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Climate Change, Conflict, and Children*

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Abstract:
This paper reviews the evidence linking climate variability to conflict, broadly defined, and the subsequent short and long-term implications of children's exposure to conflict. Evidence generally supports strong links between hotter temperatures, reduced rainfall and more conflict, defined to include violence ranging from intergroup to interpersonal to intrapersonal. Individuals exposed to conflicts while *in utero* or in childhood suffer negative health and education effects. There is less evidence about long-term impacts or how conflict exposure beyond early childhood affects children. In contrast with other types of negative shocks experienced by children, exposure to conflict is not always correlated with significant gender bias against girls, as many studies show impacts on all children. Much less is known about the mechanisms through which conflict impacts child health and education, how households cope with conflict shocks, or the impacts of conflict on other outcomes including intergenerational transmission of the shock.

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1. Introduction

This article reviews the evidence linking climate variability to conflict, broadly defined, and what happens to children after they are exposed to conflict. One challenge in examining this link is the question of how to define conflict. Wars between nations, civil conflicts, genocides, ethnic cleansing, political and neighborhood violence, localized rioting or disputes, interpersonal violence, and suicide have all been examined under the rubric of conflict research. Conflicts vary in duration, with some lasting days and others decades; in how many individuals are exposed and/or displaced; in whether deaths are concentrated among soldiers or civilians; and in their underlying causes.

Conditions children experience in the womb or early in life have been shown to be especially harmful, because they not only affect health in the short term but may also influence health, education, and socioeconomic wellbeing in adulthood (see seminal work by Stein et al. (1975) and more recent reviews by Strauss and Thomas (2008); Currie and Almond (2011); Currie and Vogl (2013)). Children are especially vulnerable to conflict, yet different types of conflict can vary wildly in their effects, and researchers have not yet started to explore that variation in a systematic way. In addition to directly exposing children to violence and trauma, conflict may disrupt child care, family arrangements, educational or health opportunities, and adult employment. Most studies of exposure to conflict focus on how it affects health and education, although researchers are beginning to look at other outcomes, such as political beliefs and adult mental health. Recent studies have also found that exposure to conflict may have different effects depending on the age at which a child is exposed, and some of the evidence suggests that the effects can be particularly pronounced if exposure occurs during adolescence. The negative effects of conflict exposure can carry over to the next generation: children of

parents exposed to conflict can experience health and education deficits themselves. It is worth noting that research that examines how conflicts affect children is part of a broader research agenda studying how children are impacted by different types of shocks such as weather (Maccini and Yang, 2009), famine (Dercon and Porter, 2014), epidemics (Almond, 2006), natural disasters (Currie and Rossin-Slater, 2013; Caruso, 2014), and pollution (Currie, Neidell, and Schmieder, 2009).

The possibility that growth disturbances in early life might affect future outcomes is particularly relevant in developing countries, where armed conflict occurs more often than in other regions of the world. During the past 50 years, more than half of all countries have experienced conflicts, but nearly 70 percent of countries in sub-Saharan Africa have experienced an armed conflict since 1980 (Raleigh et al., 2010). Evidence appears to indicate a strong link between climate variability and increased likelihood of more conflict. If those forecasts are accurate, policy makers will need to understand how conflicts affect children and how households respond to these shocks.

The relationship between climate, conflict, and children could be linear; that is, climate variability may increase the risk of conflict, and this in turn may affect children. However, the relationship could also be nonlinear: conflict could render a population more vulnerable to future climatic events, or climate-triggered conflict could be different from other types of conflict, and those differences could make it more or less harmful for children. Furthermore, although conflicts are clearly bad in the short run, in the long run they may have net benefits for a society (for example, a revolution may overthrow a dictatorship), and we need to keep that in mind when we think about policies that could break the links between climate change and conflict or between conflict and children.

2. Climate Change and Conflict

Three economists—Marshall Burke, Solomon Hsiang, and Edward Miguel—recently surveyed the research on links between climate and conflict (Burke, Hsiang, and Miguel, 2015). They considered an enormous range of research on different types of conflict, including interpersonal and intrapersonal conflict, such as domestic violence, road rage, assault, murder, rape, and suicide; and intergroup conflict, such as riots, genocides, land invasions, gang violence, civil wars and wars between nations.[1] According to the most recent World Health Organization estimates, in 2012 collective violence caused about 119,000 deaths, interpersonal violence caused 505,000 deaths, and 804,000 people committed suicide. Given the large number of suicides, we know surprisingly little about the relationship between climate and suicide.

Their review focused on research that uses the best statistical tools to estimate causal relationships. Across the 55 studies they examined, they found that both extreme temperatures and rainfall (changes in climate towards hotter and drier periods) increase the risk of conflict although the effect is stronger on intergroup conflict than on interpersonal conflict.

Notably, these results hold across different geographic scales. At the village level, in Tanzania, murders of people accused of being witches increase when droughts are more extreme (Miguel, 2005). In East Africa, looking at cells that are one degree of latitude by one degree of longitude in size, higher temperatures are still linked to more local violence (O'Loughlin et al., 2012). Expanding to the country level, evidence links temperature and civil wars (Burke et al., 2009). And, finally, throughout the tropics, the probability that civil conflicts will begin increases as sea-surface temperatures rise (Hsiang, Meng, and Cane, 2011).

[1] Historical research has also shown a link between extreme climatic events and the collapse of civilizations and institutional change (Haug et al., 2003; Buckley et al., 2010).

However, Burke, Hsiang and Miguel find a big gap in the research. We do not understand the mechanisms that link climate to conflict or how societies adapt to climate change. For instance, we know relatively little about the economic, non-economic, and even psychological channels that link climate extremes to conflict. In low-income countries where most people are farmers, a link between extreme temperatures or droughts and reduced income is plausible, and the suggestive evidence is strong. In richer countries, the evidence shows links between high temperatures and increased crime, suggesting that non-economic channels, such as psychology, might explain the relationship. Many pathways likely lead from climate variability to conflict, and those channels could be highly context-specific.

2.1 Climate Change and Intergroup Violence

One of the first economics studies on climate, economic conditions, and conflict estimated the causal relationship between economic conditions and civil war in African countries from 1981 to 1999 (Miguel, Satyanath, and Sergenti, 2004). Earlier research had found an association between economic conditions and civil wars but had not been able to convincingly establish a causal relationship. Given that most of Africa's economies are based on rain-fed agriculture, the researchers measured the relationship between conflict and years of particularly low rainfall. Their dataset had two key limitations. First, its definition of conflict specified that the government of a state must be one of the actors in the conflict; second, it specified that a conflict must result in at least 25 battle-related deaths in a year. Thus their analysis excludes types of organized violence that do not involve the state, such as violent crime or clashes among ethnic groups, as well as smaller conflicts. Keeping those limitations in mind, they found that poor rainfall in a given year lowered economic growth and increased the likelihood of civil wars in the

following year. The magnitude of the relationship was large: a five percentage point drop in annual economic growth increased the chance of a civil war in the following year by 50 percent.

Building on this work, another study looked at how temperature variability might affect armed conflict in Africa (Burke et al., 2009). Most previous research on the link between climate variability and conflict had focused on the role of rainfall, which is certainly appropriate when we consider how rain-fed agriculture influences both economic output and employment in developing countries. However, climate change models are much less certain about future rainfall changes (for Africa in particular) than they are about temperature changes; they consistently predict higher temperatures in Africa over the next few decades. Agricultural evidence confirms that for every degree Celsius of warming, agricultural yields in Africa would be reduced by 10 to 30 percent, mainly through increased evapotranspiration and quickened crop growth. The researchers found strong historical links between higher temperatures and increased likelihood of civil wars: an increase in the average annual temperature of 1° Celsius (1.8° Fahrenheit) leads to a 4.5 percent increase in civil war in that year and a 0.9 percent increase the next year. If the historical relationship between temperature and conflict holds, the authors calculated, we can expect a 54 percent increase in armed conflicts in Africa by 2030.

Not all scholars agree that climate change is actually linked to civil wars. Halvard Buhaug, a research professor at the Peace Research Institute Oslo, has used alternative measures of drought, heat, and civil war and alternative model specifications to argue that climate variability is not a good predictor of conflict (Buhaug, 2010). He blames African civil wars on ethno-political exclusion, poor economies, and the collapse of the Cold War patronage system. But his analysis has been shown to be based on faulty econometrics (Burke et al., 2010). Despite that, Buhaug makes two convincing points. First, the link between climate change and civil wars

in Africa may not hold for smaller-scale conflicts (defined as those with more than 25 but fewer than 1,000 deaths in a year), though that is not necessarily the question the research he critiqued was attempting to answer. Second, the relationship between temperature and civil wars that existed from 1981 to 2002 no longer holds, according to more recent data: the incidence of civil wars has fallen as temperatures have continued to increase.

Until recently, research on the links between climate and conflict was limited. But during the past few years, debate over the link has grown. In 2012, a special issue of the *Journal of Peace Research* focused exclusively on climate change and conflict. The 16 studies included in the special issue show varying results, and definite conclusions are hard to draw. For instance, some of the researchers found that in certain contexts, more conflicts and killings take place during seasons of relative abundance or after wet years than during seasons of scarcity; other researchers found that civil war is more likely in dry conditions (Adano et al., 2012; Raleigh and Kniveton, 2012; Theisen, 2012). Those context-specific results and the lack of definitive conclusions might stem from the fact that many of the studies in the special issue dealt with intergroup violence at levels below the state rather than the civil wars and interstate conflicts that previous researchers had examined.

While most previous research has compared data on weather and conflicts at the country level, one recent study analyzed civil conflict in Africa at the sub-national level (within cells of one degree latitude by one degree longitude) for the years 1997–2011 (Harari and La Ferrara, 2013). They used a drought index that takes into account rainfall, evaporation, and temperature; such an index is particularly relevant for agricultural production because it captures within-year variation in the timing of weather shocks and variation in crop cover. They found that weather shocks that affect the main crop grown in a region have a large impact on conflict, but weather

shocks that happen outside the main growing season have no relationship to conflict, suggesting that agricultural yields constitute the mechanism linking climate variability to conflict.

Several other more recent studies have also focused on within-country variation in examining the link between climate and conflict (Eynde, 2011; Dell, 2012; Jia, 2014). One researcher consulted four centuries of historical data from China at the prefecture level to find that severe droughts increased the likelihood of peasant revolts, though the relationship was substantially mitigated when farmers began growing drought-resistant sweet potatoes. Another researcher, looking at insurgency and drought during the early 20th century Mexican revolution, found that municipalities experiencing severe drought were more likely to see insurgent activity. Finally, another researcher found that poor rainfall in India from 2005 to 2011, measured at the district level, increased a Maoist insurgency's violence against civilians.

In 2013, two years before their recent review discussed earlier, Hsiang, Burke, and Miguel conducted a meta-analysis of studies on the link between climate variability and conflict, drawing on research from such disciplines as archaeology, criminology, economics, geography, history, political science, and psychology (Hsiang, Burke, and Miguel, 2013). The 60 primary studies they evaluated used 45 conflict datasets from all regions of the world and covered a range of time periods from 12,000 years ago to the present, examining everything from interpersonal violence to crime, political instability, and the collapse of civilizations. A robust and consistent finding from the 60 studies was that deviations from normal rainfall and temperature increase the occurrence of conflicts. Specifically, an increase in temperature or extreme rainfall that is still within the range we might expect today can raise the likelihood of interpersonal violence by 4 percent and of intergroup violence by 14 percent. Effects of that magnitude are worrisome, given

that climate models predict much larger variability in heat and rainfall for some regions in the coming years.

2.2. Climate Change and Interpersonal and Intrapersonal Violence

Although the evidence linking climate variability and conflicts between nations is growing, we know much less about how climate change may affect criminal behavior. Recently, a number of researchers have begun to expand the focus of climate-conflict research to see whether there is a relationship between extreme temperatures and murders, assaults, rapes, and suicides. One study used 30 years of monthly county-level U.S. data on crime and weather, finding that extreme temperatures have a strong positive effect on criminal activity (Ranson, 2014). The author used his model to make detailed predictions, although he assumed limited adaptation to climate changes. His model showed that by 2100, U.S. crime rates will be 1.5 to 5.5 percent higher for most crimes, and climate change will have caused an additional 22,000 murders, 180,000 cases of rape, 1.2 million aggravated assaults, 2.3 million simple assaults, 260,000 robberies, 1.3 million burglaries, 2.2 million cases of larceny, and 580,000 vehicle thefts.

A study from India focuses on a particular type of homicide: dowry deaths. These are killings of married women who supposedly did not bring enough dowry to their marriage (Sekhri and Storeygard, 2014). Dowry deaths typically happen after the marriage, when the initial dowry paid at the time of the wedding is already controlled by the husband. In response to poor rainfall, the husband may demand additional transfers from the wife's family; because the stigma associated with divorce in India is extremely high, the wife is not in a strong bargaining position. Husbands (or the husbands' extended families) may resort to killing the wife so that the husband can re-enter the marriage market and secure another dowry. The researchers used data from almost 600 districts in India for 2002–2007, empirically measuring how rainfall shocks affect

dowry deaths. Significant declines in rainfall in a given year led to a 7.8 percent increase in dowry deaths and a 4.4 percent increase in domestic violence against women more generally. They also examined women's political representation in the national parliament as a possible strategy to mitigate the impact of rainfall shocks but found it had no mitigating effect on dowry deaths.

Another study used district-level data from two states in India to estimate the relationship between temporary economic shocks to agriculture caused by poor rainfall and the incidence of suicide in the affected families (Hebous and Klonner, 2014). When lack of rainfall increased poverty, suicides rose among men—a 1 percent increase in poverty from poor rainfall meant that male suicides rose by 0.6 percent. Among women, however, suicides actually declined under the same conditions.

2.3 Mechanisms Linking Climate Change to Conflict

As we can see from the previous section, evidence for a relationship between climate variability and conflicts is quickly growing, and the consensus indicates hotter temperatures and reduced rainfall are leading to more conflicts, broadly defined. But what are the mechanisms that link temperature and rainfall variation to increased conflicts? At the moment, this is probably the biggest gap in our knowledge, and researchers are attempting to answer the question because more detailed understanding of the mechanisms will lead to better long-run predictions.

One group of researchers used data from Mexico to see whether economic factors might be the main mechanisms linking climate variability and conflict (Baysan et al., 2015). They explored the relationship between high temperatures and three distinctly different types of conflict: gang killings by drug trafficking organizations, homicides, and suicides. High temperatures produced a large and similar increase in all three types of violence, suggesting that

the mechanism linking climate variability and conflict is likely to consist of psychological or physiological factors that are affected by temperature.

Another group of researchers looked at how historical fluctuations in temperature within a given country affected aggregate economic outcomes (Dell, Jones, and Olken, 2012). In poor countries, but not in wealthier ones, higher temperatures reduced economic growth, growth rates, and both agricultural and industrial output. Specifically, in poor countries, a 1° Celsius (1.8° Fahrenheit) increase in average temperature over a given year lowered economic growth by 1.3 percentage points.

More recently, the same group reviewed research on how temperature and precipitation affect economic outcomes (Dell, Jones, and Olken, 2014). Taken together, the studies they examined showed that changes in local weather over time can affect agricultural output, industrial output, labor productivity, health, and economic growth. Similarly, but on a planetary scale, another pair of researchers examined whether the El Niño-Southern Oscillation, which causes large fluctuations in temperature and rainfall in the tropics, can drive economic volatility in those areas (Hsiang and Meng, 2015). They found that across the tropics, higher temperatures and lower rainfall tied to El Niño reduced cereal yields and agricultural income in general.

3. How Conflict Affects Children's Wellbeing

Much of the earlier research on conflict was oriented toward macroeconomic issues and generally focused on understanding the causes and spread of war and its role in reducing economic growth (Collier and Hoeffler, 1998; Collier, 1999). Civil wars often cause immediate economic harm by destroying productive capacity and disrupting normal activity. In the long term, however, most countries bounce back after wars are over. For instance, postwar economic recovery was extremely strong in Japan, West Germany, and Vietnam despite the bombings by

the Allied forces in World War II and by the Americans during the Vietnam War (Davis and Weinstein, 2002; Brakman, Garretsen, and Schramm, 2004; Miguel and Roland, 2011). In Vietnam, areas bombed more heavily showed no long-term effects on poverty rates, consumption levels, literacy, infrastructure, or population density compared with areas that saw less bombing (Miguel and Roland, 2011). In Sierra Leone, households exposed to the civil war turned out to be more rather than less involved after the war in local collective action, including voting, joining political and community groups, and attending community meetings (Bellows and Miguel, 2009). A study of the aftermath of 41 civil wars that occurred from 1960 to 2003 found that although the wars did significant harm across a range of indicators, such as economic performance, political development, demographic trends, and security, once lasting peace was achieved, stability and the economy improved (Chen, Loayza, and Reynal-Querol, 2008).

Despite the casualties and destruction that wars cause, until very recently, researchers had paid relatively little attention to how wars affect children. Although wars may not generally produce long-term macroeconomic harm, research that looks at the microeconomic impacts of exposure to conflict has consistently found harm among groups of people who were directly exposed.

Wars are generally viewed as bad and worth avoiding, and so research that finds that people exposed to wars can be worse off might seem to state the obvious. However, governments and international organizations need accurate assessments of the full long-term costs of conflicts in order to make decisions with respect to post-conflict interventions. Evidence increasingly suggests that the effects of exposure to conflicts are both longer-lasting (experienced over the entire lifecycle) and more extensive than many might suspect. Knowing which ages are most affected is also critical for targeting remediation efforts in the most effective way.

In contrast to research on climate change and conflict, research examining the impacts of conflict on children focuses almost exclusively on intergroup conflict and not interpersonal violence. Most of this research on the impacts of conflict exposure examines health or education impacts in both the short and long run. As more data has become available, researchers have started to examine how conflict exposure affects other outcomes, including the labor market, mental health, and political beliefs. Such research typically exploits variation in the geographic extent and timing of a conflict and the extent to which different birth cohorts are exposed to the fighting.

3.1 Short-Term Health Impacts

One of the earliest analyses of how conflict exposure affects children's health examined the civil war that began in October 1994 in Burundi's northwestern provinces and then spread across the country (Bundervoet, Verwimp, and Akresh, 2009). The fighting caused enormous macroeconomic disruptions; from 1990 to 2002, per capita income in Burundi fell from $210 to $110, making it the world's poorest country. In the same period, the proportion of people living below the nationally defined poverty line increased from 35 to 68 percent, and the spread of the civil war starting in 1994 led to double digit inflation rates, which peaked at more than 30 percent in 1997 (all figures are from the International Monetary Fund (2007)).

That study focused on early childhood malnutrition and on stunting as measured by age and gender-standardized measures of height. Combining data from a nationally representative household survey (the 1998 Burundi Priority Survey carried out by the World Bank and the Burundi Institute of Statistics and Economic Studies) with data on the timing and evolution of the conflict from 1994 to 1998, the researchers found that children who had been exposed to war were shorter than those who had not been. Based on other research that links children's height to

educational outcomes and returns to schooling, they estimated that the average child exposed to the war would complete 0.7 fewer years of school and earn 21 percent less as an adult.

Much of the research on conflict and health has focused on civil wars, but wars between nations are also common. In many cases, particularly in Africa, conflicts between nations are started or exacerbated by territorial disputes.[2] Using household survey data from Eritrea, one study aimed to estimate how exposure to the 1998–2000 Eritrea-Ethiopia war affected children's health (Akresh, Lucchetti, and Thirumurthy, 2012). When Eritrea, formerly a province of Ethiopia, became independent in 1993 following a long guerrilla war, the countries never demarcated certain sections of the new border. Full-fledged fighting over those areas started in May 1998. Though the region has been described as desolate and inconsequential, more than 300,000 troops dug in and deadlocked on both sides of the border. Because most civilians fled the war-torn areas, leaving the armies to fight over empty villages, most of the conflict's casualties were soldiers.

As in the Burundi study, the Eritrea study exploited variation in the conflict's geographic extent and timing and the extent to which different birth cohorts were exposed to the fighting. Helpfully, household survey data included information on each household's region of residence during the war—in addition to region of residence at the time of the survey—thereby improving the accuracy of the results; without that information, war exposure could have been classified incorrectly. The authors found that war-exposed children were shorter, with similar effects on height for children born before or during the war. Because the study was able to accurately record a child's region of residence at the time of the war, the estimated negative impacts of

[2] The United States Central Intelligence Agency World Factbook (2010) lists over 187 regions in the world that have disputes over international land or sea boundaries or have resource or resident disagreements; 50 of these disputes are in Africa.

exposure to conflict were 13 percent larger than they would have been if the study had used the child's region at the time of the survey.

Other recent research on conflict and health has attempted to improve measures of conflict exposure by incorporating global positioning system (GPS) data on the distance between survey villages and conflict sites to more precisely capture a household's exposure to conflict (Akresh, Caruso, and Thirumurthy, 2014). This research builds on the study of the Eritrea-Ethiopia war by using survey data that include households' GPS locations. The GPS-based approach showed that in Eritrea, 24 percent of households within 100 kilometers (about 62 miles) of the battle sites had been previously coded as not being in war regions; similarly, 28 percent of Ethiopian households within 100 to 300 kilometers of conflict sites had been previously coded as not being in war regions; and 2.2 percent of households that were more than 300 kilometers from conflict sites had been coded as being in war regions. Using GPS information, the authors estimated detrimental effects that were two to three times larger than they would have been if exposure had been measured only at the [imprecise] regional level. Specifically, children exposed to the war and living nearest to the battle sites were shorter by approximately 1 to 2 inches; the negative impact diminished as distance from the conflict increased.

Because of the fortuitous timing of the household survey data collection, the researchers were also able to explore whether the conflict had different effects on children who were fetuses in the womb at the time of the fighting compared with those who were in early childhood (ages 0-5), thereby assessing the relative importance of disturbances during those two critical growth periods. Exposure in the womb may harm children's health for a number of reasons, including poorer maternal nutrition due to disruptions in food supply or income shocks, lack of adequate

prenatal care, and the possibility that the conflict reduced the number of deliveries in the presence of trained providers. Though much research finds later-life effects from shocks experienced in the womb, several recent studies have not confirmed those findings; however, this study found that Ethiopian and Eritrean children exposed to the war while in the womb were significantly shorter (Endara et al., 2009; Maccini and Yang, 2009; Fletcher, 2014).

The researchers were also able to examine whether conflict-exposed children in Ethiopia, the nation that won the conflict, suffered smaller health consequences than children in Eritrea. Theoretically, households in a winning nation might suffer less destruction or face fewer disruptions to their economic activities or public health delivery systems. Although children in the losing country, Eritrea, suffered more than those in Ethiopia, the researchers found sizeable negative impacts for both boys and girls in both countries, and the effects were comparable in magnitude whether exposure occurred in the womb or during early childhood.

Researchers have only just begun to explore the mechanisms by which conflicts affect children's health. Looking at health-seeking behaviors and indicators of maternal stress, researchers have found evidence that conflict-exposed children are less likely to be delivered at hospitals, suggesting health service delivery may be compromised in conflict areas. Furthermore, conflict-exposed children are more likely to be very small at birth, and their mothers are more likely to experience post-birth complications. Disruptions in health care delivery and added maternal stress are mechanisms that could explain conflict-exposed children's lower heights. From a policy standpoint, those results suggest that households may not be able to adequately cope with conflicts that disrupt the economy and displace people, even if the number of civilian casualties is limited.

Although we know a lot about how non-conflict shocks affect children, few studies have compared the effects of exposure to conflict with the effects of exposure to other types of shocks. One group of researchers examined whether exposure at birth to small-scale localized conflict had different effects on Rwandan children's health than did exposure at birth to crop failure (Akresh, Verwimp, and Bundervoet, 2011). The conflict was an outbreak of localized fighting in northern Rwanda in October 1990, and the crop failure was a localized and extremely severe event in southern Rwanda in 1988–1989. The researchers had access to household survey data that asked about agriculture and child health, as well as to reports on the fighting from nongovernmental organizations. They used variation across birth cohorts and region of residence to capture a child's exposure to the shock. Both crop failure and armed conflict harmed children's health. But gender and poverty affected the outcomes differently. Both boys and girls born during the fighting in regions experiencing the conflict were shorter in stature no matter whether they were poor or better off. Conversely, only girls were harmed by the crop failure, and the impact was worse for girls from poor households.

Research on how various kinds of shocks affect children commonly finds evidence of gender bias. For instance, evidence on agricultural shocks in India and China shows better outcomes for boys than for girls when it comes to infant mortality, disability, and illiteracy (Rose, 1999; Mu and Zhang, 2008). Thus, in contrast to findings of gender bias in response to other types of shocks, it is significant that we see no such gender bias in response to conflict. Researchers have consistently found that both boys and girls exposed to conflict suffer negative health effects.

We do not know for certain why conflict and crop failure affect children differently, or, more accurately, affect different children. But we do know that the October 1990 fighting in

northern Rwanda began suddenly and unexpectedly, which could explain why both boys and girls in both poor and better-off households were harmed by the conflict: Parents could not protect any of their children from this type of event. Case studies conducted by local organizations suggest that theft of crops and livestock and families' violence-induced displacement from their homes into the surrounding forests were the principal mechanisms at work. Both of these mechanisms would reduce children's nutrition, and displacement also makes children more vulnerable to illnesses from contaminated water and to diseases transmitted by insects and other pests. In contrast, during the crop failure, households were able to shield boys from harm—consistent with other research demonstrating that households practice gender discrimination by reallocating scarce resources toward boys and therefore only girls suffer the negative effects —and better-off households were able to avoid the shock entirely.

Most of the research on how conflict affects health focuses on wars. Political repression has received much less attention from economists, mainly because we have lacked adequate data. One recent study looked at political and economic repression by the government of Zimbabwe (Shemyakina, 2015b). From 2000 to 2005, Robert Mugabe's government in Zimbabwe violently repressed the opposition party through farm invasions and land theft, leading to an economic crisis, hyperinflation, and an environment of general insecurity. Looking at data from 1999, before the repression began, and from 2006, after it ended, the study found large negative effects on children's height. Like exposure to conflict, exposure to political violence appears to harm both boys and girls.

Another study, which looked at the Indian state of Andhra Pradesh, examined the combined effect of exposure to political violence and drought on child malnutrition (Tranchant, Justino, and Müller, 2014). Andhra Pradesh has experienced a guerrilla insurgency for decades.

At the same time, households there face cyclical climatic shocks that affect their children's nutrition. The study found that drought harmed child nutrition only in villages that saw political violence, and that the violence made it harder for households to cope with the droughts.

Though much of the research on childhood exposure to conflict focuses on height as a measure of health, some researchers have examined birth weight as an indicator. In Colombia, for example, one study found that random terrorist landmine attacks occurring during the first trimester of pregnancy reduced children's birth weight and increased the likelihood of a preterm delivery (Camacho, 2008). Another study examined the conflict that began in 2000 between Israel and the Palestinians living in Gaza and the West Bank, during which noncombatants experienced intense psychological stress, which is known to increase the risk of having a low-birth weight child—that is, an infant who weighs less than 2,500 grams (5.5 pounds), a threshold associated with worse health outcomes in the long term (Mansour and Rees, 2012). Each additional conflict-related death to which a pregnant woman was exposed during her first trimester of pregnancy further increased the likelihood that she would have a low-birth weight child. Similarly, a study of the Mexican drug war found that exposure to violent crime during the first trimester of pregnancy reduced birth weight by an average of 75 grams and increased the risk of having a low-birth weight child by 40 percent (Brown, 2014). These studies on birth weight suggest that maternal stress may be one of the mechanisms through which exposure to conflict harms children's health.

3.2 Long-Term Health Impacts

Most of the research that examines how children's exposure to conflict affects their health focuses on short-term impacts. Recently, however, several researchers have started to explore the long-term effects. Across many types of conflicts in different regions, research tells us that even

if children's health improves as a tangible peace dividend once a conflict is over, a generation of children exposed to the conflict will continue to suffer adverse effects long after the fighting ends.

One group of researchers examined the Nigerian civil war—the first modern war in sub-Saharan Africa after independence and one of the bloodiest—which took place from July 1967 to January 1970 in Biafra, a secessionist region in southeast Nigeria (Akresh et al., 2012b). The war caused widespread malnutrition and devastation, and 1 million to 3 million people died. The researchers measured the impact of war exposure in the womb or during childhood on adult height, which has been found to be correlated with intelligence and economic success. They found that 40 years after the war ended, its full consequences were still being realized. Women who had been exposed to the war for the average duration between the time they were newborns and three years of age were 0.75 centimeters (0.3 inches) shorter than women the same age who had not been exposed. Women who were exposed when they were 13 to 16 years old were 4.53 centimeters shorter.

The fact that war exposure in adolescence had the strongest impact is striking. This effect may have stemmed from disruption of the normal adolescent growth spurt. Children's growth in height is fastest during infancy, slows down until around age three, and then continues at a low rate until peaking again in adolescence (Beard and Blaser, 2002). However, we have limited causal evidence of how nutritional deprivation affects children at different ages, and we particularly lack studies that compare how shocks experienced during adolescence differ from shocks experienced during early childhood (Cunha and Heckman, 2007; Case and Paxson, 2010). Certainly, even if children grow faster in early childhood than they do as teenagers, the increase in food demand that accompanies adolescents' growth spurt may be greater, given their

larger size. But because so few researchers have examined children's exposure to conflict at ages older than five years, we do not know whether the effect observed in Nigeria is specific to the local context or whether adolescent exposure is systematically different from exposure in the womb or during early childhood. In either case, this is an important avenue for future research.

A follow-up study—the first to explore the impact of conflict on second-generation outcomes—examined the intergenerational transmission of harm from exposure to the Nigerian conflict (Akresh et al., 2015). The Biafra war was extremely violent. Households in the war-affected regions faced both nutritional deprivation and displacement. The Nigerian government blockaded the region, and starvation reached critical levels. This study analyzed whether mothers' exposure to the Nigerian civil war as children, at any point from before birth to adolescence, had a persistent adverse effect on their children's health. To be clear, this second generation was not born during the war, so they were not exposed to any shock, but their adult mothers had been exposed to the conflict when they themselves were children. The researchers found that the war had significant negative impacts on the mothers' health and education (first-generation impacts), which then led to higher mortality and more stunting among their children (second-generation impacts). However, second-generation impacts were seen only among children of mothers who had been exposed to the conflict during their adolescent years. The fact that exposure during adolescence led to the largest negative effects in the first generation could explain the second generation impacts, but the authors were unable to rule out alternatives. Future research can help establish whether the results from Nigeria can be seen elsewhere and start to uncover the mechanisms that link impacts across generations.

3.3 Short-Term Education Impacts

Exposure to conflict harms children's education as well as their health. Most research on this subject examines school enrollment and years of education completed. An early study looked at how exposure to the 1994 Rwandan genocide affected children's educational outcomes (Akresh and de Walque, 2008). The Rwandan genocide killed at least 800,000 people, or 10 percent of the country's population, in approximately 100 days (Des Forges, 1999). However, the war was short, and the country was taken over by a relatively well-organized regime after the end of the fighting. Armed conflicts typically do immediate economic harm, and Rwanda's experience was no exception. During the genocide, per capita GDP plummeted almost 50 percent and consumer prices increased 64 percent. But by 1996, both had returned nearly to prewar levels (all figures from International Monetary Fund (1998)). Exports of coffee, the country's predominant export crop, declined 54 percent in 1994 but returned to prewar levels in 1995. Given the rapid return to prewar economic levels, we might expect that long-run impacts would not be severe.

The researchers examined whether and how the genocide affected children's school enrollment and the probability that children would complete a particular grade. They combined two nationally representative household surveys: one collected in 2000, six years after the genocide ended, and one collected in 1992, two years before it began; few studies of conflicts have data from both before and after the event. Overall education rates in Rwanda, on average, improved between 1992 and 2000, as the fraction of people with no education decreased from 30 to 24 percent. However, that overall improvement masked a large negative effect for the children who were school-age when exposed to the genocide in 1994. Using the prewar data to control for baseline schooling levels for a given age group and exploiting variation across provinces in the intensity of killings and in which cohorts of children were school-aged when exposed to the war, they found that the genocide had a strong negative effect. Exposed children completed half a

year less of school, an 18.3 percent decline. Following the end of that brutal period in Rwandan history, aggregate measures of the economy as well as overall children's schooling rates have rebounded, although the generation of children exposed to the conflict is still experiencing adverse effects long after the fighting ends.

A study of Tajikistan's 1992–1998 civil war also found negative effects on schooling (Shemyakina, 2011). That study was one of the first to incorporate household-level measures of conflict exposure—specifically, whether individual households experienced any damage to their dwellings during the war—in addition to typically used measures of exposure at the province level. The researcher found that people who were of school age during the conflict were less likely to complete their mandatory education than were people old enough to have finished their education before the start of the war. The impact on schooling had a gendered component: girls exposed to the conflict were less likely to be enrolled in school, but there was no equivalent impact on boys.

On the other hand, a review of the research on how conflict affects education found that either boys' or girls' schooling can suffer greater harm depending on the setting (Buvinić, Das Gupta, and Shemyakina, 2013). Factors that can tilt the gendered impacts one way or the other include the specifics of the conflict itself, prewar differences in education levels for each gender, and labor market and educational opportunities in the absence of war. A study of the civil conflict that took place in Nepal from 1996 to 2006 illustrates just how much difference the context can make when it comes to a conflict's effect on education (Valente, 2014). In districts that saw more casualties from the conflict, girls' educational attainment increased. But in districts that saw more abductions by the Maoist insurgents, who often targeted schoolchildren, the opposite was true.

Although most researchers have focused on how conflict affects school enrollment, two recent studies examined student academic achievement. The first study found that the 2000-2006 Israeli-Palestinian conflict reduced the likelihood that Palestinian students would pass the final high school exam and be admitted to college (Brück, Di Maio, and Miaari, 2014). The second found that gang warfare in Rio de Janeiro's favelas from 2003 to 2009 reduced fifth graders' standardized math test scores. Both studies suggested the students' worsening psychological wellbeing as the possible mechanism linking conflict and lower scholastic achievement.

Turning to a broader definition of conflict, researchers have found that domestic violence and school-based violence harm children's test scores and high school graduation rates (Grogger, 1997; Carrell and Hoekstra, 2010). Furthermore, evidence indicates that childhood abuse has long-term impacts on the likelihood of committing future crimes, achieving less education, and earning less as an adult (Currie and Widom, 2010; Currie and Tekin, 2012).

3.4 Long-Term Education Impacts

Although the research measuring conflict's short-term effects on education is more extensive, some researchers have examined the longer-term educational impacts. For example, one study found that exposure to Peru's 1980-1993 civil war had long-lasting negative impacts on schooling, particularly among children exposed early in life (Leon, 2012). Specifically, children exposed to the conflict before reaching school age accumulated 0.3 fewer years of schooling by the time they became adults. On the other hand, children who were already of school age when they were exposed to the conflict were able to fully catch up to their peers who were not exposed. In Germany, school-age children who experienced the destruction caused by Allied bombing during WWII suffered long-lasting harm to their education and, as adults, to their employment outcomes (Akbulut-Yuksel, 2014).

3.5 Other Impacts

Recently, researchers have looked beyond health and education and started to measure how conflict affects labor market outcomes, mental health, and political beliefs.

3.5.1 Labor Market

Exposure to Peru's civil war during the first three years of children's lives led to a 5 percent decline in monthly adult earnings and a 3.5 percent reduction in the probability of working in the formal economy; the negative effects were 5 percent larger for women than for men (Galdo, 2013). Survey data shows that Ugandan adults who were abducted as children by rebel groups and forced to become soldiers in the rebel army during Uganda's 1990s civil war had attained almost one year less of schooling, were half as likely to be working in a skilled job, and had one-third less annual earnings (Blattman and Annan, 2010). In Tajikistan's 1992–1998 civil war, on the other hand, younger women (defined as those who were of school age or who had recently entered the labor force) exposed to the conflict were 10 percent more likely to be employed than were women the same age who lived in regions that had experienced less conflict (Shemyakina, 2015a). There were no such effects for men, nor were there effects on wages for men or women. Thus the only effect of exposure to the conflict was to increase women's participation in the labor force, possibly as a coping strategy during a crisis.

3.5.2 Mental Health

Research on how exposure to conflict affects mental health typically faces methodological challenges, including lack of validated mental health scales in surveys and difficulties in measuring individual exposure to conflict. However, some researchers have overcome those obstacles. A study of the 1992-95 conflict in Bosnia and Herzegovina used a clinically validated scale of mental health and war exposure based on administrative data on war casualties (Do and

Iyer, 2009). Surprisingly, the study found no significant differences in adult mental health among people who had experienced different levels of exposure to the conflict. Looking at conflict-induced displacement in Colombia since the mid-1990s, another study found that people who had been exposed to severe violent events suffered feelings of hopelessness and pessimism about their prospects for upward mobility (Moya and Carter, 2014). The authors argued that those changes in mental health create psychological barriers that impede people's recovery after a conflict ends.

3.5.3 Political Beliefs

Conflict's effects on preferences and beliefs have not received as much attention from researchers as have effects on health, education, and labor market outcomes. From a theoretical perspective, because children growing up in difficult circumstances are surprisingly psychologically resilient, conflict exposure might not lead to distrust, factionalism, or disengagement from the political system or to other types of outcomes that could produce continuous violence. Recently, researchers examined whether exposure to conflict-related violence during childhood affected adults' political beliefs and engagement (Adhvaryu and Fenske, 2014). Reviewing all conflicts in sub-Saharan Africa since 1945, they found that conflict exposure as children had little effect on political attitudes or engagement as adults. Another set of researchers, examining the Burundi civil war, conducted a series of field experiments to measure how conflict exposure affected social, risk, and time preferences and found that individuals exposed to conflict act more altruistically, take more risks, and are less patient (Voors et al., 2012).

4. Conclusions

Research shows strong links between hotter temperatures, reduced rainfall, and more conflict, broadly defined. Despite the fast-growing evidence, however, we still know little about the mechanisms that link temperature and rainfall variation to conflict or about how societies respond and potentially adapt to climate change. In addition, we have almost no evidence on what policies (for instance foreign aid, refugee support, or cash transfers) could best reduce the effects of climate change-related violence on children. We also do not know whether the fact that climate triggers a given conflict means that we need to adopt different policies to mitigate the impacts. Another open question is the extent to which violence directly causes poor outcomes for children or whether violence is only a symptom of other, unobservable factors, such as mismanagement of resources or poorly run institutions that are themselves harming children.

In the past decade, we have learned a lot more about the impact of exposure to conflicts and violence. We have strong evidence, from different types of conflicts worldwide, that conflict exposure in the womb and during early childhood harms children's health and education. However, because researchers often rely on geographically large administrative regions to measure conflict exposure or ignore conflict-induced migration/displacement, they may not always accurately measure a given individual's conflict exposure. Given the importance of the issue, we also have surprisingly little evidence about how conflict exposure beyond early childhood affects children and relatively little research examining the long-term and intergenerational impacts of conflict exposure. Often because of limitations in the data, we also know very little about the specific mechanisms that link conflict exposure to particular outcomes, about the behavioral adaptations that households adopt in response to conflict, or about the compensating or reinforcing investments that parents make for their children (Akresh et al., 2012a). Although many researchers have speculated about what those mechanisms might be,

convincing evidence is rare. We also know little about how exposure to conflicts is similar or different compared with exposure to other types of shocks, particularly when it comes to how conflict affects different types of children (for example, boys versus girls) or children at different ages. Recent research on natural disasters has started to disentangle the impacts caused by different types of disasters; we need similar research with respect to different types of violence (Caruso, 2014).

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