Unequal Hunger

Pathways to Armed Conflict Onset

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Abstract

In many conflict-ridden countries, food insecurity prevails. However, the relationship between food insecurity and armed conflict onset is a complex one, and scholarly attention has increasingly been directed towards furthering our understanding of its nature. In this study, the proposition is brought forth that the effect of food insecurity on armed conflict onset should be contingent on certain features of the economic, social and political environment. Specifically, it suggests that (i) food insecurity should increase the risk of armed conflict onset by generating deprivation in absolute terms, and (ii) that the risk should be heightened when such insecurity disproportionally affects certain groups in society. The latter point pertains to the level of horizontal inequality – i.e. inequality at the group level –, the presence of which is expected to compound the risk of food insecurity leading to armed conflict onset by adding a relative dimension of deprivation to the absolute. A logistic regression analysis is employed using global data for the years 1961 to 2009. The findings do not support the hypothesized relationship. Rather, although food insecurity does increase the risk of armed conflict in cases where the level of horizontal political inequality is low, it decreases the risk in cases where it is high. This indicates that the impact of food insecurity on the risk of armed conflict indeed is contingent on certain features of the political environment, which calls for conditionality to increasingly be taken into account in future research on the relationship between food insecurity and armed conflict onset.

Keywords: Food Insecurity, Horizontal Inequality, Armed Conflict Onset
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1. Introduction

Over the past decades, the level of food insecurity in the world has decreased steadily. In recent years, however, this trend has been reversed for most of the countries sharing a particular trait: they are ridden by armed conflict. Armed conflicts can for example generate refugee flows and internal displacements, lead to the destruction of infrastructure and assets, and have adverse effects on the economy – factors that all can exacerbate food insecurity (FAO et al., 2017: 29-31). The notion of the inverse relationship on the other hand – that food insecurity leads to armed conflict –, is not as well-established. In fact, food insecurity has been found to have both fueling and dampening effects on the risk of violence (Hendrix and Brinkman, 2013: 3-4). Furthermore, food insecurity is neither a necessary nor a sufficient condition for armed conflict to occur. Rather, the effect of food insecurity on armed conflict is contingent on other economic, social and political factors (Brinkman and Hendrix, 2010: 2-4). Yet most studies have hitherto considered food insecurity as an independent determinant. For this reason, research taking the potential conditional impacts that features of the economic, social and political environment may have on the risk of food insecurity leading to armed conflict onset is scant. The purpose of this study is to further our understanding of such conditional impacts by asking under what conditions food insecurity leads to armed conflict onset. Academically, gaining such insights would contribute to disentangling the nature of the relationship between food insecurity and armed conflict. Practically, it could help in advancing efforts to fight hunger, and to do so in a manner that does not exacerbate the risk of armed violence.

Drawing from the literature on food insecurity and the literature on horizontal inequality and their links to armed conflict onset, a theoretical framework is brought forth whereby the risk of food insecurity leading to armed conflict onset is expected to be contingent on the prevailing level of horizontal inequality – i.e. inequality at the group level. Specifically, the risk of food insecurity leading to armed conflict onset should be exacerbated in cases where such insecurity disproportionately affects certain groups relative to others. In order to test this proposition, the following hypothesis is formulated: the likelihood of food insecurity leading to armed conflict onset increases when the level of horizontal inequality increases. It builds on the expectation that deprivation is the key causal link between both food insecurity and armed conflict onset, and between horizontal inequality and armed conflict onset. However, food insecurity is expected to bring about deprivation in absolute terms, while horizontal inequality is expected to bring about deprivation in relative terms. As such, the proposed causal argument is a combination of deprivation experienced in absolute and relative terms at the group level, where the relative dimension compounds the absolute, thereby increasing the risk of violent mobilization.
The theory is tested by employing a logistic regression analysis. The data sample is compiled using various sources covering the years 1961 to 2005. The horizontal inequality concept is broken down into three dimensions – the economic, the social and the political –, which are used as proxy indicators in order to capture the horizontal food security inequality dimension. Because of the conditional nature of the hypothesis, multiplicative interaction terms are included in the regression models. In addition, the marginal effect of food insecurity on armed conflict onset is considered for high and low levels of these three dimensions respectively. Unfortunately, data for the horizontal economic and social inequality dimensions are only available for the years 1986 to 2004, resulting in 481 observations, compared to 4,382 observations for the horizontal political inequality dimension.

The result does not support the hypothesis. Neither the horizontal economic nor social inequality dimensions have a statistically significant impact on the risk of food insecurity leading to armed conflict. However, the results are quite sensitive to different alterations of the independent and dependent variable measurements, in addition to the scarce number of observations. The results should therefore be treated with caution, as they may not be representative of the actual relationship between food insecurity and armed conflict onset as conditioned by the level of horizontal inequality.

The results for the horizontal political inequality dimension, on the other hand, are both significant and robust when testing different model specifications. However, they do not provide support for the theoretical expectations. Although food insecurity does increase the risk of armed conflict onset in cases where the level of horizontal political inequality is low, it decreases the risk in cases where the level of horizontal political inequality is high. Distinguishing between external and internal opportunities for mobilization, it appears to be the case that food insecurity simultaneously has a fueling and a dampening effect on armed conflict onset, but that the relative weight of each is contingent on the level of horizontal political inequality.

In addition to these main findings, the results corroborate previous findings which indicate that countries with larger populations suffer higher risks of armed conflict onset, and that the risk of armed conflict onset fades when longer periods of peace prevail.

In sum, the findings indicate that the impact of food insecurity on armed conflict indeed is contingent on certain features of the political environment. For this reason, more research taking conditionality into account is needed with regards to food insecurity and armed conflict onset in order to further our understanding of the complex interlinkages characterizing their relationship.
This study is structured as follows: first, previous research on the topics of food insecurity and horizontal inequality and their links to armed conflict onset is accounted for respectively. The subsequent section presents the theoretical framework brought forth in this study, including the ways in which food insecurity and horizontal inequality jointly are expected to lead to a compounded risk of armed conflict onset. Thereafter, the research design developed to test the theory is accounted for. The results of the logistic regression analysis are then presented together with marginal effects and robustness checks. In the subsequent section, the results are analyzed, and practical implications, limitations and areas for future research are reflected upon. Finally, the study is concluded by summarizing its content as a whole.
2. Previous Research

2.1 Food Insecurity and Armed Conflict

Food security is a multidimensional concept. In the 1970s, the notion of food security revolved around the availability of food supply, but it has since evolved to include the access people have to such supply, the extent to which such access is stable over time, as well as its nutritional quality, whilst also taking cultural aspects of food consumption into consideration. As such, food security relates both to the production and distribution of food, as well as its consumption (Napoli et al., 2011: 7-9). It is important to bear in mind that the onus of the studies reviewed in this section diverge and are often not encompassing of this broad conception of food security nor its antipode (which is of interest here): food insecurity. This complicates the task of drawing general conclusions about the impact of food insecurity on armed conflict, although the findings are indicative. In this study, the definition of food insecurity employed is formulated by the Food and Agriculture Organization of the United Nations (FAO), which defines food insecurity as “a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life” (ibid: 9).

The relationship between food insecurity and armed conflict is one of bidirectional causality – whereas food insecurity can be a factor leading to armed conflict onset, armed conflict often exacerbates the level of food insecurity. The latter link has been rather well-established and recognized as one of the key challenges for addressing food insecurity (Hendrix and Brinkman, 2013: 5). However, the ways in which armed conflict affects food insecurity are many. Some of the most evident ones identified by the World Food Programme (WFP) include the destruction of resources for food production such as land and water, the displacement of people, and the increase in military expenditure leading to lower investments in e.g. health and agriculture (Bora et al., 2011: 7-8). Furthermore, the effects have been found to be particularly substantial when food is used as a weapon of war (Teodosijević, 2003: 17). Notably, these dynamics result in an average annual per-capita agricultural production fall by around 1.5 percent and a drop of 7 percent in calorie availability per-capita during civil war (ibid: 26).

The notion of the inverse relationship – that food insecurity can be a causal factor leading to armed conflict onset – is not as well-established. Researchers have approached the subject in quite different ways, focusing on different aspects of the relationship and using different data. One issue that has been considered is that of whether levels of food insecurity in themselves or changes to levels of food insecurity most substantially impact the risk of violence. With regards to the former, Sobek and Boehmer have found that lower levels of calorie intake are associated with higher risk of civil war onset (Sobek and Boehmer, 2009: 22). Similarly, Pinstrup-Andersen and Shimokawa
found that countries where the population had poor nutritional status – measured by under-five child malnutrition rates – suffer higher risks of armed conflict onset. Notably, they found nutritional status to have a stronger effect on the risk of armed conflict than per capita GDP and annual GDP growth (2008: 517-519). Considering food prices and social unrest, on the other hand, Weinberg and Bakker found that changes – rather than levels – have an impact (2014: 320). Such notions of changes in food prices (and food price shocks in particular) increasing the risk of violence in different forms have been given much attention in the literature and are supported by several studies (see e.g. Bellemare, 2015; Smith, 2014; Fjelde, 2015). However, it should be noted that they are not uncontested. For example, Elbadawi and Hegre find no support for a relationship between economic shocks and armed conflict in the short term, although they suggest that they can have an impact in the longer term by affecting growth negatively and thereby increasing the risk (2008: 57-59). Bazzi and Blattman also reject the proposition as they do not find evidence suggesting that commodity price shocks affect the risk of conflict onset. They do, however, find support – albeit less robust – suggesting that increases in the level of commodity prices heighten the risk of shorter conflicts with generally fewer casualties (2014: 3).

Even if changes in food prices do impact the risk of armed conflict, they alone are not likely to be sufficient to cause the onset of armed conflict. Smith, for example, notes that although sudden increases in domestic food prices increase the probability of urban unrest, more fundamental political and economic grievances also matter and likely determine the way in which it manifests (2014: 679). Similarly, Bush notes that increasing prices is merely one dimension of deeper political and economic dissatisfaction triggering food riots (2010: 122). Although the research on what additional factors might matter is scant, there are some notable findings. One is that of Miguel et al. who studied growth shocks and found that their impact on armed conflict was neither contingent on countries’ wealth, level of democracy, nor level of ethnical diversity. Due to lacking panel data, however, they do not control for factors such as inequality, hunger or unemployment (2004: 728, 742-745). In contrast to this finding, Hendrix and Haggard make a distinction between urban and rural areas and find that the effect of rising global food prices on protests and rioting is contingent on regime type, with rising prices increasing urban unrest in democracies but not in autocracies. They suggest that this is because democracies have more permissive opportunity structures and because they generally pursue policies more favorable to rural areas compared to autocracies (2015: 143). In addition to whether studies focus on the national or sub-national level, another potential explanation for some of these divergent findings is whether studies consider violence, nonviolence, or both, as dependent variables. Indeed, the share of unrest that emerges as nonviolent in comparison to violent is significantly larger in
countries ranked as having higher government effectiveness (von Braun, 2008: 6). While much remains to be explored by making for example rural/urban or violent/nonviolent distinctions, this lies outside the scope of this study.

In sum, although the findings are not conclusive, both the level of food security and changes to such levels appear to be positively related to armed conflict to a certain extent. However, the relationship is evidently multifaceted, which speaks to the importance of making distinctions clear and acknowledging the difficulty of providing parsimonious explanations.

Another area that has been given much attention in recent years is that of climate change and its impact on both food insecurity and armed conflict. In a progress report on the Sustainable Development Goals (SDG), the United Nations recognized climate change, together with increasing inequality between and within countries, as the greatest challenges of our time. The effects of rising global temperatures – including land degradation and the collapse of ecosystems – are projected to put food production at risk, leading to widespread food shortages and hunger that disproportionately affect the most vulnerable countries and segments of their populations (United Nations, 2019: 3). However, Buhaug has criticized the research community for prematurely suggesting that climate change in itself is a driver of armed conflict. Studying African countries, he found that structural and contextual conditions – rather than droughts and prolonged heat waves – had prompted violence (2010: 16477). In a later study of which he was one of the authors, however, the finding did corroborate the notion that climatic conditions can have an impact on armed conflict, but that the impact again depends on structural and contextual conditions. Specifically, the authors found that drought conditions only increased the risk of armed conflict for agriculturally dependent and politically excluded groups (von Uexkull et al., 2016: 12391). As of yet, the research community has not reached consensus on the extent to which there might exist relationship between climate change and armed conflict nor the nature of such a relationship (ibid: 12391). One conclusion, albeit general, is that climate change in itself is not a sufficient factor to cause armed conflict, but that it heightens the risk, in part because the effects of climate change increase food insecurity (Levy, 2019: 3-4).

In addition to the findings of a positive relationship between food insecurity and armed conflict, Hendrix and Brinkman raise three ways in which food insecurity also may dampen the risk. First, acute food insecurity limits the resources available to militants. This is suggested to pertain in particular to less well-organized groups due to substandard infrastructure in place to withstand shortages caused by droughts, crop failures etcetera, which undermines their resilience. Second, at the individual level, food insecurity can impede active political participation due to the prioritization of averting hunger over other less physiological needs. Third, limiting people’s access to food is
often used as a tactic in warfare as a means of disempowering the opponent by undermining one of many armed actors’ most central pillars of support – the local population. However, this tactic brings about the risk of backfiring by pushing the loyalties of the local population further away from the actor denying them such access (Hendrix and Brinkman, 2013: 4-5). These dynamics provide an additional illustration of the complexity of the linkages between food insecurity and armed conflict.

Considering the literature reviewed in this section, there appear to exist strong correlations between food insecurity and armed conflict. However, with regards to causality, Brinkman and Hendrix have drawn the conclusion that “food insecurity in neither a necessary nor a sufficient condition for violent conflict” (2010: 2), but rather that the effects of food insecurity on conflict are contingent on other economic, social and political factors (ibid: 4). It is from this notion that this study departs. The next section therefore reviews the strand of literature related to the second factor considered in this study – horizontal inequality.

2.2 Horizontal Inequality and Armed Conflict

Traditionally, the relationship between inequality and conflict has been studied by considering a vertical notion of inequality – i.e. one focusing on inequalities between individuals. Furthermore, the conceptual focus has usually been put on economic inequality, which limits the breadth of possible dimensions of inequality that may influence armed conflict (Østby, 2008: 144-145). Conclusions derived from such studies of vertical economic inequality have often suggested that inequality does not have a significant impact on the risk of civil war (see e.g. Fearon and Laitin, 2003: 88; Collier and Hoeffler, 2004: 588). Increasingly, however, the focus has shifted towards a broader conception of inequality commonly known as horizontal inequality – i.e. “inequalities among groups in political, economic, and social dimensions” (Stewart, 2000: 245). The proposition of a causal relationship between horizontal inequality and armed conflict has been substantiated by a number of studies the past two decades. One of the most prominent scholars in the area is Stewart, who brought forth a theoretical argument suggesting that the risk of economic and political differences leading to armed conflict is particularly high when they coincide with cultural differences between groups (Stewart, 2002: 3). Such differences can produce perceptions of relative deprivation compared to other groups, fueling feelings of grievance and injustice. The group level is of importance here because the salience of group boundaries increases the likelihood that perceptions of relative deprivation are experienced collectively rather than individually, which mitigates collective action problems for mobilization (Hillesund et al., 2018: 465). Although proposed causal mechanisms vary, most explanations in the literature linking inequality to armed conflict are related to this notion of relative deprivation brought forth by Gurr in 1970 (Østby,
The ways in which this relates to the causal argument proposed in this study is further elaborated on in the theory-section below.

Like food insecurity, horizontal inequality is a multidimensional concept. Although some dimensions have been given more attention than others, the ones most commonly considered in the literature are horizontal economic, social and political inequalities (Hillesund et al., 2018: 476-471). One prominent study is that of Østby in which she measured the effect of, inter alia, horizontal economic and social inequalities on armed conflict onset. Her results show mixed support: while horizontal economic inequality has a positive effect on armed conflict, the relationship is not statistically significant. The effect of horizontal social inequality, on the other hand, is both strong and statistically significant (Østby, 2013). It is important to note that the group delineation she used in this study is based on ethnicity. Specifically, the inequality measurement is based on data from the two largest ethnic groups in each country. Doing so, she followed Brockerhoff and Hewett (2000) and contended that a comparison of the largest ethnic groups is an appropriate way to capture the general level of horizontal inequality at the country level (Østby, 2008: 151). Surprisingly, however, her findings differ somewhat in another study she conducted the previous year, in which she considered whether the effect of horizontal inequality on armed conflict is contingent on the political environment. In addition to considering ethnicity, she added religious and regional group delineations. In contrast to the former study where only the effect of horizontal social inequality on armed conflict onset reached statistical significance, both the effect of horizontal economic and social inequalities did in the latter. This was the case for all three types of group delineations (Østby, 2007: 12, 19). Hillesund et al. expect that the reason horizontal economic inequality did not reach statistical significance in the former study was because the sample size was smaller (2018: 477). Moreover, Østby’s findings support the proposition that polity matters, with horizontal inequality having a stronger impact on the likelihood of armed conflict onset in democracies and semi-democracies than in autocracies. Similarly, the effect was stronger in countries where the political system was more inclusive, as well as where minority groups were excluded from the political sphere. She argued that this does not suggest that democracy or political inclusiveness are drivers of armed conflict, but rather that such countries are at greater risk of armed conflict when horizontal economic and social inequalities do prevail (Østby, 2007: 15-19).

In addition to horizontal inequality, Østby also measured the effect of vertical economic inequality on armed conflict but did not find support in her analysis, which contrasts the findings of e.g. Fearon and Laitin (2003) and Collier and Hoefﬂer (2004). Neither did she find a significant effect of vertical social inequality on armed conflict, which leads her to draw the conclusion that
inequalities between individuals in general are insufficient to spur violence because there is no clear group component other than class (Østby, 2008: 153).

In addition to horizontal economic and social inequalities, a number of studies have investigated the effect of horizontal political inequality on armed conflict, most often considering ethnic group delineations. For example, studying ethnonationalism at the group level, Cederman et al. found that competing ethnonationalist claims over state power constitute a driving force behind many intrastate armed conflicts. This effect was found to be stronger the more excluded certain ethnic groups are from state power, the higher their mobilization capacity is, and the more they have experienced conflict in the past (Cederman et al., 2010: 88). Similarly, at the country level, Buhaug et al. have found strong statistical evidence that countries in which large ethnic groups are discriminated from national politics suffer a higher risk of armed opposition against the state. Moreover, horizontal economic inequality was more strongly associated with separatist violence, whereas horizontal political inequality was more strongly associated with violence over control of central power (Buhaug et al., 2014: 419). Wimmer et al. argue that a fundamental reason why certain ethnic politics increase the risk of violence in nation-states is because incentives exist for political elites in control of executive power to favor people belonging to their own ethnic group when allying and distributing public goods. The authors suggest that this should pertain in particular to poor states where resources for universal inclusion are lacking, as well as in countries where civil society institutions are weak. Politics in such countries are more likely to be centered around ethnic divides along which power is distributed. Similar to the findings of Buhaug et al., it is the component of exclusion that is of interest here, as the proposition that more ethnically diverse countries should be more likely to experience armed conflict is not supported by the results of their analysis (Wimmer et al., 2009: 316-317, 321).

It should be noted that horizontal inequality may not always play out along ethnic lines, however. For example, Siroky and Hechter have distinguished between between-group inequality and within-group inequality, and found that conflict is more likely to play out along ethnic lines in cases where between-group inequalities are high and within-group inequalities are low, whereas conflict is more likely to play out along class lines in cases where between-group inequalities are low and within-group inequalities are high (Siroky and Hechter, 2016: 91). This adds nuance to the relationship between horizontal inequalities and armed conflict. Unfortunately, research on within-group inequalities remains scarce (Hillesund et al., 2018: 466).

Finally, perhaps somewhat counterintuitively, horizontal inequalities may not only be a factor leading relatively deprived groups to take up arms, they can also result in relatively privileged groups doing so in order to preserve a position of power and access to resources (Hillesund et al.,
This notion is supported by e.g. Cederman et al., who have found that both groups that are relatively richer and poorer compared to country averages are more likely to engage in violent conflict (2011: 492). However, evidence related to the link between relatively privileged groups and armed conflict is more mixed, and there exist a high uncertainty with regards to whether an independent relationship exists (Hillesund et al., 2018: 464, 469). Because the theoretical argument brought forth in this study brings together food insecurity and horizontal inequalities, the focus lies on relatively deprived groups rather than on relatively privileged ones. For this reason, while the role of relatively privileged groups indeed is important to consider, it lies outside the scope of this study.
3. Theory

3.1. Research Gap and Theoretical Model

Indeed, food insecurity does not exist in a vacuum. The risk of food insecurity leading to violence is contingent on features of the economic, social and political environment (Tilly, 1978, as cited by Brinkman and Hendrix, 2010: 8). Not only does this suggest that armed conflict likely erupts and leads to armed conflict as a result of multiple factors, but also that these factors may be interrelated and affected by one another. Although a rich literature is emerging on the relationship between food insecurity and armed conflict onset, most studies have considered food insecurity as an independent determinant – by looking at e.g. calorie intake or food price shocks – rather than how the impact of such factors can be compounded by other potentially significant features of the economic, social and political environment. Hendrix and Haggard have recognized the lack of research taking such country-specific characteristics into account (2015: 155). Therefore, in order to advance our common understanding of the causes of armed conflict onset, there is a need to complement existing research with theoretical models that account for these inherent complexities and potential conditional effects. This has prompted the following research question:

**Under what conditions does food insecurity lead to armed conflict onset?**

In order to answer this question, this study brings forth and tests a theoretical explanation of armed conflict onset by combining two of the factors related to armed conflict onset identified in the peace and conflict literature – food insecurity and horizontal inequality. Although both these have been identified separately as drivers, no large-N study has yet investigated whether the effect of one compounds the effect of the other. The theoretical argument brought forth in this study suggests that this should be the case. It is summarized in Figure 1 below:

![Figure 1. Theoretical Framework](image-url)
The theoretical framework suggests that when certain groups are more food insecure than others – i.e. when horizontal inequalities prevail along the food security dimension – the risk of food insecurity leading to armed conflict onset is exacerbated. This means that the effect of food insecurity is compounded by the effect of horizontal inequalities. In order to test this proposition, the following hypothesis has been formulated:

*The likelihood of food insecurity leading to armed conflict onset increases when the level of horizontal inequality increases.*

The next section develops the theoretical reasoning further in order to account for *why* the risk of food insecurity leading to armed conflict onset is expected to increase when it disproportionately affects certain groups.

3.2. The Causal Chain

In essence, the causal argument builds on the proposition that deprivation is the key causal link between both food insecurity and armed conflict onset and between horizontal inequality and armed conflict onset. However, food insecurity and horizontal inequality are suggested to bring about deprivation along two different but interrelated dimensions: the absolute dimension and the relative dimension. This section presents each pathway separately and concludes by bringing them together. It is suggested that the effect of absolute deprivation on armed conflict should be stronger when it is compounded by the relative dimension of deprivation.

First, in the food security literature, deprivation has often been considered in absolute terms. Sobek and Boehmer wrote that “food deprivation is a material condition that has psychological and political ramifications” (2009: 12). They build their causal argument on the notion that the risk of armed conflict should increase when mass grievances emerging from food deprivation do – grievances that political entrepreneurs subsequently can capitalize on to bring about violent mobilization (ibid: 12-13). As such, they only consider deprivation in absolute terms. The fact that they find support for the proposition that the risk of armed conflict onset is higher in countries where the level of food insecurity – measured as average calorie availability – is higher (ibid: 22) indicates that absolute deprivation indeed is positively related to armed conflict.

Deprivation has been identified as one of the key drivers of armed conflict onset in the horizontal inequality literature as well. However, in this strand of literature, it is the way in which deprivation is perceived to affect the in-group compared to other groups in society that is suggested to explain why violence sometimes erupts (see e.g. Cederman et al., 2011). The key dimensions that
are added to deprivation in absolute terms here are the group dimension and the relative dimension. Østby proposed that “horizontal inequalities capture a collective aspect of relative deprivations which can facilitate mobilization for conflict” (2008: 148). In order to explain how this could happen, Cederman et al. identified two analytical steps. The first step entails a transformation of objective asymmetries into grievances through a process of group comparison driven by collective emotions. Second, the authors contend that the grievances generated serve as a mobilization resource for collective action (Cederman et al., 2011: 481-482).

The latter step taps into a debate regarding whether grievances or opportunities matter most for engendering mobilization (see e.g. Collier and Hoeffler, 2004, who advocate for the opportunity explanation). The causal argument of this study suggests that these two concepts cannot be entirely disentangled from one another and that they should not be considered in either/or-terms. Rather, both should help explain how horizontal inequality can lead to mobilization (a number of scholars – e.g. Bara, 2014 – have also advocated for a more inclusive approach). The rationale for adopting an inclusive approach in this study comes from the distinction made by Gurr between external and internal opportunities for mobilization. External opportunities for mobilization include factors such as state characteristics and its resources to repress rebellion. Internal opportunities, on the other hand, entail for example salience of group identity and the extent of grievances. Østby has built on this distinction to suggest that horizontal inequality therefore can engender mobilization by increasing internal opportunities. This is because horizontal inequality both strengthen the salience of group identities and leads to grievances being experienced collectively (Østby, 2013: 216). The inclusive approach therefore suggests that horizontal inequalities influence both grievances and certain dimensions of opportunities for mobilization.

In sum, the theoretical reasoning brought forth here suggests that both absolute and relative deprivation matter. In countries where food insecurity is prevalent but not coupled with perceptions of horizontal inequalities, deprivation exist in absolute rather than relative terms. While such absolute deprivation can be perilous (as suggested by e.g. Sobek and Boehmer with regards to calorie availability), the risk of armed conflict onset should be particularly high in cases where the absolute dimension of deprivation (resulting from food insecurity) is compounded by the relative dimension of deprivation (stemming from perceptions at the group level of food insecurity disproportionately affecting the in-group), jointly leading to resentment. As such, the proposed causal mechanism is a combination of deprivation experienced in absolute and relative terms at the group level.
3.3. Theoretical Assumptions

For food insecurity to increase the risk of armed conflict onset in cases where horizontal inequalities prevail, there needs to exist perceptions amongst the deprived that someone is to blame for their grievances. In this study, the dependent variable is intrastate armed conflict onset, and the actor of interest here is therefore the state. Two key assumptions need to be made in this regard – one for each of the independent variables.

First, the theoretical reasoning suggests that people’s experiences of food insecurity lead to deprivation in absolute terms. However, for this deprivation to translate into armed mobilization against the state, the assumption is made that the state is perceived as the actor to blame for the food insecurity. This effect could be both direct and indirect. For example, if the state engages in predatory policies, impoverishing the population and leaving them food insecure, the effect is rather direct. On the other hand, if for example climatic factors such as drought lead to losses in agricultural outputs, and the government’s policies are perceived to be corrupt or inadequate in addressing food insecurity that ensues, the effect is more indirect. In essence, this assumption builds on the assumption by Sobek and Boehmer that citizens believe that the government has responsibility in assuring access to life-sustaining needs such as food and water supplies, and that food deprivation therefore can lead to resentment against the state (2009: 11-12).

The second assumption is similar to the first. The theoretical reasoning suggests that horizontal inequality adds a relative dimension to the experienced food security deprivation. For this relative deprivation to translate into armed mobilization against the state, the assumption is made that the state is perceived as the actor to blame for the prevailing horizontal inequality.

Moreover, as elaborated on in the research design section below, the dimensions of horizontal inequality operationalized in this study are the economic, social and political. The type of horizontal inequality most relevant for the theoretical reasoning, however, would be horizontal food security inequality. Following the theoretical reasoning, the risk of food insecurity leading to armed conflict onset should be particularly high in countries where certain groups suffer a high degree of food insecurity compared to others. However, as such data is not available, the assumption is made that countries in which horizontal economic, social and political inequalities prevail should be more likely to also be unequal in terms of food insecurity.

3.4. Why Food Insecurity?

Indeed, food insecurity is closely related to the income of households (see e.g. Molnar, 1999; Wodon and Zaman, 2010; Bush, 2010), and many studies have found a positive relationship between lower levels of income and armed conflict onset (see e.g. Fearon and Laitin, 2003; Hegre and Sambanis, 2006). The rationale behind focusing on food insecurity rather than income in this
study comes from the article by Sobek and Boehmer. They write that money is merely an instrument enabling people to purchase things of value, and during strained times, people increasingly need to prioritize between them. Food and water are likely to be the last things cut due to their physiological necessity for human survival. For this reason, they argue that considering food deprivation comes close in capturing grievances and the extent to which people are deprived of satisfying their fundamental needs (2009: 3-4). Another reason for considering food insecurity – as noted above – is that its links to horizontal inequalities have not as of yet been studied systematically. Building a theoretical argument that accounts for the food security dimension therefore yields a more novel contribution to the field of peace and conflict research.
4. Research Design

4.1. Independent and Dependent Variables

4.1.1. Food Insecurity

The first independent variable, food insecurity, is a multidimensional concept. As such, measuring food insecurity is not a straightforward task. The four dimensions most commonly considered are availability, access, utilization and stability, and methodologies are still being refined in order to best capture these (Napoli et al., 2011: 7-9). One notable step taken in recent years is that of FAO, which launched the survey-based Food Insecurity Experience Scale (FIES) in order to monitor developments related to targets formulated under Sustainable Development Goal 2.1 to end hunger and ensure access by all people to safe, nutritious and sufficient food all year round (FAO et al., 2018: 7). Although this is an important initiative to improve our understanding of food insecurity around the globe, it is a nascent endeavor. Launched in 2014, the data available is yet too limited to utilize when studying the impact that food insecurity historically has had on armed conflict onset.

In this study, food insecurity is measured as the average daily number of calories that are available for consumption per person during a given year. The data are retrieved from FAO’s database “FAOSTAT”, which contains data on a number of food and agriculture indicators from 245 countries ranging back to 1961\(^1\). Following Sobek and Boehmer, the variable is log-transformed to reflect the decreasing relative effect that food security is expected to have on the risk of armed conflict onset. That is, the effect of a move from 1700 to 2100 calories is larger than a move from 3100 to 3500. On average, a person needs to reach a subsistence level of between 1800-2000 calories a day (Sobek and Boehmer, 2009: 18-19). The lowest country year in the data sample is for Burkina Faso 1962, where the average intake was 1308 calories a day. The highest recorded value is for the United States in 2005, where the average intake was 3828 calories a day.

This measurement of food insecurity is utilized in order to capture the availability dimension of food insecurity. Preferably, the access dimension would be measured instead of the availability one, because although there needs to exist availability of food supplies in a country, people also need to access such supplies. If not, the availability does not generate food security. The choice to measure food supply availability is therefore a matter of data availability. As not all food that is available in a country is consumed due to food being wasted, however, it is expected that the level of access is lower than the level of availability. Nevertheless, measuring food

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\(^1\) The data can be accessed together with more information at: http://www.fao.org/faostat.
availability in conjunction with the level of horizontal inequality should be a fruitful way to test the theory – if there exist availability of food supplies in a country, yet certain groups of society are unable to access them due to their relatively disadvantaged position compared to other groups, this adds a relative dimension of food insecurity for the disadvantaged group in addition to an absolute one.

Moreover, the choice to discard two of the other dimensions of food security – utilization and stability – needs to be motivated. First, utilization pertains in part to the quality of the food available (Napoli et al., 2011: 9), and the assumption is made that this should have a lesser impact on the risk of food insecurity leading to armed conflict onset than the impact of whether food is available in the first place. Furthermore, utilization refers to the “…preferences, traditional habits and socially acceptable food types” (ibid: 9). It is plausible that politically relevant grievances related to such cultural aspects of food utilization often should be a result of horizontal inequalities – if such grievances exist, this should be because the food that is available for utilization corresponds to the cultural preferences of other more privileged groups. It might therefore be misleading to consider the potential effect of cultural aspects of food utilization and horizontal inequality as independent causal factors.

The choice to discard the stability dimension from the analysis, on the other hand, likely brings about a higher risk of weakening the theoretical model’s explanatory power. Stability captures the time aspect of the food insecurity concept, and whether food insecurity is chronic or transitory (the latter pertaining to the notion of changes to food insecurity) (Napoli et al., 2011: 8). It could very well be the case that whether food insecurity leads to armed conflict onset depends both on past experiences of food insecurity and future expectations, as well as on whether the state is perceived to be to blame for them. Although it lies beyond the scope of this study, future research should build on the findings presented here by considering this stability dimension. Doing so would add further nuance and empirical stamina to our understanding of the complex linkages between food insecurity and armed conflict.

In sum, although operationalizing food insecurity as the average daily calorie availability per person brings about some limitations, it arguably captures a central dimension of food security that should be of relevance to the causal argument.

4.1.2. Horizontal Inequality
The second independent variable, horizontal inequality, has mainly been measured along economic, social and political dimensions in the peace and conflict research literature. In this study, however, the type of inequality that is of most theoretical relevance is horizontal food inequality, i.e. the extent to which the level of food insecurity is uneven between groups in a country. Unfortunately,
group-level disaggregation of data on the availability of food supplies is not available. For this reason, horizontal inequality is operationalized along the economic, social and political dimensions to serve as proxy indicators for horizontal food security inequality. The assumption is made that these operationalizations should capture the concept of horizontal food security inequality to certain extent. It should nonetheless be recognized as one of the more substantial limitations of the research design.

Data on the first two dimensions, horizontal economic and social inequalities, are replication data retrieved from Østby (2008), which is originally retrieved from Demographic and Health Surveys (DHS). The DHS is an ongoing research project launched by the United States Agency for International Development (USAID) that retrieves data related to population, health, HIV and nutrition. The replication data set contains information from 36 developing countries between 1986 and 2004, from which information of ethnic affinity was available to enable the construction of horizontal inequality indicators. The first one, horizontal economic inequality, is measured using information from a household asset index and calculated by compiling information on whether or not a household has electricity, a refrigerator, a television, a radio, a bicycle, and a motorcycle and/or a car. The second variable, horizontal social inequality, is constructed using information on the total number of years of education completed. The group dimension is captured by accounting for information retrieved from the two largest ethnic groups in a country, based on the assumption that the level of inequality between them reflects the general level of horizontal inequality in the country as a whole (Østby, 2008: 149-151).

The data utilized to account for the third dimension, horizontal political inequality, are replication data retrieved from Buhaug et al., measuring the “…demographic size of the largest discriminated ethnic group (LDG) relative to the joint size of the discriminated group and the group(s) in power” (2014: 424) for the years 1961 to 2005. This is based on data from the Ethnic Power Relations dataset compiled by the Center for Comparative and International Studies in Zürich. A discriminated group is defined as such when “…group members are subjected to active, intentional, and targeted discrimination by the state, with the intent of excluding them from political power. Such active discrimination can be either formal or informal, but always refers to the domain of public politics (excluding discrimination in the socio-economic sphere)” (Vogt et al., 2018: 5).

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2 The data can be accessed together with more information at: https://www.prio.org/Data/Replication-Data/.
3 The data can be accessed at: https://www.prio.org/Data/Replication-Data/. More information can also be found at the ETH Zürich website at: https://icr.ethz.ch/data/.
The group delineation accounted for in this study is that of ethnic groups – the same as in Østby (2008) and Buhaug et al. (2014). Conceivably, however, other types of delineations should also be relevant to consider as well. For example, as previously raised, Østby took religious and regional group delineations into account in addition to the ethnic one in another study, and found horizontal inequality to be positively associated with the likelihood of armed conflict onset for all three delineations (2007: 19). Still, ethnicity is the most common delineation to consider in the literature on horizontal inequalities (Hillesund et al., 2018: 464) and is therefore the one accounted for in this study.

4.1.3. Armed Conflict Onset

The dependent variable, *intragroup armed conflict onset*, is derived from the GROW data portal that unites a number of datasets on ethnic groups and intrastate armed conflict into one. The data originally come from the Uppsala Conflict Data Program’s (UCDP) Armed Conflict Dataset (ACD), which defines state-based armed conflict as “a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in a calendar year” (UCDP, n.d.). The *Drop Ongoing* variable option is utilized, whereby a conflict onset is coded as 1 for the years in which the number of battle-related deaths exceed 25 in a given country; is censored if a country has experienced any conflict in the previous two years; and otherwise coded as 0 (Bormann et al., 2015).

4.2. Control Variables

In order to control for other relevant and potentially confounding factors that are often considered in the literature, *democracy, economic development, population size*, and the number of *peace years* are included in the analyses. These are all variables that Østby (2008) and/or Buhaug et al. (2014) control for in their studies, and their operationalizations are accounted for below.

4.2.1. Democracy

Østby has found that horizontal inequality is more likely to lead to armed conflict onset in democratic countries with inclusive electoral systems. However, she contends that this does not suggest that democracy nor political inclusiveness breed conflict as such, but rather that countries that are more democratic and politically inclusive suffer higher risk of experiencing conflict if the level of horizontal inequality is high (Østby, 2007: 19). Buhaug et al., on the other hand, did not find support for the proposition that polity should be associated with ethnic governmental nor non-ethnic wars when accounting for horizontal political inequality in their analysis. However, they did find a positive correlation between democracy and ethnic separatist conflict (2014: 425). Both Østby (2007) and Buhaug et al. (2014) use the polity measurement brought forth by Gates et al.
(2006). It is based on three institutional dimensions: (i) the process for electing the executive, (ii) the extent of political participation, and (iii) the level of constraints on the executive decision-making authority (ibid: 893). The data are retrieved from the Buhaug et al. (2014) replication dataset.

4.2.2. Population Size
Several studies have found a positive relationship between the second control variable, population size, and armed conflict onset (see e.g. Fearon and Laitin, 2003). Because measurements for conflict entail imposing certain thresholds, it implies that conflicts are more likely to break out in more populous countries (Hegre and Sambanis, 2006: 514-515). Population size is therefore included as a control variable in this study. The data are retrieved from the Buhaug et al. (2014) replication dataset.

4.2.3. Economic development
Another factor associated with armed conflict onset is the level of economic development (see e.g. Fearon and Laitin, 2003). In fact, Hegre and Sambanis note that economic development and population size are two of the few factors that are robustly linked with armed conflict onset and that they are rather undisputed as explanatory factors (2006: 508-509). In this study, economic development is accounted for by using the logged per capita gross domestic product as a proxy indicator. It is expected that higher levels of economic development are associated with a lower likelihood of armed conflict onset.

The democracy, population size and economic development variables have all been lagged by 1 year in order to mitigate bias from potential reversed causality (Buhaug et al., 2014: 424). The data are retrieved from the Buhaug et al. (2014) replication dataset.

4.2.4. Peace Years
Finally, the number of years since the last conflict in a given country ended is included in the models. Collier, for example, has found support for the notion of a “conflict trap” where conflicts e.g. degrade societies’ resources, hamper economic growth and leave a legacy of violence, thereby increasing the risk of armed conflict relapse (Collier, 2007: 32-33). Longer periods of peace are therefore expected to yield decreased risks of armed conflict onset. The data are retrieved from the GROW<sup>up</sup> data portal.

4.3. Method
The independent and control variables’ impact on the likelihood of armed conflict onset is measured using logistic regression analysis. The dependent variable – armed conflict onset – is dichotomous and can only take on the value “0” or “1”. Logistic regression generates the predicted
probability that the dependent variable is one, i.e. that there is an onset of armed conflict during a given year. Moreover, because the likelihood of food insecurity leading to armed conflict is expected to be influenced by the level of horizontal inequality, the hypothesis is analyzed using interactive terms. This corresponds to Kam and Franzese Jr., who contend that “research questions that propose heterogeneity in how different types of individuals (or different microlevel units, even more generally) respond to their environments and institutional (i.e., macrolevel) contexts can and should be modeled interactively” (2007: 11).

4.4. Validity and Reliability

There is a risk that the operationalization of certain concepts could yield crude measurements. For example, the operationalization of food security should capture the food availability dimension, but does not account for the access, utilization, nor stability dimensions. Similar risks are present for the operationalization of the three horizontal inequality dimensions. Arguably the biggest limitation, as noted above, is the assumption made that the horizontal inequality dimensions should be informative of the level of horizontal food security inequalities. This analytical leap demands caution and reflection when considering the results.

Moreover, in order to engender reliability, all data sources utilized are specified and accessible. The research design steps taken are also accounted for in order to enable the reader to follow the rationale behind methodological choices made and – should it be of interest – to replicate the study.

4.5. Bias

With regards to bias, some comments should be made. First, Hillesund et al. contend that the risk of bias should be mitigated because the DHS surveys – from which the data on horizontal economic and social inequalities are based in this study – were not constructed with the intention of measuring inequalities between ethnic groups (2018: 473). On the other hand, Østby argued that the surveys should be less likely to be conducted in conflict-ridden countries due to security restrictions, thereby biasing the sample against the likelihood of finding support for the theoretical expectation that horizontal inequality should increase the risk of armed conflict onset (2008: 156). Second, Hillesund et al. recognize that the Ethnic Power Relations (EPR) data – from which the horizontal political inequality measurement is derived – excludes politically “non-relevant” ethnic groups. This is problematic to certain extent because it leaves out information on groups that potentially could become involved in conflict but that as of yet have not (2018: 472). Another potential source of bias is the fact that the data on horizontal economic and social inequalities only are available for developing countries. Should inequalities be more common in developing countries, the variance of the horizontal economic and social inequality variables might be lower.
than if a broader sample of countries had been considered. This risks undermining the fruitfulness of testing a theory that is contingent on the expectation that the risk of food insecurity leading to armed conflict onset should be lower in more equal countries. For this reason, the robustness of the findings are checked by considering an alternative measurement of horizontal economic inequality that Buhaug et al. (2014) employed in their study. The variable is constructed by comparing the relative gap between the mean national income and the average income level for the poorest ethnic group in a given country (ibid: 423). The sample data for this variable are both larger and are retrieved for a broader set of countries, making them more diverse. Unfortunately, no appropriate alternative measurement of horizontal social inequality has been identified, and such a robustness check is therefore only conducted by using an alternative measurement of the dependent variable. This is further reflected on in the analysis section.
5. Results and Analysis

5.1. Main Regression Results

In order to test the hypothesis, three logistic regression analyses are performed, one for each of the three dimensions of horizontal inequality: economic, social, and political. The results are presented in Table 1 below. Multiplicative interaction terms are included for the calorie availability variable and the variables for each horizontal inequality dimension: calorie availability*economic HI in Model 1, calorie availability*social HI in Model 2, and calorie availability*political HI in Model 3. The control variables are included in all three models.

5.1.1. Interpreting Regression Models Containing Interaction Terms

Before analyzing the results, it should be noted that interpreting regression models that include interaction terms is not a straightforward task. The main reason for this is that unlike additive regression models, the coefficients of the interaction term and the constitutive terms do not represent the effect of X on Y and must not be interpreted as such\(^4\). This is because the effect of X on Y is contingent on the value of Z, and therefore differs across different values of Z. It should be understood as the effect of X on Y as a function of Z (Kam and Franzese, 2007: 19-20). Moreover, following the recommendation of Brambor et al., the models in Table 1 include the constitutive terms (i.e. the variables constituting the interaction term). These are included in order to avoid omitted variable bias, which happens in cases where for example X is omitted from a model including an interaction term X*Z, and where X is correlated to Z or X*Z (2006: 66-67).

Moreover, the mean of the food availability variable has been centered around zero in order to better detect and interpret potential multicollinearity issues\(^5\). This is not an uncontested practice, as some scholars argue that centering should only be used in rare cases because it does not substantively change the models, nor help overcoming potential multicollinearity issues (see e.g. Brambor et al., 2006: 71). However, one such case, Dalal and Zickar argue, is when a variable in an interaction model cannot take on a meaningful zero-value, which is the case for the calorie availability variable in this study. Centering reduces what is known as nonessential collinearity (arising from the scaling of variables) between the constitutive terms and the interaction term, without affecting the coefficient of the interaction term, its standard error, its significance, nor the model fit – (R\(^2\)) (Dalal and Zickar, 2012: 340, 358). Moreover – and importantly – it should be noted that the coefficient for the constitutive term X captures the effect of X on Y in the case of Z being zero. Similarly, the coefficient for the constitutive term Z captures the effect of Z on Y in

\(^4\) The interaction term is the multiplicative term, e.g. economic HI*calorie availability in Model 1. The constitutive terms in the same model are the economic HI and calorie availability coefficients that are not multiplied by one another.

\(^5\) See Table 2 in the appendix for Models 1-3 in Table 1 with the calorie availability variable uncentered.
the case of X being zero (Brambor et al., 2006: 71-72). This is rather straightforward with regards to calorie availability since the three horizontal inequality variables range between 0 and 1. This means that the coefficient for the constitutive term calorie availability reflects the effect that calorie availability has on the risk of armed conflict onset in cases where no horizontal inequality prevails (as the dimensions have been operationalized). The coefficient for the constitutive term horizontal inequality, on the other hand, is not as easily interpreted. This is because the scale of the variables influences the coefficients of constitutive terms (ibid: 68). With regards to the calorie availability variable, it is important to note that it cannot take on the value 0. If that would be the case, it would mean that the average daily calorie availability in a country during a given year would be 1 (meaning the population would perish before the year’s end), because calculating the logarithm of 1 equals 0. Recall that the lowest recorded daily average of calorie availability in the data sample is 1308, which was recorded in Burkina Faso 1962, and calculating the logarithm for 1308 yields the value 7.18 (the lowest value in the data sample). The logged calorie availability variable does therefore not have a meaningful 0 value. This renders it largely meaningless to draw any inferences from the coefficient estimates for – and the significance of – the constitutive terms for the horizontal inequality dimensions in the models, because they “refer to conditions that could not logically exist” (Kam and Franzese Jr., 2007: 44), i.e. one where the average daily number of calories consumed during a given year is 1. It is possible, however, to meaningfully consider the coefficients for the constitutive term calorie availability, as they represent the change in the likelihood of armed conflict onset induced by a change in calorie availability in cases where the level of horizontal inequality is recorded as 0 in the data, which is logically possible.

5.1.2. Constitutive Terms, Interaction Terms and Control Variables
In Model 1 in Table 1, the coefficient for the constitutive term “calorie availability” is positive (4.327) and statistically significant at the 90 % confidence level, which is contrary to the theoretical expectation that higher levels of calorie availability should lessen the likelihood of armed conflict. However, the variance inflation factor is 6.178, indicating that there exists a high level of multicollinearity between the independent variables (Frost, 2017). For this reason, this result should be treated with caution. In Model 2, the coefficient is not significant, albeit negative (-1.232). In Model 3, the coefficient is also negative (-1.731), statistically significant at the 99 % confidence level, and has a VIF score of 2.441. This indicates that higher levels of calorie availability are

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6 Note again that this constitutive term is commented on because the other constitutive term – horizontal inequality – has a meaningful 0-value.
7 A high level of multicollinearity results in poor coefficient estimates and questionable p-values (Frost, 2017). For this reason, a robustness check is performed below where the independent and dependent variable measurements are altered.
negatively associated with armed conflict onset in cases where there is no recorded horizontal political inequality, which is in line with the theoretical expectations.

<table>
<thead>
<tr>
<th>Dependent variable:</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Armed Conflict Onset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calorie Availability</td>
<td>4.327*</td>
<td>-1.232</td>
<td>-1.731***</td>
</tr>
<tr>
<td></td>
<td>(2.528)</td>
<td>(2.615)</td>
<td>(0.471)</td>
</tr>
<tr>
<td>Economic HI</td>
<td>2.633</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.864)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social HI</td>
<td></td>
<td>3.625***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.926)</td>
<td></td>
</tr>
<tr>
<td>Political HI</td>
<td></td>
<td></td>
<td>3.113***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.381)</td>
</tr>
<tr>
<td>Democracy</td>
<td>1.039*</td>
<td>0.790</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>(0.558)</td>
<td>(0.521)</td>
<td>(0.175)</td>
</tr>
<tr>
<td>Logged Population</td>
<td>0.560***</td>
<td>0.701***</td>
<td>0.565***</td>
</tr>
<tr>
<td></td>
<td>(0.179)</td>
<td>(0.180)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>Logged GDP/Capita</td>
<td>-0.971***</td>
<td>-0.455</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>(0.318)</td>
<td>(0.347)</td>
<td>(0.097)</td>
</tr>
<tr>
<td>Peace Years</td>
<td>-0.219***</td>
<td>-0.220***</td>
<td>-0.265***</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.029)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Calorie*Economic HI</td>
<td>-7.816</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(11.279)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calorie*Social HI</td>
<td></td>
<td>8.771</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(7.360)</td>
<td></td>
</tr>
<tr>
<td>Calorie*Political HI</td>
<td></td>
<td></td>
<td>9.923***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2.058)</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.678***</td>
<td>-6.691***</td>
<td>-4.954***</td>
</tr>
<tr>
<td></td>
<td>(1.788)</td>
<td>(1.859)</td>
<td>(0.498)</td>
</tr>
<tr>
<td>Observations</td>
<td>481</td>
<td>481</td>
<td>4,382</td>
</tr>
</tbody>
</table>

Note: Robust standard errors in parenthesis; *significant at < 90 %, **significant at < 95 %, ***significant at < 99 %
Moreover, with regards to the interaction terms in Table 1, the interaction term between food availability and horizontal political inequality in Model 3 reaches statistical significance at the 99 % confidence level, while neither of the interaction terms between food availability and horizontal economic (Model 1) nor social (Model 2) inequalities do. The VIF score for the significant interaction term in Model 3 is 1.372. The results indicate that there is a statistically significant interaction between calorie availability and horizontal political inequalities, but not between calorie availability and horizontal economic – nor social – inequalities. To reiterate, the coefficient of the interaction term in each model must not be interpreted as an average effect of a change in X*Z on Y (Kam and Franzese Jr., 2007: 19-20). In addition, interpreting the direction of the interaction term’s coefficient should be particularly precarious in this study, because the expected causal effect differs between X on Y, and Z on Y. That is, X (calorie availability) is expected to be negatively associated with Y (armed conflict onset), while Z (horizontal inequality) is expected to be positively associated with Y. Hence, it would likely not be feasible to attempt to interpret the direction of the interaction coefficients (which are produced by multiplying the constitutive terms X and Z). In addition, when including interaction terms and constitutive terms in regression models, the likelihood of the interaction term reaching statistical significance decreases. However, this does not suggest that insignificant interaction terms unequivocally mean that an interaction does not exist in reality. Rather, it is possible that the marginal effect that X has on Y – i.e. the change in Y induced by a change in X – is “…significant for substantively relevant values of the modifying variable Z even if the coefficient on the interaction term is insignificant” (Brambor et al., 2006: 74). For this reason, in order to get a better understanding of the results, the marginal effect of X (calorie availability) on Y (armed conflict onset) is considered for “high” and “low” levels of Z (horizontal inequalities) in the subsequent section. First, however, the control variables are commented on.

With regards to the control variables, none has a VIF score exceeding 2.5, which indicates that the correlation amongst them is low for some variables and moderate for others, but that it does not warrant a correction of the models (Frost, 2017). In Model 1, the democracy variable is significant at the 90 % confidence level and positively associated with armed conflict onset, which suggests that countries with more democratic institutional structures suffer a higher risk of armed conflict onset in cases where horizontal economic inequality prevails, which corroborates the findings of (Østby, 2007). However, in line with her reasoning, this does not suggest that

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8 The control variables are only marginally influenced by the inclusion of an interaction term in Model 1-3. Therefore, the sizes of the coefficients will be commented on, but should be interpreted with caution and considered in relation to the corresponding coefficients in the non-interactive models, which can be found in Table 3 in the appendix.
democracy as such breeds conflict, but that the risk of armed conflict onset is particularly high in democratic countries where horizontal economic inequality prevails. With regards to horizontal social inequality (Model 2), the coefficient is somewhat smaller, although not significant. In Model 3, on the other hand, the effect diminishes, although it does not reach statistical significance.

The logged population variable is positively associated with armed conflict onset in all three models, as well as statistically significant at the 99 % confidence level. This suggests that countries with larger population sizes generally suffer greater risk of experiencing armed conflict onset, which corroborates previous findings (e.g. Fearon and Laitin, 2003; Hegre and Sambanis, 2006). As previously noted, this makes sense intuitively, as the threshold of 25 battle-related deaths in a calendar year means that the proportional size of conflicts relative to the population should be lower in countries with large populations compared to countries with small ones.

The effect of the logged GDP/capita-variable is negative and statistically significant at the 99 % level in Model 1. In line with previous research (again, e.g. Fearon and Laitin, 2003; Hegre and Sambanis, 2006), this indicates that that wealthier countries are less likely to experience armed conflict onset. However, as was the case for the democracy variable, the effect of the logged GDP/capita-variable is smaller but not statistically significant in Model 2, and diminishes in Model 3 without reaching significance.

Finally, the number of years since a country last experienced armed conflict is negatively associated with armed conflict onset. This pertains to all three models, and the coefficients are all statistically significant at the 99 % confidence level. Like the relationship between population size and armed conflict as well as that between wealth and armed conflict, support for this relationship has been found in several studies in the field of peace and conflict research (see e.g. Collier, 2007; Regan and Norton, 2005).

5.2. Marginal Effects

In order to facilitate interpretation of the main regression results presented in Table 1 above, the horizontal inequality variables are divided into “High Levels of HIs” and “Low Levels of HIs”. Each horizontal inequality variable is separated by its mean, with the mean value being assigned to the “high” category. The marginal effect of X on Y is subsequently plotted for the high and low levels respectively. This enables visual interpretation of how the effect of calorie availability on the likelihood of armed conflict onset may vary for different levels of horizontal inequalities.

First, the predicted probabilities for the two levels of the horizontal economic inequality dimension are displayed in Figure 2:
Again, since the theoretical framework suggests that the effect of food insecurity on armed conflict is contingent on the level of horizontal inequality, it is expected that the marginal effect of calorie availability on armed conflict onset should be stronger in cases where horizontal inequality prevails than when it is absent. Figure 2, however, suggests that higher levels of calorie intake are positively associated with armed conflict onset when the level of horizontal economic inequality is low but barely have an effect when it is high. However, as the interaction term in Model 1 in Table 2 is not significant and the confidence intervals in Figure 2 (as displayed by the transparent color fields around each regression line) are too wide, no inferences should be drawn.

Figure 3 displays the predicted probabilities for the two levels of the horizontal social inequality dimension:
In this figure, higher levels of calorie availability are positively associated with armed conflict in countries where the level of horizontal social inequality is high but are slightly negatively associated with armed conflict in cases where the level of horizontal social inequality is low. This is in stark contrast to Figure 2. Similar to Figure 2, however, the interaction term in Model 2 in Table 2 was not significant and the confidence intervals in Figure 3 quite large, whereby no inferences should be drawn.

In Figure 4, the predicted probabilities for the two levels of the horizontal political inequality dimension are displayed:

This figure indicates that higher levels of calorie intake are positively associated with armed conflict onset in countries where horizontal political inequality prevails, but that they are negatively
associated with armed conflict onset where horizontal political inequality does not. The interaction term in Model 3 in Table 1 is statistically significant, and the confidence intervals are narrow enough for us to be able to reject the null hypothesis. With regards to lower levels of horizontal political inequality, this is in line with the theoretical reasoning of this study. That is, in cases where horizontal political inequality is not pervasive, higher levels of calorie availability generally have a negative impact on the risk of armed conflict onset, because absolute levels of grievances are lower than in cases where calorie availability is scarce. Contrary to the theoretical expectations, on the other hand, higher levels of calorie availability increase the risk of armed conflict onset in countries where the level of horizontal political inequality is high. Conceivably, this could mean that calorie availability constitutes a resource that engenders mobilization, and that armed conflict onset is therefore less likely in cases where horizontal political inequalities are present but where the amount of food available is insufficient. But how then could the other relationship exist – that higher levels of calorie availability do decrease the risk of armed conflict in countries where the level of horizontal inequality is low? One possible explanation is that relative deprivation on the group level has a stronger impact on the drive to collectively mobilize than deprivation in absolute terms has – i.e. that the relative trumps the absolute, but that both have an effect independently. If so, this would explain why higher levels of calorie availability at times are associated with a lower risk of armed conflict onset. That is, in countries where the level of horizontal political inequality is low, higher levels of calorie availability do decrease the risk of armed conflict because the level of absolute deprivation decreases, even though the high calorie availability levels simultaneously engender mobilization capacity to certain extent. This reasoning is further elaborated on in the analysis-section.

5.3. Robustness Checks

In order to check the robustness of the findings above, two alterations of the model specifications are undertaken. The first is to consider alternative measurements of the independent variables for the horizontal economic and political inequality dimensions. The second is to replace the Drop Ongoing-version of the dependent variable with the Keep Ongoing-one, which is elaborated on further below.

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9 Surprisingly, the “high” and “low” denotations for Figure 4 are opposite in relation to the same denotations in the other figures. That is, blue denotes “low” in Figure 4 and “high” in the other figures. This is a technical issue, but one needs to be observant of this when comparing different figures to one another.

10 Note that the y-axis ranges between 0 % to 10 % in Figure 3. In Figure 1 and 2, the y-axis ranges between 0 % and 100 %. This makes the confidence intervals look visually similar in all three models, although they in reality are not.

11 See Table 4 in the appendix for regression results for when using the alternative independent variable measurements.
5.3.1. Alternative Independent Variable Measurements

With regards to the first alteration, horizontal economic inequality is measured as the country-level GDP/capita divided by the mean per capita income for the poorest ethnic group, and the data are retrieved from the Buhaug et al., (2014) replication dataset. In their analysis, they found horizontal economic inequality to be positively associated with the onset of armed conflict.

Data for the alternative measurement of horizontal political inequalities are retrieved from the GROW data portal and is measured as the excluded population as a fraction of the ethnically relevant population of a given country (Bormann et al., 2015). This measurement is chosen because it was used by Wimmer et al. (2009) to investigate the impact of different ethnopolitical configurations of power on the risk of armed conflict onset. They find higher levels of exclusion to be positively associated with armed conflict onset (ibid: 330).

Unfortunately, no relevant alternative measurement of horizontal social inequalities has been identified and the robustness of these results are therefore only analyzed by altering the measurement of the dependent variable.

Figure 5 below displays the predicted probabilities for the alternative horizontal economic inequality measurement:

![Figure 5: Economic HI Robustness (Table 4)](image)

The figure indicates that higher levels of calorie availability are negatively associated with armed conflict for both levels of horizontal economic inequality, although the effect is somewhat stronger for low the level. The interaction term is not significant (see Table 4 in the appendix) although the confidence intervals are rather small. For this reason, one should be cautious drawing interferences based on the results. Note, also, that the results changed significantly when considering this
alternative measurement of horizontal economic inequality. The conclusion can therefore be drawn that the results are not robust when considering different model specifications.

Figure 6 below displays the predicted probabilities for the alternative horizontal political inequality measurement:

![Figure 6: Political HI Robustness (Table 4)](image)

The results display the same type of variation as for the other measurement of horizontal political inequality. That is, the effect of calorie availability on armed conflict onset is negative in cases where the level of horizontal political inequality is low, and positive in cases where it is high. In addition, the interaction term in Table 4 (see appendix) is statistically significant at the 99% confidence level. This finding is therefore robust with regards to a model specification where the independent variable measurement has been changed.

5.3.2. Alternative Dependent Variable Measurement

The second robustness check performed is one where the dependent variable measurement is altered. Specifically, the *Keep Ongoing* (KO) option for intrastate armed conflict onset variable is utilized. Similar to the *Drop Ongoing* (DO) option, an armed conflict onset is recorded whenever the number of battle-related deaths pass the threshold of 25 in a calendar year, and the particular conflict has not been active the previous two years. However, unlike the DO option, the KO option does not censor the country during the subsequent two post-onset years, but allows for other intrastate armed conflict onsets in the same country to be recorded.

The regression table and figures accounting for each horizontal inequality dimension can be found in the appendix (Table 5 and Figure 7-9). Again, the interaction term is only significant in the horizontal political inequality model (Model 3 in Table 5) and the relationship for this
dimension is similar to the previous model specifications. In cases where the level of horizontal political inequality is low, higher levels of calorie availability are associated with a decreased likelihood of armed conflict onset. In cases where the level of horizontal inequalities is high, on the other hand, higher levels of calorie availability are associated with an increased likelihood of armed conflict onset, although the effect is somewhat smaller than when using the DO-option for the dependent variable (see Figure 4 and 7).

5.4. Analysis

In sum, the results did not support the proposition that the impact of food insecurity on the risk of armed conflict onset should be contingent on the level of horizontal inequality – with higher levels of horizontal inequality adding a relative dimension of deprivation to deprivation experienced in absolute terms (due to food insecurity), thereby increasing the risk of armed conflict onset in cases where both these conditions are present. In the analysis, neither the interaction term for calorie availability and horizontal economic nor social inequality variables reached statistical significance. In addition, the results were sensitive to different model specifications. One potential explanation is that the number of observations in Model 1 in Table 1 (horizontal economic inequality, N=481) and Model 2 (horizontal social inequality, N=481) are significantly smaller than the number of observations in Model 3 (horizontal political inequality, N=4,382). The alternative measurement of the horizontal economic inequality variable – the country-level GDP/capita divided by the mean per capita income for the poorest ethnic group (from Buhaug et al., (2014)) – on the other hand, had 4,382 observations and did indeed yield a less radical result (see Figure 5). However, the interaction term did not reach statistical significance (see Table 4 in the appendix). It nonetheless suggests that the data for the main measurements of the horizontal economic and social inequality dimensions might not be comprehensive enough for testing the present theory.

The interaction term for calorie availability and horizontal political inequality, on the other hand, did reach statistical significance. In line with the theoretical expectations, this indicates that food insecurity is positively associated with armed conflict onset in cases where the level of horizontal political inequality is low – i.e. that there exists a standalone effect of food insecurity on the risk of armed conflict onset. On the other hand, in cases where the level of horizontal political inequality is high, food insecurity decreases the risk of armed conflict.12 These findings remain robust for model specifications both where the independent variable measurement has been altered and when the dependent variable measurement has. This is contrary to the theoretical expectations suggesting that although a standalone effect of food insecurity should exist, the risk of food

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12 Recall that food insecurity is measured as the level of calorie availability. An increase in calorie availability therefore leads to a decrease in food insecurity. One must be cognizant of this when analyzing the results.
insecurity leading to armed conflict should be compounded when the level of horizontal inequality is high.

In order to better understand the dynamics at work with regards to food insecurity and horizontal political inequality, recall the distinction made by Gurr between external and internal opportunities for mobilization (discussed by Østby, 2013: 216). First, as noted by Hendrix and Brinkman, food insecurity could potentially dampen the risk of armed conflict by limiting the resources available to militants (2013: 4). In this sense, calorie availability could be regarded as an external opportunity for mobilization, and food insecurity therefore decreases the risk of armed conflict onset. Second, on the other hand, food insecurity might aggravate deprivation in absolute terms and become a motivating source for mobilization (Sobek and Boehmer, 2009: 3-4). In this sense, food insecurity could be regarded as an internal opportunity for mobilization that increases the risk of armed conflict onset. Third, as noted by Østby, horizontal inequality both strengthens the salience of group identities and leads to grievances being experienced collectively – factors pertaining to internal opportunities for mobilization and that are proposed to increase the risk of armed conflict onset (Østby, 2013: 216). These three dynamics might not be mutually exclusive. Rather, it should be possible for them to be at play simultaneously, which could explain the empirical results. However, this would demand that the relative weight of each factor varies across cases. Consider first a case where the level of horizontal political inequality is low. The empirical findings suggest that food insecurity then increases the risk of armed conflict onset. This indicates that even though the level of food available as a resource for potential combatants is restricted, the effect is trumped by the effect of absolute deprivation motivating uprising. Now consider a case where the level of horizontal political inequality is high. Under such circumstances, the empirical findings suggest that food insecurity decreases the risk of armed conflict onset. A potential explanation for this is that the presence of relative deprivation experienced horizontally is sufficient for armed conflict onset, and that the impact is stronger than the impact of absolute deprivation (stemming in this case from food insecurity). If this is the case, the relative weight of food as a resource (external opportunity) trumps that of food insecurity as a source of deprivation (internal opportunity), because the internal opportunity dimension is already generated by the high level of horizontal political inequality. As such, there indeed appears to exist an interactive relationship between food insecurity and horizontal political inequality, although the nature of the relationship differs from the theoretical expectations originally presented in this study.

### 5.5. Practical Implications

The findings suggest that the relationship between food insecurity and armed conflict onset is not an isolated one, but one that is contingent on features of the political environment. One of
the practical implications of this is that even though food insecurity is more common in countries affected by armed conflict (FAO et al., 2017: 35), efforts to alleviate food insecurity should not be regarded as a blueprint for conflict prevention. Rather, in cases where political inequalities prevail at the horizontal level, the findings suggest that the effect of food supplies as a resource for mobilization (external opportunity) might be stronger than their mitigating effect on deprivation in absolute terms (internal opportunity). In addition, although this study has considered food insecurity coupled with horizontal inequalities, other features of the political environment could potentially have a similar conditioning impact on the relationship between food insecurity and armed conflict onset. Therefore, the findings of this study point to the general importance of practitioners employing sound conflict-sensitivity analyses in order to best navigate complex, multidimensional, and potentially precarious political environments.

5.6. Limitations and Avenues for Future Research

There are a number of limitations of this study that result from its scope and certain data restrictions. For example, the dimension of food insecurity captured is that of calorie availability. This static notion of food insecurity fails to capture the impact that changes to food insecurity have on the risk of armed conflict onset. Indeed, changes to food insecurity could potentially act as a trigger of violence and analyzing this could contribute to our understanding of when conflicts break out. In addition, changes to levels of food insecurity would capture a relative dimension of deprivation not considered in this study – that of the level of deprivation changing relative to an earlier point in time. An interesting avenue for future research would be to incorporate this dimension of change into a theoretical model that considers the conditions under which food security might (or might not) lead to armed conflict.

Another limitation of this study is that only the ethnic group delineation has been considered. The theoretical argument would lend itself to the consideration of other ones as well – for example religious or regional, as considered by Østby (2007). Moreover, the only type of armed conflict dyad considered is that between armed groups and states. In cases where the state is perceived to be to blame for deprivations that are experienced among those mobilizing, this should be the most appropriate type of conflict to consider. However, it is possible that food insecurity and horizontal inequality in certain cases could spark non-governmental conflict as well. Only considering state-based conflict therefore yields a risk of overlooking potentially relevant dynamics that do not relate to the state as such.

As noted above, the relatively small number of observations for the horizontal economic and social inequality variables might have been a factor leading to the inconclusive results. In addition, there exists a risk of the results being biased since the DHS survey data on which the
variables are based were only conducted in developing countries. Since the result for the horizontal economic inequality variable differed significantly compared to the results from the independent variable robustness check (for which a broader sample set was considered), the risk that biased measurements did indeed skew the results cannot be disregarded.

A final – and again, perhaps the most substantial – limitation of this study is that no appropriate measurement of horizontal food security inequality has been identified. Instead, the economic, social and political dimensions of horizontal inequality were considered, serving as proxy indicators. Because only the relationship between food insecurity and the horizontal political inequality dimension was substantiated, this weakens the likelihood that the horizontal food security inequality dimension was captured. Moreover, considering that the nature of the relationship between food insecurity and horizontal political inequalities was not as proposed by the theoretical framework, it is possible that this is the case for food insecurity and horizontal food security inequality as well. The theoretical expectation was that the effect of food insecurity in absolute terms coupled with food insecurity in relative terms would lead to a particular high risk of armed conflict onset. Although this might hold merit theoretically, it is possible that higher levels of food availability could lead to an increase in the risk of armed conflict in cases where the level of horizontal food security inequality is high, because the difference in food insecurity between relatively deprived and relatively privileged groups is comparatively larger. Similar to the findings related to the horizontal political inequality dimension, this would suggest that the present hypothesis is ill-poised to capture certain nuances of how the effects of food insecurity and horizontal food security inequality on armed conflict onset might be interrelated.
6. Conclusion

Armed conflict is a major underlying cause of food insecurity (FAO et al., 2018: 14). Following a prolonged decline of food security in the world over the past decades, the prevalence of hunger has started to rise again in recent years, and the deterioration has been most severe in countries affected by armed conflict. Armed conflict therefore constitutes a major impediment for the work towards a world free of hunger (FAO et al., 2017: 30). The links between armed conflict and food insecurity have increasingly been paid attention to in recent years. The notion of the inverse relationship on the other hand – that food insecurity leads to armed conflict –, is not as well-established. A rich literature on the subject has emerged in the past decades, and food insecurity has been found to have both fueling and dampening effects on the risk of violence (Hendrix and Brinkman, 2013: 3-4). Furthermore, food insecurity is neither a necessary nor a sufficient condition for armed conflict to occur. Rather, the effects of food insecurity on conflict are contingent on other economic, social and political factors (Brinkman and Hendrix, 2010: 2-4). It is from this notion that this study has departed. It brought forth the proposition that food insecurity should increase the risk of armed conflict onset, but that the effect should be heightened when it is coupled with the presence of horizontal inequality – i.e. inequality at the group level. This is because groups who perceive food insecurity to be disproportionally prevalent amongst members of the in-group compared to other groups in society are likely to experience a combination of deprivation in absolute and relative terms, which is expected to compound the risk of such groups mobilizing violently. A logistic regression analysis was employed using global data for the years 1961 to 2009. In order to measure horizontal inequality, the concept was broken down into three dimensions: the economic, social and political. The impact of food insecurity on armed conflict onset was considered for high and low levels of these three dimensions respectively.

The results did not support the theoretical expectations, and neither the interaction term for food insecurity and horizontal economic – nor social – inequalities reached statistical significance. The interaction term for food insecurity and horizontal political inequalities on the other hand, did. This finding remained robust when controlling for different model specifications using alternative operationalizations of both the independent and the dependent variable. However, contrary to the theoretical expectations, although food insecurity does increase the risk of armed conflict onset in cases where the level of horizontal political inequality is low, it decreases the risk in cases where the level of horizontal political inequality is high. These results indicate that food insecurity simultaneously should have a fueling and a dampening effect on armed conflict onset, with the mitigating effect stemming from food insecurity limiting the resources for mobilization available to militants, and the fueling effect stemming from food insecurity generating
deprivation in absolute terms. The former could be regarded as pertaining to external opportunities for mobilization and the latter to internal opportunities for mobilization. Interestingly, however, the relative weight of each of these is contingent on the degree to which horizontal political inequality prevails.

In addition to these main findings related to the independent variables – food insecurity and horizontal inequality –, population size and the number of years since the latest armed conflict ended had a significant and robust impact on the likelihood of armed conflict onset in almost every model specification – with the effect of population size being positive and the effect of the number of peace years being negative. This corroborates previous findings of, for example, Fearon and Latin (2003), Hegre and Sambanis (2006) and Collier (2007).

The results point to some avenues for future research. First, incorporating the dimension of time into models explaining under what conditions food insecurity might lead to armed conflict onset could potentially increase our ability to predict also when violence is likely to break out. Second, considering different independent variable measurements, groups delineations and contextual dimensions would further our understanding of the more precise nature of the relationship between food insecurity and armed conflict onset.

The findings of this study point to the importance of not overlooking the fact that relationships at times are conditional. This is not to say that important non-conditional dynamics related to the causes of armed conflict do not remain to be explored as well, and considering certain types of conditionality might be redundant in certain cases. However, researchers should increasingly ask the question of why a conditional relationship is not expected to exist before bringing forth theoretical models that do not account for conditionality.
7. Bibliography


Napoli, M., Muro, P.D., Mazziotta, M., 2011. Towards a Food Insecurity Multidimensional Index (FIMI).


8. Appendix

Table 2 - Models from Table 1 Without Centering Calorie Availability

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Armed Conflict Onset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calorie Availability</td>
<td>4.327* (2.528)</td>
<td>-1.232 (2.615)</td>
<td>-1.731*** (0.471)</td>
</tr>
<tr>
<td>Economic HI</td>
<td>63.778 (86.736)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social HI</td>
<td></td>
<td>-64.993 (57.114)</td>
<td></td>
</tr>
<tr>
<td>Political HI</td>
<td></td>
<td></td>
<td>-74.518*** (15.986)</td>
</tr>
<tr>
<td>Democracy</td>
<td>1.039* (0.558)</td>
<td>0.790 (0.521)</td>
<td>0.017 (0.175)</td>
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<tr>
<td>Logged Population</td>
<td>0.560*** (0.179)</td>
<td>0.701*** (0.180)</td>
<td>0.565*** (0.047)</td>
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<tr>
<td>Logged GDP/Capita</td>
<td>-0.971*** (0.318)</td>
<td>-0.455 (0.347)</td>
<td>0.032 (0.097)</td>
</tr>
<tr>
<td>Peace Years</td>
<td>-0.219*** (0.031)</td>
<td>-0.220*** (0.029)</td>
<td>-0.265*** (0.012)</td>
</tr>
<tr>
<td>Calorie*Economic HI</td>
<td>-7.816 (11.279)</td>
<td></td>
<td></td>
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<tr>
<td>Calorie*Social HI</td>
<td></td>
<td>8.771 (7.360)</td>
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<td>9.923*** (2.058)</td>
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<td>8.588” (3.473)</td>
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<tr>
<td>Observations</td>
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<td>481</td>
<td>4,382</td>
</tr>
</tbody>
</table>

Note: Robust standard errors in parenthesis; *significant at < 90 %, **significant at < 95 %, ***significant at < 99 %
<table>
<thead>
<tr>
<th>Model 1 (1)</th>
<th>Model 2 (2)</th>
<th>Model 3 (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calorie Availability</td>
<td>2.959**</td>
<td>1.407</td>
</tr>
<tr>
<td>(1.508)</td>
<td>(1.598)</td>
<td>(0.436)</td>
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<td>Economic HI</td>
<td>3.693***</td>
<td>3.168***</td>
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<td>(1.100)</td>
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<td>(0.763)</td>
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</tr>
<tr>
<td>Political HI</td>
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<tr>
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<td></td>
<td>(0.369)</td>
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<tr>
<td>Democracy</td>
<td>0.904*</td>
<td>0.874*</td>
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<td>(0.526)</td>
<td>(0.511)</td>
<td>(0.174)</td>
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<tr>
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<td>0.693***</td>
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<tr>
<td>(0.177)</td>
<td>(0.181)</td>
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<td>(0.316)</td>
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<td>(0.096)</td>
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<td>-0.220***</td>
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<td>(0.029)</td>
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<td>(11.212)</td>
<td>(12.033)</td>
<td>(3.221)</td>
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Observations: 481, 481, 4,382

Note: Robust standard errors in parenthesis; *significant at < 90 %, **significant at < 95 %, ***significant at < 99 %
Table 4 – IV Robustness Check - Economic and Political HIs

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<td></td>
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<td>Economic HI</td>
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<td></td>
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<td>(0.280)</td>
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<tr>
<td></td>
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<td>(0.175)</td>
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<td>0.557***</td>
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<tr>
<td></td>
<td>(0.049)</td>
<td>(0.046)</td>
</tr>
<tr>
<td>Logged GDP/Capita</td>
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<td>0.170*</td>
</tr>
<tr>
<td></td>
<td>(0.098)</td>
<td>(0.100)</td>
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<td>Peace Years</td>
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<td>-0.260***</td>
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<td></td>
<td>(0.012)</td>
<td>(0.012)</td>
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<td>(0.495)</td>
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Note: Robust standard errors in parenthesis; *significant at < 90 %, **significant at < 95 %, ***significant at < 99 %
Table 5 – DV Robustness Check - Armed Conflict Onset

<table>
<thead>
<tr>
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<th>Model 1 (1)</th>
<th>Model 2 (2)</th>
<th>Model 3 (3)</th>
</tr>
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<tbody>
<tr>
<td>Calorie Availability</td>
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<td>-2.432***</td>
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<td>(4.051)</td>
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<td>(0.740)</td>
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<td>(1.044)</td>
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<td>0.660***</td>
<td>0.641***</td>
<td>0.499***</td>
</tr>
<tr>
<td></td>
<td>(0.175)</td>
<td>(0.171)</td>
<td>(0.063)</td>
</tr>
<tr>
<td>Logged GDP/Capita</td>
<td>-1.007*</td>
<td>-0.826</td>
<td>-0.144</td>
</tr>
<tr>
<td></td>
<td>(0.543)</td>
<td>(0.582)</td>
<td>(0.154)</td>
</tr>
<tr>
<td>Peace Years</td>
<td>0.006</td>
<td>0.005</td>
<td>-0.010</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.016)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>celnfood:ehi</td>
<td>-21.031</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(21.041)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>celnfood:sochi</td>
<td></td>
<td>-0.838</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6.845)</td>
<td></td>
</tr>
<tr>
<td>celnfood:polhi</td>
<td></td>
<td></td>
<td>6.784**</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(2.868)</td>
</tr>
<tr>
<td>Constant</td>
<td>-8.943***</td>
<td>-9.266***</td>
<td>-8.008***</td>
</tr>
<tr>
<td></td>
<td>(1.654)</td>
<td>(1.891)</td>
<td>(0.722)</td>
</tr>
<tr>
<td>Observations</td>
<td>481</td>
<td>481</td>
<td>4,382</td>
</tr>
</tbody>
</table>

Note: Robust standard errors in parenthesis; *significant at < 90 %, **significant at < 95 %, ***significant at < 99 %