent so-called “bad controls” as they are themselves endogenous due to reverse causality or simultaneity (Angrist and Pischke, 2008). Mary and Mishra (2020) test the influence of their “bad controls” by estimating a parsimonious model only using emergency food aid as the explanatory variable. The coefficient remains negative, but its p-value exceeds all standard levels of significance ($p > 0.1$). The results of the article should therefore be interpreted with caution.

Besides the studies discussed in-depth above, there is other evidence on the relationship between food aid and conflict which do, however, not provide promising attempts to alleviate issues of endogeneity. For instance, Braithwaite and Licht (2020) use lagged food aid instead of current food aid to avoid simultaneity. Their results yield no significant correlation between food aid and conflict. However, as Bellemare et al. (2017) show, the use of lagged explanatory variables only alleviates endogeneity, if the explanatory variables were serially uncorrelated. This assumption is i) unlikely to hold in the context of aid flows, and ii) also not tested by Braithwaite and Licht (2020). Narang and Stanton (2017) regress the average number of attacks on aid workers in Afghanistan on food aid in an ordinary least squares regression. They find a negative link between food aid and the number of attacks on aid workers, i.e., a lower number of attacks on aid workers with increasing food aid.

Other studies examine the impact of humanitarian aid on conflict more broadly instead of food aid. Collier and Hoeffler (2002) apply the same strategy as Braithwaite and Licht (2020), i.e., use

lagged aid. They also do not find a significant relationship between aid and conflict. Wood and Sullivan (2015) estimate a model using lagged humanitarian aid as an explanatory variable for the number of attacks of rebellions. They find a robust positive and significant link between humanitarian aid and the number of rebellion attacks. Wood and Sullivan (2015) also attempt to eliminate endogeneity of humanitarian aid and conflict using a matching approach. Their results still yield a positive impact of aid on conflict. However, their matching is based on endogenous variables, e.g., the number of battles fought in a particular region. Wood and Molino (2016) also find that lagged humanitarian aid promotes conflict, again suffering from the aforementioned issues of serial correlation.

Examining the impact of overall foreign aid (including humanitarian and development aid), Ree and Nillesen (2009) find that foreign aid decreases conflict duration where they instrument aid with the gross domestic product of the donor countries. Narang (2015) investigates the impact of humanitarian aid on the likelihood of conflicts to end. He finds that humanitarian aid prolongs conflict. He acknowledges the joint determination of aid and conflict, and includes a set of control variables that influence aid and conflict. Yet, he does not account for reverse causality of aid and conflict.

The results above show that neither for food aid nor for humanitarian aid a consensus on the effect of conflict has been reached in the literature. More importantly, none of the above studies incorporates an empirical strategy that allows causal inference since the endogenous relationship of aid and conflict is either ignored or not properly addressed. A notable exception is Lyall (2019), who presents an interesting case study on the conflict in Afghanistan. He investigates the impact of humanitarian aid provided by the United States to civilians affected by the conflict in Afghanistan until two years after aid disbursement on violence against the International Security Assistance Force, Afghan state forces, and civilians. He finds that violence against the International Security Assistance Force decreases in aided communities with less than 50,000 inhabitants, and increases to a lower extent

in aided communities with more than 50,000 inhabitants compared to unaided communities two years after aid distribution. Violence of the Taliban against Afghan state forces and civilians does not differ in aided versus unaided villages (Lyll, 2019). A drawback of the study is, however, the lack of generalizable results to other contexts. Even though quasi-/experimental studies allow causal identification, the general problem is that the results often depend on contextual factors and can thus not be transferred to other contexts (Blattman and Miguel, 2010).

Methodological challenges and empirical strategies

In this Section, we will first discuss possible strategies to identify the causal impact of food aid on conflict using observational data. We after that also depict how experimental studies can enrich our understanding of the relationship between food aid and conflict. We finally stress the need for data collection advancements and future research directions. In the general case, researchers quantify the effect of food aid on conflict using regression analysis. Some measure of conflict (C) denotes the dependent variable, which is regressed on some measure of food aid (F) and a range of control variables (X):

$$C = \alpha + \beta F + \mathbf{X}'\boldsymbol{\gamma} + \boldsymbol{\varepsilon} \quad . \quad (1)$$

α , β and $\boldsymbol{\gamma}$ are parameters to estimate, and $\boldsymbol{\varepsilon}$ is an error term. Empirical applications mostly use a binary variable for C where C equals one, if a country¹⁴ experienced a conflict in a specific period and zero otherwise (Mary and Mishra, 2020; Nunn and Qian, 2014; Wood and Sullivan, 2015). Most studies approximate F as the weight of food aid shipped to recipient countries or in monetary terms of cash-based assistance (Mary and Mishra, 2020; Nunn and Qian, 2014).

4.1 Measurement of conflict, food aid and the inclusion of control variables

¹⁴ Note that we do not restrict the cross-sectional unit of observation in equation (1) to countries but they may also consist of regions/villages/individuals.

A problem consists of the measurement of \mathcal{C} . Defining \mathcal{C} as a binary variable to capture conflict misses important information (Mary and Mishra, 2020; Nunn and Qian, 2014). The interest of policymakers in conflicts does not only lie in the existence of a conflict but also its intensity. However, measuring conflict as a binary variable ignores the intensity of a conflict.

While food aid may not necessarily influence the mere presence of a conflict, it could reduce its intensity. This holds particularly for conflicts that have multiple causes. The ongoing conflict in Afghanistan represents an example of this. The country has experienced within-country conflicts since 1978, where different parties have overturned the ruling government or have tried to do so (Goodhand, 2002). These conflicts are politically and religiously motivated (Goodhand, 2002). The conflicts worsen if the country also experiences periods of high food insecurity, e.g., due to droughts. Even though food aid will not end the conflict, it may dampen its intensity.

Despite some studies already investigating the impact of food aid on conflict intensity, the empirical approaches are not well suited to this point, and conflict intensity does not present the main focus of the papers. For instance, Mary and Mishra (2020) use a two-stage least squares (2SLS) regression where the natural log of battle deaths plus 0.1 is used as the dependent variable. However, the dependent variable is clearly censored. The condition upon which we observe conflict intensity consists of the existence of a conflict. Ignoring the hurdle, i.e., the existence of a conflict, entails biased estimates in such instances (Cragg, 1971). We, therefore, propose an econometric framework that allows unbiased and consistent estimation of the impact of food aid on conflict existence and subsequent intensity in Section 4.3.

Food aid is also prone to measurement error. Datasets often include monetary values of food aid valued at the donor country's prices. For example, one U.S. Dollar of aid has different impacts depending on the price level of the recipient country. Qian (2015) points out that commodity prices differ substantially between recipient countries. This is even reinforced when the analysis includes

several donor countries for which price levels diverge. Therefore, we encourage using quantities, converting monetary values of aid into quantities, or accounting for different price levels. Price information is necessary for this purpose, and national price indices may be ill-advised as they do not capture the dispersion of prices or price spikes in conflict areas. However, aid organizations may provide valuable information on prices as they are usually present in conflict areas. In addition, projects like AidData constitute promising tools for obtaining subnational data sets on different kinds of aid for analysis (Findley, 2018).

The complexity of conflicts necessitates incorporating a significant set of control variables (\mathbf{X}) in the estimation (Christian and Barrett, 2017). Some control variables (confounders) have an effect on food aid and conflict. Their omission leads to an omitted variable bias that causes endogeneity and makes the coefficient estimates biased. Important control variables related to food aid and conflict are characteristics of the recipient country regarding (1) *conflict history*. These include the political stability of the country and whether a conflict has been ongoing in the previous year (Mary and Mishra, 2020; Nunn and Qian, 2014). *Natural resources* (2), such as the availability of arable land and weather conditions in the recipient country, will also affect foreign food aid and conflict and should be included in \mathbf{X} (Becerra et al., 2014; Cardwell and Ghazalian, 2020; Mary and Mishra, 2020, Qian, 2015). The same applies to the availability of metals, rare earth and minerals in the recipient country. They may lead to conflict if they are limited or certain groups get rich on the benefits from natural resources while the rest of the population suffers (Berman et al., 2017). In addition, it is attractive for rebellious groups to get natural resources under their control using violence (Berman et al., 2017; Dube and Vargas, 2013; Koren, 2018). At the same time, potential donors may be more interested in providing food aid to countries delivering critical raw materials for their industries (e.g., ore or rare earth) than countries that do not possess natural resources (Dreher et al., 2021; Hoeffler and Sterck, 2022;

Raschky and Schwindt, 2012). Hence, natural resources likely influence conflict and food aid. It is thus necessary to include natural resources as a control variable.

Societal characteristics (3) of the potential recipient country have been found to influence food aid and aid more generally (Olsen et al., 2003), which may also affect conflict. These include religion (Blackman, 2018), the form of government (Blackman, 2018), population size (Annen and Strickland, 2017; Doucouliagos and Paldam, 2007; Dreher et al., 2021; Hoeffler and Sterck, 2022), and colonial history (Becerra et al., 2014; Hoeffler and Sterck, 2022; Qian, 2015).¹⁵ They must hence be included as control variables in the estimation.

The *cause of conflict* (4) likely influences the provision of food aid and the relationship between food aid and conflict. The determinants of conflict include income (as well as its distribution and growth) (Berman and Couttenier, 2015; Collier and Hoeffler, 1998b; Collier et al., 2009), the share of young male people (Collier et al., 2009; Humphreys and Weinstein, 2008), the geography of the recipient country (Buhaug and Rød, 2006; Collier et al., 2009), infrastructure (Buhaug and Rød, 2006), ethnic diversity (Arbatli et al., 2020; Buhaug and Rød, 2006) or weak institutions (Fearon, 2005; Walter, 2015).

As the cause of conflict may also affect food aid, it is to be included as a control variable. Since the cause of the conflict may also moderate the relationship between food aid and conflict, one should also consider to include interaction terms. For instance, suppose there are religiously motivated conflicts in which the relationship between food aid and conflict is zero. For conflicts caused by droughts which lead to food insecurity, food aid may in turn decrease conflict. Using an interaction term between dummy variables that account for the type of conflict cause and food aid, or

¹⁵ Becerra et al. (2014) do not find evidence that political factors have an impact on the amount of aid provided. However, they only study cases of post-natural disasters.

alternatively, running subsample regressions by conflict cause allows to control for the cause of the conflict.

4.2 *Joint determination and reverse causality*

Equation (1) could theoretically be estimated with ordinary least squares (OLS) or limited dependent variable (LDV) models such as a probit or logit model. However, two significant issues make the OLS and LDV estimates biased. First, a political crisis or natural disaster may simultaneously cause conflict and food aid (Cardwell and Ghazalian, 2020; Nunn and Qian, 2014). Second, conflict may also increase food aid when third countries increase food aid shipments as a reaction to the emerging conflict (Kang and Meernik, 2004; Nunn and Qian, 2014). The opposite, i.e., that countries reduce food aid as a response to conflict may also be true. The causality between food aid and conflict will hence be reversed. These two issues imply that F is endogenous, so OLS and LDV will not reliably identify the effect of food aid on conflict.

More sophisticated models, such as instrumental variable estimation, that alleviate the problems of endogeneity need to be applied. For this purpose, variables that are related to food aid but not related to conflict through other channels are needed to estimate a first-stage regression, including food aid as the dependent variable:

$$F = \alpha^* + \mathbf{Z}'\boldsymbol{\delta} + \mathbf{X}'\boldsymbol{\gamma}^* + \boldsymbol{\eta} \quad . \quad (2)$$

α^* , $\boldsymbol{\delta}$ and $\boldsymbol{\gamma}^*$ denote the parameters to estimate. \mathbf{X} is the vector of exogenous variables from (1). \mathbf{Z} is a vector of instruments that are correlated with F but uncorrelated with C . $\boldsymbol{\eta}$ denotes an error term. The predicted values (\hat{F}) of F are used in (1) instead of the original variable to measure food aid in a second-stage regression. The second stage can be estimated with OLS or LDV which do not show significant differences in empirical applications (Papke and Wooldridge, 2008). We favor estimating both and checking the sensitivity of the results. The parameter estimate of \hat{F} will be unbiased as long

as each element of \mathbf{Z} is only correlated with conflict through food aid (exclusion restriction). The most challenging task is the identification of suitable instruments that have enough explanatory power to predict food aid while the exclusion restriction still holds (Qian, 2015; Zürcher, 2017).

The first category of instruments refers to (1) *natural conditions in the donating country*. Weather represents an instrument widely used in different research areas (Miguel et al., 2004).¹⁶ The instrument rests on the assumption that countries with comparatively favorable weather conditions in terms of crop production in a given year will donate more food aid. Nunn and Qian (2014) point out correctly that weather conditions in the donating and recipient countries may be correlated. Since weather also impacts conflict (Miguel et al., 2004), the instrument would be endogenous again. For instance, the correlation of weather between Nigeria and Somalia will be comparatively high. However, the correlation decreases with decreasing geographical proximity of the aid donor and the recipient, e.g., the weather in the U.S. and sub-Saharan Africa is poorly correlated (Bacchi and Kottegoda, 1995; Israelsson et al., 2020; Malcher and Schönwiese, 1987).¹⁷ In most cases, the distance between the donor and recipient countries is sufficiently large that the spatial correlation of weather does not pose a problem. Suitable instruments are average temperature and precipitation in the donating country (Nunn and Qian, 2014). In addition, the donor country's area of arable land per capita can serve as an instrument. The probability that a country donates food aid might be higher if more arable land per capita was available. When using variables capturing the food production capacity in the donating country as instruments, one should consider the shift away from in-kind aid towards cash transfers in

¹⁶ Note that weather may also influence other variables in a model. If these other variables are treated as being exogenous, the model will suffer from endogeneity. Mellon (2022) shows that many studies ignore this effect.

¹⁷ Note that there are also phenomena with global impact, that simultaneously influence weather at far distant locations. For instance, El Nino has an impact on the weather in South America but also North America, Asia and Europe (Brönnimann, 2007; Cai et al., 2020; Zhai et al., 2016). The same applies to climate change (Jolly et al., 2015; Schlenker and Roberts, 2009; Thirumalai et al., 2017; Wheeler and Braun, 2013; Young et al., 2011). It is thus necessary to correct for such phenomena and trends before using weather as an instrument.

international food aid (Alderman et al., 2018; World Bank Group, 2018). This shift will negatively influence the strength of the instruments, i.e., the power of the variables in predicting food aid.

A second category (2) of potential instruments broadly refers to *awareness of the population* in donating countries. This includes the distance of the donor to the recipient country, which will, in every case, be exogenous (Cardwell and Ghazalian, 2020; Fink and Redaelli, 2011; Fuchs and Vadlamannati, 2013). Mary and Mishra (2020) also propose using media coverage as an instrument. They believe that “louder” conflicts are more likely to raise awareness. Politicians will therefore provide more aid to such countries. This effect has also been found for aid in general (Joly, 2014; Olsen et al., 2003) and in the context of natural disasters (Drury et al., 2005; Kuhlitz et al., 2010; Kuhlitz and Abdulai, 2012; Strömberg, 2007). However, the instrument will likely be influenced by conflict and thus be endogenous. A more suitable measure may be the news coverage before the conflict emerges. One could, for instance, use the Nexis Uni Database (LexisNexis, 2023) and generate the number of articles covering the respective recipient country, i.e., the country where a conflict emerges within a given period before the conflict. That period should end before the conflict starts to avoid reverse causality and/or simultaneity. Another variable increasing the awareness of grievances in potential recipient countries is the ethnic diversity in the potentially donating country. In more diverse populations, some of the subgroups will likely point towards these grievances such that the likelihood of providing food aid will increase in that donor country.

The third category (3) of potential instruments represents *political and societal circumstances* in the donor country and their (4) *similarity to the political circumstances* in the recipient country (Dreher and Fuchs, 2016; Fink and Redaelli, 2011; Kuhlitz and Abdulai, 2012; Neumayer, 2005; Nunn and Qian, 2016; Wright and Winters, 2010). The form of government and ideology represent candidate variables influencing the likelihood of providing food aid to third countries (Chong and Gradstein, 2010; Round and Odedokun, 2004; Skitka and Tetlock, 1992). Democratic systems could tend to support other

countries more than dictatorships. The similarity between the forms of governments, as well as societal congruency between the donor and recipient country, also influences the provision of aid to a country (Aidt et al., 2021; Bayram and Holmes, 2020; Demirel-Pegg and Moskowitz, 2009; Doherty et al., 2020; Kuziemko and Werker, 2006; Taormina and Messick, 1983). The political party in power in the donor country also matters for the amount of foreign aid, and thus also food aid (Bluhm et al., 2021; Thérien and Noel, 2000). However, the political party's influence in power evolves over a more extended time horizon and is not necessarily visible immediately (Thérien and Noel, 2000). A rather unsettling but likely influential instrument is the time to the next election in the donating country. Annen and Strickland (2017) find that donors increase their humanitarian aid by 19 percent in pre-election years.

Note that the inclusion of other controls and/or variables than the ones we suggest have been proposed in the literature. For instance, Mary and Mishra (2020) control for aid other than food aid. However, additional assistance is, like food aid, endogenous and causes the “bad control” problem (Angrist and Pischke, 2008). The same holds for the assistance of other countries. If a researcher wished to include other forms of aid as a control variable, they would have to instrument this other aid as they have to instrument food aid.

Note that some of the instruments from above lack variation depending on the sample at hand. For instance, the form of government of the donor countries will only vary in the cross-sectional dimension of donor countries as countries rarely (if ever) change their form of government. The political party in power of the donor country will only vary if the sample contains a sufficient number of years. Therefore, the choice of instruments in empirical analyses may be restricted to a subset of those we suggest.

Last, we would like to point to the importance of testing the strength of the instruments used in empirical applications. This has become standard practice in contemporary research. Testing

overidentifying restrictions is only possible if the number of instruments exceeds the number of endogenous variables. Even though there is no test of global exogeneity, i.e., all instruments (van Kippersluis and Rietveld, 2018; Kiviet, 2020; Mellon, 2022; Yang et al., 2014), we can test the exogeneity of a subset of the instruments. However, we have to assume that at least some of the instruments are exogenous which must be guided by theory (Mellon, 2022). We strongly advocate researchers collect data on as many instruments as possible to allow tests of instrument strength and overidentification.¹⁸ In addition, Christian and Barrett (2017) and Christian and Barrett (2021) show that the relationship between the instrument used in Nunn and Qian (2014) and food aid suffers from spurious correlation, which questions the validity of their results. Christian and Barrett (2017) and Christian and Barrett (2021) demonstrate a straightforward way to implement a test for such spurious correlations between the instrument(s) and the endogenous variable(s).

4.3 *Food aid, conflict onset, and conflict intensity*

The mechanisms by which food aid affects conflict differ for the onset and continuation of a conflict (Mary and Mishra, 2020; Nunn and Qian, 2014). Combined estimation of onset and continuation distorts the estimation impacting the size of the estimated coefficient on food aid as well as its standard error. Studies on the impact of food aid on conflict should therefore opt to assess these impacts separately. The model for conflict onset can be estimated using equation (1) but with a binary dependent variable $CO = 1$ for periods where a conflict starts and zero otherwise.

As we point out in Section 3, the impact of food aid on the intensity of a conflict may be very different compared to its mere onset and continuation, i.e., food aid may dampen conflict in terms of death numbers. The number of deaths within a given year serves as a good measure of the intensity of a conflict (Lacina and Gleditsch, 2005). An issue will be the large number of zero values for the

¹⁸ We refer the reader to Lal et al. (2021) for current guidelines in the use of IV regressions and testing.

dependent variable (number of deaths) when the sample contains all food aid deliveries to recipient countries.

We propose to apply a hurdle model to allow for different impacts of food aid on the existence of a conflict, i.e., the binary variable and the intensity of a conflict (Cragg, 1971). In general, hurdle models should be used, if values larger than zero for the dependent variable can only be observed conditional on a hurdle (Cragg, 1971; Jafari et al., 2023). In our case, values larger than zero for conflict intensity, i.e., the dependent variable, can only be observed if there was a conflict, i.e., the hurdle has been overcome. We introduce a binary variable s , which represents the conflict existence as the hurdle:

$$s = \begin{cases} 1 & \text{if } \alpha + \beta F + \mathbf{X}'\boldsymbol{\gamma} + \varepsilon > 0 \\ 0 & \text{otherwise} \end{cases}, \quad (3)$$

where ε is an error term that is identically and independently distributed. We further define a continuous latent variable $C = sC^*$ where C^* is only observed if $s = 1$, and C are our observations for conflict intensity. We regress the latent variable C^* on our explanatory variables for conflict intensity:

$$C^* = \alpha^* + \beta^*F + \mathbf{X}'\boldsymbol{\gamma}^* + \boldsymbol{\eta}. \quad (4)$$

We can also control for the endogeneity of food aid in the hurdle model. As for the case where we measure conflict as a binary variable, we can run an IV regression to obtain an instrument for F using the instruments we suggest in Section 3.2.

The type of model used to incorporate a hurdle model ultimately depends on the definition of the dependent variable, i.e., how we define conflict intensity. Poisson or negative binomial would be the correct choice if we defined conflict intensity as, e.g., the number of fatalities or the number of combats. We can then use the hurdle model proposed by Mullahy (1986) for the Poisson case and the model proposed by Welsh et al. (1996) for the negative binomial case (Farbmacher, 2013; Gerdtham, 1997; Greene, 2009). Winkelmann (2008) discusses possible strategies to tackle the endogeneity of the

regressors (e.g., food aid) in the participation equation (e.g., the existence of conflict) and the “count” equation (e.g., number of fatalities). In cases where conflict intensity is defined as a continuous variable, e.g., the financial damage due to a conflict (buildings, infrastructure, etc.), we may follow the approaches of García (2013), Jafari et al. (2023) or Ricker-Gilbert et al. (2011), and use a probit model for the participation equation and least squares regression the second stage to explain intensity while accounting for endogeneity of food aid.¹⁹

We make two notes of caution at this point. First, the hurdle model does not account for (sample) selection bias. Selection bias is ultimately an empirical question and depends on the data available to the researcher (see Section 17 of Wooldridge (2001) for a discussion). Second, the default standard errors of the hurdle model (Cragg, 1971) must be adjusted when estimating a first stage IV regression to account for the endogeneity of regressors in the hurdle model (Ricker-Gilbert et al., 2011). For instance, Ricker-Gilbert et al. (2011) obtained their standard errors from a bootstrapping procedure.

Last, something inherent to conflict settings is whether measurement can be conducted accurately. This applies particularly to fatalities in conflict areas. Given that the measurement error is correlated with other variables, i.e., not random, it entails bias in the coefficient estimates. There are, however, several possible ways to alleviate this issue. First, one may estimate the models with data from different sources on fatalities to test the sensitivity of the results with respect to the data sources (Dafoe and Lyall, 2015). Second, one may use the average number of fatalities across different sources to rule out measurement error. This could be well suited if there were data from various conflict parties. For instance, one party may heavily overstate fatalities, while the other party might heavily understate fatalities (Jaeger and Paserman, 2008).

¹⁹ It will also be possible to estimate an ordered probit model, if no exact numbers of combat deaths are available but the intensity of a conflict can only be evaluated roughly (see Bluhm et al. 2021).

Third, depending on the extent of measurement error, it may help to define conflict intensity as a categorical variable. This would imply a loss of information contained in the continuous variable, and the appropriate model would shift from a count data/ordinary least squares regression to an ordered probit/logit model. However, it could be a better fit depending on the expected direction and strength of measurement error. Fourth, it is possible to use different measures of conflict intensity, some of which may be measured more precisely. For instance, one could measure the share of damaged houses in conflict zones via satellite images, and use this as the dependent variable in a conflict intensity model. Projects like AidData (aiddata.org) can help to alleviate measurement error by combining and offering data, e.g., on international aid and conflict, including conflict intensity. Fifth, one may investigate the robustness of the results by testing different model specifications or using Bayesian Model Averaging (Blattman, 2009; Dafoe and Lyall, 2015; Montgomery and Nyhan, 2010).

Dafoe and Lyall (2015) argue that data on conflict collected by the military are more accurate than, e.g., news reports. Generally speaking, datasets like the Armed Conflict Location and Events Datasets (Raleigh et al., 2010) or the Uppsala Conflict Data Program (UCDP; Sundberg and Melander, 2013) appear to be quite accurate (Weidmann, 2015). Weidmann (2015) investigates the accuracy of the UCDP comparing the reported number of fatalities with those of military reports. He finds that UCDP numbers are almost identical to those from military reports in more than half of the cases. For deviations between the two sources, there is a slight tendency to overestimate fatalities in the UCDP data. However, the deviations are generally considered to be negligible (Weidmann, 2015).

4.4 *(Quasi-)experiments, external validity, and the need for disaggregated data*

So far, we have covered studies that focus on rather aggregate levels of data. However, the above analyses are not restricted to country-level studies but can also be conducted using disaggregated data. These data may be on the regional/village/individual level. More disaggregated data allow us

specifically uncover the effects of the different channels through which food aid influences conflict.²⁰ In addition, more disaggregated data help to mitigate aggregation bias. Many conflict-affected countries are large and characterized by considerable heterogeneity of conflict between different areas as well as the distribution of food aid. Data on a disaggregated level will allow us to better understand the mechanisms through which food aid influences conflict (for examples, see Guadrado and Pennings (2020), McGuirk and Nunn (2021) or Ubilava et al. (2022)).

In addition to analyses using disaggregated units of observation, randomized control trials present a promising method to identify causal impacts of food aid on conflict. They do, however, involve a major drawback. Randomized control trials are unlikely to deliver generalizable and transportable results since contextual factors moderate the relationship between food aid and conflict (Findley, 2018; Findley et al., 2021; Quisumbing et al., 2020; Shemyakina, 2022). Consider, for instance, a situation where religiously motivated riots occur in a country. A randomized control trial where some communities/villages receive food aid while others do not could deliver a zero effect of food aid on conflict. In a setting where the violence is induced by a natural disaster causing food insecurity, food aid may decrease conflict. Randomized control trials can therefore not be the go-to solution. Even if one conducted a randomized control trial, one cannot ensure the identification of the channel through which food aid influences conflict (Croston et al., 2016).

To summarize, analyses including several countries/regions often lack internal validity since their identification strategy does not allow causal inference. On the other hand, randomized control trials often lack external validity since their results are not generalizable. There are basically two solutions to achieve validity. First, one could repeat/conduct randomized control trials in numerous different settings and undertake a (meta) regression analysis that takes into account the contextual

²⁰ See for instance Dietrich et al. (2018) or Lyall et al. (2020) for examples on how to test for the hearts and minds channel.

factors moderating the relationship between food aid and conflict (Dehejia, 2015; Gisselquist, 2020; Todd and Wolpin, 2023). This could deliver externally valid results. In addition, one could augment structural equation modelling with randomized control trial which may also produce results with external validity (Todd and Wolpin, 2023).²¹

Second, conduct regressions with data on sub-national, regional, village-level or even individual observations that allow identifying the specific channels through which food aid influences conflict (see Section 2). Such regression analyses spanning multiple countries and years will provide internal and external validity given that they are based on a comprehensive econometric framework allowing causal inference. Guadrado and Pennings (2020), McGuirk and Nunn (2021) or Ubilava et al. (2022) present good examples of such analyses in conflict settings. However, this requires the availability of the necessary data sets that are seldom present. We, therefore, encourage governments and aid organizations to collect the corresponding data to allow thorough impact analyses of humanitarian operations.

Conclusion and future research

In this article, we provide a conceptual framework for the impact of food aid on conflict. We differentiate between the channels through which food aid affects conflict for food aid in times of peace, food aid in inter-country and intra-country conflicts. We illustrate the methodological challenges in estimating the impact of food aid on conflict due to reverse causality and simultaneity. We offer a large variety of possible instruments to alleviate the issue of endogeneity and allow causal inference, and stress the importance of including control variables influencing conflict as well as food aid. We also suggest a hurdle model to estimate the impact of food aid on conflict intensity. We review the empirical studies on the effects of food aid on conflict and conclude that none of those studies

²¹We refer the reader to Todd and Wolpin (2023) for an example on how to implement randomized control trials in structural models.

proposes a compelling identification strategy. The second problem is that the two contradicting studies of Nunn and Qian (2014) and Mary and Mishra (2020) use different food aid definitions, account differently for country-specific time trends, and use a different set of food donating countries. Therefore, the link between food aid and conflict remains unclear and requires further analysis.

Based on these results, we derive the following directions for future research: First, there is a need for studies that have a rigorous identification strategy. A helpful starting point might be a shift from instruments that are related to the recipient country toward determinants related to donor countries since these are more likely to be exogenous. Tests for the strength of the instruments and overidentification, as well as spurious correlation, are readily available and should be used in future studies. The non-violation of the exclusion restriction is not empirically testable. Therefore, the choice of instruments should be well-motivated based on theoretical and conceptual considerations (Mellon, 2022).

Second, the impact of food aid on the intensity of conflict deserves attention in future research. As we argue, conflicts are complex in nature. Food aid may not necessarily end conflicts. However, it may save lives in conflicts, i.e., dampen the conflict intensity or dampen the consequences of conflicts by providing food to those starving. That being said, future analyses should not only measure conflict intensity as battle deaths. Conflict also causes food insecurity, such that above-average mortality could represent a useful indicator given that one can control for other causes, such as epidemics or natural disasters.

Third, the channels through which food aid impacts conflict are poorly understood empirically, as already pointed out by previous authors (Nunn and Qian, 2014; Zürcher, 2017). While previous work mainly tries to understand this by running subsample regressions (e.g., Nunn and Qian, 2014; Mary and Mishra, 2020; Sheppard, 2021), a more fruitful approach may include interaction terms between food aid and variables representing a respective channel. Promising approaches in that

direction also require data on a more disaggregate level. Therefore, aid organizations and governments should put more effort into collecting the necessary disaggregated data to allow thorough impact evaluations.

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