Wars and Child Health: Evidence from the Eritrean-Ethiopian Conflict *

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Abstract

This is the first paper using household survey data from two countries involved in an international war (Eritrea and Ethiopia) to measure the conflict's impact on children's health in both nations. The identification strategy uses event data to exploit exogenous variation in the conflict's geographic extent and timing and the exposure of different children's birth cohorts to the fighting. The paper uniquely incorporates GPS information on the distance between survey villages and conflict sites to more accurately measure a child's war exposure. War-exposed children in both countries have lower height-for-age Z-scores, with the children in the attacked but winning country (Ethiopia) suffering as much as the war-instigating and losing nation (Eritrea). Both boys and girls who are born during the war experience negative impacts due to conflict. Effects are robust to including region-specific time trends, alternative conflict exposure measures, and addressing potential biases due to endogenous migration.

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1. Introduction

Conditions experienced early in life or in utero have been shown to have persistent and long-term effects on health, education, and socioeconomic outcomes (see seminal work by Stein et al. (1975) and more recent papers by Maccini and Yang (2009) and Maluccio et al. (2009)). Barker (1998) argues that health shocks suffered in utero can cause irreversible adaptations to the local food environment and that children cannot catch up even if they later have good nutrition and health care. Consequently, shocks that negatively impact a child's growth trajectory may lead to lower adult height, less cognitive ability and education, lower productivity and wages, and worse marital outcomes (see Strauss and Thomas (2008) for a review of the link between early childhood health and later life outcomes). Wars are one type of negative shock, and since World War II, armed conflict has affected three-fourths of all countries in sub-Saharan Africa (Gleditsch et al., 2002). In many instances, particularly in developing countries, the conflicts are started or are exacerbated by territorial disputes.[1] Despite the casualties and destruction caused by wars, the impacts of conflict on health have received surprisingly limited focus in the literature, mainly due to data limitations, although that is changing recently (Alderman, Hoddinott, and Kinsey, 2006; Akbulut-Yuksel, 2009; Akresh, Verwimp, Bundervoet, 2011).[2]

In this paper, we examine the impact of exposure to an international war at birth or as a young child by estimating the subsequent effect on children's health status. We focus on the

[1] The United States Central Intelligence Agency World Factbook (2010) lists over 180 regions in the world that have existing disputes over international land or sea boundaries or have resource or resident disagreements; 41 of these disputes are in sub-Saharan Africa.

[2] Seminal work on conflict focuses on understanding the causes and spread of war and its role in reducing growth (Collier and Hoeffler, 1998; Miguel, Satyanath, and Sergenti, 2004; Guidolin and La Ferrara, 2007; Do and Iyer, 2010). The magnitude of conflict's long-term negative economic consequences are debated in the literature (see Davis and Weinstein (2002) for Japan; Brakman, Garretsen, and Schramm (2004) for Germany; Bellows and Miguel (2009) for Sierra Leone). There is also a growing literature examining the relationship between conflict and education outcomes (Ichino and Winter-Ebmer, 2004; Akresh and de Walque, 2008; Swee, 2009; Miguel and Roland, 2011; Shemyakina, 2011). Research focusing exclusively on soldiers finds large negative impacts on their earnings, and soldiers exposed to more violence face a harder time reintegrating into civilian society (Angrist, 1990; Imbens and van der Klaauw, 1995; Humphreys and Weinstein, 2007; Blattman and Annan, 2009).

1998-2000 Eritrea-Ethiopia war that was based on a territorial border dispute.[3] When Eritrea, formerly a province of Ethiopia, became independent in 1993 following a long guerrilla war, sections of the new border were never properly demarcated. Full-fledged fighting started in May 1998 over these areas, which have been described as desolate and inconsequential. Reporters have portrayed the Eritrea-Ethiopia war as having “echoes of World War One in its bloody stalemate and trench warfare” (GlobalSecurity.org, 2000). More than 300,000 troops were dug in and deadlocked on both sides of the border. Most of the conflict’s casualties were soldiers, since most civilians left the war-torn areas, leaving the armies to fight over empty villages.

We make four main contributions to the literature examining the impacts of shocks on children’s welfare. First, as noted above, there has been limited research measuring the impact of war on child outcomes, and this is the first paper able to measure the welfare impacts for the two sides involved in a war, thereby providing a more comprehensive and robust understanding of how wars affect children’s well-being. Second, we use multiple empirical identification strategies to measure the causal impact of war on child health. We combine data from nationally representative household surveys (2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys) with event data on the timing and geographic extent of the war to exploit the exogenous variation in children’s birth cohorts that are exposed to the conflict. Further, to address potential measurement error in accurately capturing a child’s war exposure that is often present when comparing large regions (parts of which experienced fighting and parts of which did not), we incorporate global positioning system (GPS) data on the distance between the survey villages and conflict sites. To verify that estimated health differences across regions and

[3] In the past 30 years, border wars were fought in Africa (Djibouti and Eritrea in 2008, Mauritania and Senegal starting in 1989, Burkina Faso and Mali in 1985, Ethiopia and Somalia in 1982), Asia (Cambodia and Thailand in 2008, India and Bangladesh in 2001, Israel and Lebanon starting in 2000, India and Pakistan in 1999, Thailand and Laos starting in 1987, India and China in 1987, Pakistan and India starting in 1984, Iran and Iraq starting in 1980, Vietnam and China starting in 1979), and South America (Ecuador and Peru in 1995, Ecuador and Peru in 1981).

birth cohorts are due to the conflict, we incorporate direct measures of the number of displaced individuals in each region as a share of the region's pre-war population to proxy for the war's intensity in that area. Third, because of the fortuitous timing of the household survey data collection, we are able to explore how the effects of the shock differ for children born during the conflict compared to those born before the war started (and were subsequently young children at the time of the fighting). Fourth, the paper contributes to the study of gender bias in early childhood development and how that bias is affected differently by conflict shocks. Our separate estimation of the impact of war exposure for boys and girls finds that both suffer negative consequences of similar magnitude, contrasting with the existing literature.[4]

We find that war-exposed children in both countries have lower height-for-age Z-scores. Our main results indicate that children born during the war and living in a war region have 0.39 and 0.45 standard deviations lower height-for-age Z-scores in Eritrea and Ethiopia, respectively, which represents declines of 20 and 31 percent compared to the average height-for-age Z-scores of children born during the war in a non-war region. Alternative measures of war exposure based on GPS location data or conflict intensity indicate negative impacts of a similar magnitude. Both boys and girls experience significant negative impacts that are similar in size. The results are robust to a number of alternative specifications that address issues of endogenous migration, fertility, and mortality, as well as potential misspecification of our geographic exposure variables. Based on the existing early childhood development literature, the negative health impacts of the Eritrean-Ethiopian conflict are also likely to have long-run welfare impacts on war-exposed children.

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[4] The contributions highlighted here are also the key differences between our paper and the most closely related prior work by Bundervoet, Verwimp, and Akresh (2009) who explore the impact of the Burundi civil war on child health. In particular, the multiple empirical identification strategies described earlier (GPS data and war intensity data) address the shortcomings of the difference-in-differences approach used in the Burundi paper, leading to a more convincing causal estimate of war's impact on child health.

Besides the previously discussed papers about impacts of shocks at birth, our results are related to research on gender bias during early childhood. Much of the literature finds evidence favoring boys over girls (see Rose (1999) for evidence from India that gender bias in infant mortality drops significantly when districts experience higher rainfall or Dercon and Krishnan (2000) for evidence from Ethiopia that poor households are unable to smooth their consumption, with women bearing the brunt of adverse shocks). However, in contrast to this literature, we find no differential gender impact of war on children's health, as both war-exposed boys and girls suffer negative consequences of similar magnitude.

The remainder of the paper is organized as follows. Section 2 provides an overview of the history of the Eritrea-Ethiopia conflict and sketches the spatial and temporal event data for the most recent war. Section 3 describes the survey data used in the analysis and explains the key variables. Section 4 describes the empirical identification strategy and Section 5 presents the main results as well as robustness tests. Section 6 concludes.

2. Eritrean-Ethiopian War

2.1 History of Conflict and Independence of Eritrea

The war between Eritrea and Ethiopia lasted two years beginning in 1998 and stemmed from a border dispute. Even before this war, the two countries had a long history of conflict with each other. The post-World War II period saw the former Italian colony of Eritrea become a region of Ethiopia, but growing dissatisfaction with the Ethiopian occupation led to a prolonged period of armed struggle by the Eritrean People's Liberation Front (EPLF) against the Ethiopian Marxist government. The war against Ethiopia ended in 1991 and coincided with the end of the Ethiopian civil war in which a coalition of rebel groups – the Ethiopian People's Revolutionary Democratic Front (EPRDF) – overthrew the government and came to power under the leadership of Meles

Zenawi. Following a referendum in Eritrea in May 1993, the sovereign state of Eritrea was formed with the EPLF leader Isaias Afwerki as President (EPLF was later renamed the People's Front for Democracy and Justice). The immediate period following Eritrean independence saw generally friendly relations between Eritrea and Ethiopia, in part because the governments had fought together against the previous Marxist government that formerly controlled Ethiopia.

At the time of Eritrean independence, both countries claimed sovereignty over three areas: Badme, Tsorona-Zalambessa, and Bure (see Figure 1 for a regional map of Eritrea and Ethiopia highlighting these three areas). Confusion over the border demarcation between the two countries was partially due to Ethiopia’s 1962 annexation of Eritrea, since at that time the former colonial boundaries were replaced by administrative boundaries within Ethiopia, some of which shifted slightly by 1993 (Global IDP Project, 2004b). A series of continued disputes in these three border areas combined with larger conflicts over trade and other economic issues, however, proved to be a major obstacle to maintaining peace.[5]

2.2 Spatial and Temporal Intensity of the Eritrea-Ethiopia War

In our analysis of child health, the exact timing and location of the fighting play a key role in our identification strategy. In May 1998, fighting broke out between Eritrean soldiers and Ethiopian militia and security police in the Badme area, which was under Ethiopian control.[6] Within a week, the Ethiopian Parliament declared war on Eritrea, and all-out war ensued. Both countries devoted substantial resources to growing their armies, augmenting their military equipment, and fortifying their borders, which included digging extensive trenches. After the initial period of

[5] Eritrea’s independence in 1993 meant Ethiopia became a landlocked country, with implications for its trade and economic organization.
[6] The Eritrea Ethiopia Claims Commission (2005) states, “The areas initially invaded by Eritrean forces…were all either within undisputed Ethiopian territory or within territory that was peacefully administered by Ethiopia and that later would be on the Ethiopian side of the line to which Ethiopian armed forces were obligated to withdraw in 2000 under the Cease-Fire Agreement of June 18, 2000.”

intense conflict, heavy fighting resumed in February 1999 as Ethiopia succeeded, despite high casualties, in retaking the border town of Badme, but the battles around Tsorona-Zalambessa were not conclusive. Both sides initially rejected efforts by regional groups to mediate an end to the conflict, but eventually a Cessation of Hostilities agreement was brokered on June 18, 2000 and a 25-kilometer-wide demilitarized Temporary Security Zone was established along the 1,000 kilometer Eritrea-Ethiopia border and patrolled by United Nations peacekeeping forces. A final comprehensive peace agreement was signed December 12, 2000.[7]

The conflict intensity varied across regions within Ethiopia and Eritrea, with regions far from the border zones experiencing no fighting and the most intense clashes taking place in the border regions near Badme, Tsorona-Zalambessa, and Bure (see Figure 1). While there are not exact figures of the number of casualties due to the war, most estimates of the total number of fatalities, which were mainly soldiers, range from 70,000-100,000 (Human Rights Watch, 2003).

2.3 Civilian Impacts of the War

Although most casualties occurred among soldiers, thousands of civilians were displaced, which is the primary mechanism through which conflict may have affected child health. Displaced households suffered large reductions in food production, asset losses, and worsened access to water and health infrastructure. By the end of 1998, estimates suggest approximately 250,000 Eritreans had been internally displaced and another 45,000 Ethiopian citizens of Eritrean origin were deported from Ethiopia (Global IDP Project, 2004a). The Eritrean government and other observers estimate that during the war nearly 1.1 million Eritreans were internally displaced, although this number declined substantially by the war's end (Global IDP Project, 2004a). The Ethiopian government estimates that by December 1998, 315,000 Ethiopians were internally

[7] The empirical analysis in this paper treats this as the date the war ended, but our results are consistent if we treat June 2000, the date when the Cessation of Hostilities agreement was brokered, as the time when the war ended.

displaced, with the two regions that border Eritrea (Tigray and Afar) having the greatest number of internally displaced people (IDPs). The United Nations Country Team Ethiopia estimates that by May 2000 the number of IDPs in Ethiopia had risen to 360,000 (Global IDP Project, 2004b).[8] By most accounts, households directly affected by the war and those that were internally displaced tended to be located closest to the areas of the clashes.

3. Data

3.1 Demographic and Health Surveys, Eritrea (2002) and Ethiopia (2000 and 2005)

To measure the war's impact on child health, we use household survey data from both countries, specifically the 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys (DHS). The DHS are nationally representative cross-sectional surveys that have information on demographic topics such as fertility, child mortality, health service utilization, and nutritional status of mothers and young children. The 2002 Eritrea DHS collected detailed information on the date of birth and height of 5,341 children under five born before, during, or after the war with Ethiopia. The 2000 Ethiopia DHS collects similar information for 8,590 children under five, all of whom were either born before or during the war with Eritrea. By incorporating the 2005 Ethiopia DHS that has information for 3,875 children under five, we add an additional group of children in the war regions of Ethiopia who were not exposed to war (we discuss in more detail in Section 3.2 how the treatment and control groups are defined in the analysis). Combining these two Ethiopia datasets yields a final sample of 12,465 Ethiopian children.

3.2 Health and War Variables

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[8] This level of conflict-induced displacement is typical, as currently 27.1 million individuals worldwide are IDPs due to conflict. For example, during the last decade in Africa, the number of IDPs due to conflict reached 3.5 million in Angola, 633,000 in Burundi, 200,000 in Central African Republic, 180,000 in Chad, 150,000 in Congo-Brazzaville, 750,000 in Côte d'Ivoire, 3 million in Democratic Republic of Congo, 359,000 in Guinea, 600,000 in Kenya, 450,000 in Liberia, 550,000 in Nigeria, 600,000 in Rwanda, 70,000 in Senegal, 1.3 million in Sierra Leone, 1.5 million in Somalia, 6.1 million in Sudan, 1.7 million in Uganda, and 1 million in Zimbabwe (IDMC, 2010).

Child height conditional on age and gender is generally accepted as a good indicator of the long-run nutritional status of children, as height reflects the accumulation of past outcomes, and children with low height for their age are likely to be on a different growth trajectory for the rest of their life (Thomas, Lavy, and Strauss, 1996). We compute Z-scores for each child's height-for-age, where the Z-score is defined as the difference between the child's height and the mean height of the same-aged international reference population, divided by the standard deviation of the reference population. On average, across households in all regions of Ethiopia, children are 1.82 standard deviations below the average height-for-age of a reference child, and 46.3 percent of children are considered stunted and 23.3 percent are considered severely stunted.[9] In Eritrea, children are 1.56 standard deviations below the average height-for-age of a reference child, and 39.5 and 17.5 percent of children are respectively considered stunted or severely stunted.

We construct four measures of a child's exposure to the Eritrean-Ethiopian war. The first measure is defined at the region-birth cohort level and interacts residence in a war region with a dummy indicating if the child was born before the war or a dummy indicating if the child was born during the war. Specifically, we define the interaction terms ($War\ Region_j * Born\ Before\ War_t$) and ($War\ Region_j * Born\ During\ War_t$) that exploit variation across two dimensions: spatial (variation across regions in exposure to the war) and temporal (within a given region, the timing of whether a child was born during the war period). These variables are binary and indicate whether a child was born before the war (prior to May 1998) or during the war (between May 1998 and December 2000) in a region j that experienced conflict.

As we discussed in Section 2.2, the fighting was centered on the border areas near the three towns of Badme, Tsorona-Zalambessa, and Bure, so in Eritrea, the war regions are defined

[9] Children with height-for-age Z-scores below -2 are considered stunted, while children with height-for-age Z-scores below -3 are considered severely stunted.

to include Gash Barka, Debub, and Debubawi Keyih Bahri, while in Ethiopia they are Tigray and Afar. To address potential measurement error that would wrongly misclassify children as war-exposed because they reside in a village that is within a war region but far from the conflict or as non-war exposed because they live in a village that is within a non-war region but close to the conflict area, the second measure uses GPS information to determine whether a child lives geographically close to one of the three conflict sites (within kilometer ranges defined below). Specifically, we define two interaction variables ($\textit{Close to War Site}_v$ * $\textit{Born Before the War}_t$) and ($\textit{Close to War Site}_v$ * $\textit{Born During the War}_t$). These variables are also binary and indicate whether a child was born before or during the war and living in a village, *v*, which is within a certain number of kilometers from a conflict site.

The third measure of a child's war exposure is the duration in months that the child was living in a war region and exposed to the war. The duration measure is set to zero if the child resided in a region that was not affected by the war.

Since war-induced displacement was an important mechanism through which the conflict impacted child health, we incorporate direct measures of the number of internally displaced people in each region as a fraction of the region's pre-war population to proxy for the war's intensity in that area.[10] The IDP data come from the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA) in Eritrea and Ethiopia. All of the IDPs are clustered in the three war regions in Eritrea and the two war regions in Ethiopia mentioned above (Global IDP Project, 2004a, b). The IDP data are only available at an aggregate level for each region and as a result, we are not able to determine which specific villages or sub-regions had IDPs. However, there is substantial variation across regions in the number of IDPs per capita, and this represents

[10] Kondylis (2010) finds a strong link between displacement and negative labor market outcomes in Bosnia, with higher unemployment rates and a higher likelihood of dropping out of the labor force for displaced individuals.

an important distinction between this variable and the binary war region indicator. In Eritrea, the three war regions had 4, 21, and 26 percent of the population displaced in Debubawi Keyih-Bahri, Gash-Barka, and Debub, respectively, while in Ethiopia the corresponding numbers were 3 and 11 percent in Afar and Tigray, respectively.[11]

3.3 Preliminary Observations

Panel A of Table 1 compares characteristics of households in war and non-war regions of Eritrea and Ethiopia. Along some dimensions, such as education, urban status, and gender of the household head, non-war regions appear more developed and better off than war regions. For other characteristics (not shown in the table), such as mother's average height and pre-war poverty rates, the latter of which is only available for Ethiopia, there are no significant differences across regions. In Panel B, the observed differences in health outcomes (height-for-age Z-scores and proportion stunted) for children in the two types of regions could be due to the conflict and therefore should not necessarily be viewed as pre-existing differences (we present some preliminary evidence supporting this point in Panel C). Such differences between war and non-war regions are important to note, but as we discuss in detail in Section 4, our identification strategy uses region fixed effects to control for these differences and thereby overcome bias resulting from pre-existing regional differences in health and economic development.

To further explore the relationship between child height-for-age Z-scores across war and non-war regions, in Panel C we present these Z-scores broken down by whether a child's birth cohort was born after, during, or before the war. For both countries, there is no difference in Z-

[11] To the best of our understanding much of the displacement was within a region (i.e. locally displaced people who were settled in a refugee camp in the same region). Although we do not have data on whether individuals were displaced, in the Eritrean survey, detailed questions were asked about reasons for having moved for those mothers that had not resided permanently in the current location. While forced displacement and migration due to war reasons is not necessarily the same thing, we do observe that most of the migration due to the war was within the same type of region, with 85.5 percent of children whose mothers migrated due to war issues going from war regions to war regions or from non-war regions to non-war regions and only 12.7 percent from war regions to non-war regions and 1.8 percent from non-war regions to war regions.

scores across regions for those children born after the war ended. For those children born during the war, we see large and statistically significant differences across regions with children in the war regions having lower Z-scores. This effect is observed in both Eritrea and Ethiopia. We also observe a difference across regions in Ethiopia for children born before the war (and therefore alive during the war). These simple descriptive statistics will form the basis for the identification strategy that we discuss next.[12]

4. Empirical Identification Strategy

We illustrate the empirical identification strategy in Figures 2, 3, and 4, in which we estimate kernel-weighted local polynomial regressions of height-for-age Z-scores on date of birth using an Epanechnikov kernel. The dashed lines indicate children living in war regions, while the solid lines indicate children living in non-war regions. Vertical dashed lines show the starting (May 1998) and ending (December 2000) dates of the war. Figure 2 shows results using 2002 Eritrea DHS data with the initial birth cohort in the data born in April 1997; Figure 3 shows results using 2000 Ethiopia DHS data with the initial birth cohort in the data born in March 1995; Figure 4 shows results using 2005 Ethiopia DHS data with the initial birth cohort in the data born in May 2000.[13] Since the 2000 Ethiopia survey was fielded between February and July 2000, the war's end date is not observed in Figure 3. For all children, the figure shows the expected relationship with older children having lower Z-scores than younger children. In both Eritrea and Ethiopia,

[12] It is well-known that in developing countries, height-for-age Z-scores have a non-linear relationship with age, with older children having lower Z-scores than younger children, as nutritional and other deficits accumulate with age (Martorell and Habicht, 1986). In Eritrea, those children born after the war are younger than those born during or before the war, and we subsequently observe, in war and non-war regions, the typical relationship between age and height with older children having lower Z-scores than younger children. Because we are using two datasets for Ethiopia, one collected in 2000 at the end of the war and one in 2005, there is no longer a direct relationship between child age and whether the child is born after, during, or before the war. For instance, those children in Ethiopia born after the war range in age up to four years old, while children born during the war are mostly under two. In the subsequent regression analysis, we control for age by including year of birth fixed effects.

[13] Since the three datasets cover different birth cohorts, it is not possible to synchronize the start and end dates (month and year of birth) on the graphs.

children born during the war in the war regions have lower height-for-age Z-scores than children born during the war in the non-war regions. We observe a similar result for the cohorts of children born before the war and therefore who were young children during the war; this is particularly true in Ethiopia.[14] Finally, Figure 4 shows that in Ethiopia children born after the war ended have similar height-for-age Z-scores in both the war and non-war regions.

The empirical identification strategy relies on a comparison of height-for-age Z-scores of similarly aged children in war and non-war regions. We compare the Z-scores of children born before the war ended to the Z-scores of children born after the war ended in the war regions of Eritrea and Ethiopia, and we then compare this difference relative to the same difference in the non-war region in both countries. The implicit assumption is that differences across birth cohorts (born before or after the war ended) in average height-for-age Z-scores would be similar across war and non-war regions in the absence of the conflict. While we use similar identification strategies in Eritrea and Ethiopia, we are able to incorporate additional post-war data that is available only for Ethiopia that allows us to also compare cohorts of similar aged children who are from the same regions but differ in their exposure to the war. Based on the non-parametric regressions, we estimate the following region and birth cohort fixed effects regression:

(1)
$$\begin{aligned} HAZ_{ijt} &= \alpha_j + \delta_t + \beta_1 (WarRegion_j * BornBefore\ War_t) \\ &\quad + \beta_2 (WarRegion_j * BornDuring\ War_t) + \varepsilon_{ijt} \end{aligned}$$

where HAZ_{ijt} is the height-for-age Z-score for child i in region j who was born in period t, α_j are region fixed effects, δ_t are year of birth cohort fixed effects, ε_{ijt} is a random, idiosyncratic error term, and the war region interaction terms are as defined in Section 3.2. The coefficient β_1 measures the war's impact on children's height-for-age Z-scores for children born before the war

[14] Figure 3 also suggests that children in the war regions in Ethiopia who were more than two years old when the war began (born before May 1996) were less likely to be affected by the war, which is consistent with the theory that disturbances during the early years of life are most harmful to children's growth. In the Eritrea data, we do not observe children who were more than two years old at the time the war began.

in war-affected regions, while the coefficient β_2 measures the impact of the war on children's height-for-age Z-scores for children born during the war in war-affected regions.

In defining war exposure based on living in one of the three war regions in Eritrea or two war regions in Ethiopia, we are potentially including villages far from the war sites that may not have been affected by conflict. This might be problematic as some regions extend many kilometers from the war sites (see Afar in Ethiopia and Debubawi Keyih Bahri in Eritrea). Likewise, we might be excluding households close to war sites that may have been affected by conflict, but were living in a non-war region (see Semenawi Keyih Bahri in Eritrea). We therefore take advantage of information on the distance of each survey village to the three main conflict sites (even if it crosses region boundaries) to classify intensity of war exposure. Since the mean distance to the closest conflict site within the war regions is 75 kilometers in Eritrea and 125 kilometers in Ethiopia, we use those distances to define binary variables indicating households living close to any of the war sites.[15] We then estimate the following modified Equation 1 with *Close to War Site* $_v$ replacing *War Region* $_j$:

(2)
$$\begin{aligned} HAZ_{ijt} = \alpha_j + \delta_t + \beta_3(CloseToWar\ Site_v * BornBefore\ War_t) \\ + \beta_4(CloseTo\ WarSite_v * BornDuring\ War_t) + \varepsilon_{ijt} \end{aligned}$$

Equations 1 and 2 contain binary interaction variables (defined in Section 3.2) that indicate if a child was born before or during the war in war-affected areas. We also use a continuous measure of war exposure in estimating the following region and birth cohort fixed effects regression:

(3)
$$HAZ_{ijt} = \alpha_j + \delta_t + \beta_5(Monthsof\ WarExposure_{jt}) + \varepsilon_{ijt}$$

where *Months of War Exposure*$_{jt}$ measures the months of exposure to the war for a child living in a war region and equals zero for a child living in a non-war region. The coefficient β_5 measures the impact of an additional month of war exposure on children's height-for-age Z-scores.

[15] In Section 5.3, we discuss the robustness of using alternative distance cut-offs as well as a continuous distance measure to examine geographic proximity to the fighting.

The empirical strategy in Equations 1, 2, and 3 assumes that, in the absence of war, the difference between the height-for-age Z-scores of children born before and after the war ended in war-affected regions would have been the same as the difference for children living in non-war regions. To address the potential for differential time trends in height-for-age Z-scores across regions, we add region-specific time trends to each of the previous equations as follows:

$$\text{(4)} \qquad HAZ_{ijt} = \alpha_j + \delta_t + \beta_1(WarRegion_j * BornBefore\ War_t) + \beta_2(WarRegion_j * BornDuring\ War_t) + Region\ Trend_{jt} + \varepsilon_{ijt}$$

where the variables are as previously defined and $Region\ Trend_{jt}$ is a region-specific time trend that isolates the variation in children's outcomes that diverge from region time trends. The inclusion of this time trend buttresses the argument that changes in average height-for-age Z-scores in these regions would have been similar in the absence of the war.

Equation 4 assumes that, apart from the war, there are no other events that might have coincided with the war and independently affected children's health. Since this assumption may be violated, we might incorrectly attribute a decline in children's health to the war. To address this possibility and to highlight that the health differences across regions and birth cohorts are due to the war, we calculate the per capita number of internally displaced people in each region as a proxy for the war's intensity there. We interact this variable with indicators of whether the child was born during or before the war. Negative coefficients for these interaction terms would suggest that previous results are indeed due to the war rather than to other events.[16] This approach allows us to better identify the war's impact, as we compare regions with higher IDPs per capita to regions with fewer IDPs per capita. The change in the health status of children born after the war ended in high war intensity regions relative to low war intensity regions serves as a control for what the change in the health status of children born before the war ended would have

[16] Results (not shown) are also consistent when we estimate the regressions using the absolute number of IDPs as the war intensity measure.

been if the war did not occur. We estimate a modified Equation 4 where we replace *War Region* $_j$ with *War Intensity* $_j$, which indicates the number of IDPs per capita in region *j*.

5. Empirical Results

5.1 Baseline Difference-in-Differences Estimation

Table 2 presents results from our baseline specifications for estimating the war's impact on height-for-age Z-scores, as outlined in Equations 1 to 3, and includes region-specific time trends to control for the possibility of differential trends across regions.[17,18] All regressions include region and year of birth fixed effects as well as controls for child gender. The first four columns show results for Eritrea; the last four columns show results for Ethiopia. We first examine the effect of exposure to the war on the pooled group of children born before or during the war (i.e. alive during the war). We find that in Eritrea and Ethiopia height-for-age Z-scores are significantly lower for children residing in war regions and alive during the war. Columns 1 and 5 show Z-scores are lowered by 0.43 and 0.52 standard deviations in Eritrea and Ethiopia, respectively. However, it is worthwhile to explore how the effects differ based on whether a child was born before the war began or during the war. Not only are these children of different ages when the height measurements took place, they also were of different ages when exposed to the conflict. The remainder of Table 2 examines the differential impacts on children born before and during the war as well as the impacts based on months of exposure to the war.

In Eritrea, the estimates in Columns 2 and 3 indicate a significant negative impact on children born during the war in war regions or in villages close to a war site (0.39 and 0.37

[17] The magnitude of the impacts and the levels of statistical significance are consistent in regressions for Ethiopia estimated without time trends (results not shown). In Eritrea, the difference between the results with and without time trends suggest the war impacted regions in Eritrea where children's health status was actually improving.
[18] Correlation among the error terms of children living in the same local environment and experiencing similar health shocks might bias the OLS standard errors downward, so in all regressions we cluster the standard errors by enumeration area, which corresponds to local clusters of villages (Moulton, 1986).

standard deviations, respectively). However, the impacts on children born before the war began are smaller in magnitude and are not statistically significant. In Column 4 of Table 2, we examine the impact of the number of months of war exposure and find that each additional month results in a significant reduction of 0.04 in the Z-score.[19] In Ethiopia, children born during the war in a war region or in a village close to a war site experience 0.45 or 0.34 standard deviations lower Z-scores, respectively (Columns 6 and 7). Effects of larger magnitude (0.57 and 0.54 standard deviations) are found for children born before the war and experience the conflict as a young child in either the war region or close to a war site. Finally, Column 8 shows that the number of months of exposure for children in Ethiopia has a negative and significant impact on Z-scores, with a point estimate similar to that found in Eritrea.[20] The impact of the conflict on those children born during the war in war regions represents, respectively in Eritrea and Ethiopia, a decline of 20 and 31 percent compared to the average height-for-age Z-score of children born during the war in a non-war region.[21]

To test whether children born during the war experience a significantly different impact of war exposure than children born before the war started, in Table 2 we present the p-values for

[19] As a robustness check, we estimate the regressions for Eritrea using enumeration area fixed effects (instead of region fixed effects), and the magnitude of the impacts and levels of statistical significance are consistent with those in Table 2. Unfortunately, this robustness check cannot be done with the Ethiopia data as it is not possible to link enumeration areas across the two cross-sectional survey rounds. Our results, in Ethiopia, are also robust to the inclusion of month of birth fixed effects. However, for Eritrea the results are not robust to the inclusion of month of birth fixed effects. Given the significantly smaller sample size in Eritrea, we lack adequate statistical power to estimate the effect of the war precisely with so many additional fixed effects. However, the impact of the war remains negative and significant when we include month of birth fixed effects for children less than one year of age (the time period during which one month indicator variables are likely to be most important as the variation in height is greatest for this age group) and year of birth fixed effects for children older than one year.

[20] We also estimate regressions in which we replace the months of war exposure variable with three binary variables to indicate exposure for 1 to 10 months, 11 to 20 months, or 21 or more months. We find evidence of a non-linear impact, with the effect of 11 months or greater exposure being twice as large as that of 1 to 10 months of exposure.

[21] We also estimate several placebo-type regressions for Eritrea and Ethiopia in which non-war regions were labeled as if they were war regions and then compared to the other non-war regions. Results show no significant impact on height-for-age Z-scores in these non-war regions. Moreover, in Ethiopia we have pre-war regional poverty data and confirm results are similar when the non-war regions are limited to those with similar pre-war poverty levels as the war regions.

the test of the null hypothesis that $\beta_1 = \beta_2$ in Equation 1 (using war region), as well as its counterpart $\beta_3 = \beta_4$ in Equation 2 (using close to war site). In Eritrea, the coefficients indicate a larger impact for children born during the war in the war regions compared to those born before the war (column 2), while the opposite effect is observed in Ethiopia (column 6). We are not able to reject the equality of coefficients for either country. However, for the specifications using GPS information to determine proximity to the war site, we observe a similar pattern to that with the war region variable but we are able to reject the equality of coefficients for Eritrea (column 3, p=0.06) and for Ethiopia (column 7, p=0.102). Overall, this suggests that for children in Eritrea, the impact of war exposure on children born during the war is larger than the war's impact on children born before the war started, while the opposite is true in Ethiopia.

Taking stock of the results in Table 2, one result that stands out is the considerably larger impact of the war on children born before the war in Ethiopia relative to Eritrea. We highlight two possible explanations for this result. First, children were measured in different years in Eritrea and Ethiopia and therefore at different durations of time following the end of the war. If there was catch-up growth after the war ended, since each country had differing amounts of post-war time before the survey, we would not expect the measured effects of the conflict to be the same in both places (of course, other factors, which unfortunately we do not have data for, such as the nature of the response post-conflict could also contribute to differences in the size of the effect of the conflict). In Ethiopia, children born before the war were measured towards the end of the war in 2000 (note that the 2005 Ethiopia DHS does not have measurements on children born before the war because all of them were older than five years in 2005). In Eritrea, the children born before the war were not measured until 2002 and several years had elapsed since the end of the war. Thus, there may have been catch-up growth following the end of the war, and as a result the children in Eritrea appear to be less-affected than those in Ethiopia. In additional analysis that is supportive of the possibility of catch-up growth, we find in Ethiopia in the 2005 data that children born during the war in the war regions but measured several years after the end of the war, when they were 4 years or older, are less-affected compared to children born during the war and measured in 2000 at the end of the war.

Second, Figure 3 also provides suggestive evidence that the results in Eritrea and Ethiopia are not in fact very different once we consider the age at which children were measured. The figure shows that the children in Ethiopia who were born in war regions just before the start of the war and were measured at the age of 2-4 years are the ones with the largest deficits in height-for-age; older children who were 4 or more years of age at the time of measurement have no such deficit. In Eritrea, the sample of children born before the war consists of children who were 4 or more years of age at the time of measurement; hence the effect of the war on them is more akin to that on children measured at the same age in Ethiopia.

Table 3 examines whether the impact of the conflict differed for boys and girls. Unlike the literature on shocks that generally finds a large negative bias against girls, we find here that both boys and girls are negatively impacted by exposure to the war. In Eritrea, boys and girls born during the conflict and residing close to a war site have significantly lower height-for-age Z-scores. In Ethiopia, boys born during the conflict and both boys and girls born before the war started experience significant decreases in Z-scores. In both countries, the magnitude of the negative impact is slightly larger for boys, although in a fully interacted model, we cannot reject the equality of coefficients for boys and girls. Thus, the results here provide minimal evidence of girls having disproportionately suffered the consequences of the war.[22]

5.2. War Intensity Measures Based on IDP Data

Since the war represented such a large shock and occurred mainly in the border areas between the two countries, the identification strategy used so far likely correctly identifies the impact of the Eritrea-Ethiopia war on children's health status. However, during the same time period other events may have occurred that might be correlated with both the war's occurrence and changes in children's health status. If this were the case, we might be incorrectly attributing the observed decline in health status to the war. Table 4 examines this potential source of bias. We estimate a difference-in-differences regression using each region's number of IDPs per capita as a measure of war intensity. Column 1 shows results for Eritrea; Column 2 shows the Ethiopia results. All specifications include region and age fixed effects, region-specific time trends, and child gender.

In Eritrea, results indicate that children born during the war in higher war intensity areas have lower height-for-age Z-scores and results are statistically significant. An increase in the per capita number of IDPs in a region by 1 percentage point significantly lowers the Z-scores for children born during the war by 0.015 standard deviations. Children born before the war experience a similar negative impact (0.012 standard deviations), although the coefficient is not significant at standard levels. Impacts are larger in Ethiopia, with children born during or before the war in higher war intensity regions having lower height-for-age and the coefficients are statistically significant.

These impacts are large and meaningful, particularly when considering the per capita number of IDPs in Eritrea and Ethiopia. In Eritrea, a child born during the war in a region

[22] We also estimated regressions in which the sample of children in each country was divided into poor and non-poor households based the education of the household head. Results (not shown) suggest that the negative impact of the war is similar among poor and non-poor children.

experiencing the mean war intensity (average percentage of IDPs per capita across all regions in Eritrea is 9.59) has a height-for-age Z-score that is 0.144 lower. This negative impact represents a decline of 7.5 percent relative to the average height-for-age Z-scores of children born during the war in the non-war regions. The true impact on war-exposed children is even larger, as the mean war intensity in the above calculation is averaged across all regions, some of which had no IDPs. Using the average percentage of IDPs per capita only from the war regions of Eritrea (18.45) shows negative impacts of 0.28 standard deviations, representing a 14.7 percent decline compared to the average Z-scores of children born during the war in the non-war regions. In Ethiopia, while the estimated regression coefficients are larger than in Eritrea, the average percentage of IDPs per capita across all regions is much lower. Therefore, a child born during or before the war in a region experiencing the mean war intensity (average percentage of IDPs per capita across all regions of Ethiopia is 1.34) has 0.06 or 0.08 standard deviations lower height-for-age Z-scores, representing declines of 3.9 and 3.7 percent, respectively, compared to the average Z-scores of children born during or before the war in the non-war regions of Ethiopia. As many regions in Ethiopia were not part of the war, using the average percentage of IDPs per capita only from the war regions of Ethiopia (8.04) shows negative impacts of 0.34 or 0.48 standard deviations, representing 24 and 22 percent declines compared to the average Z-scores of children born during or before the war in non-war regions, respectively.

5.3 Robustness Checks

Factors such as selective migration, fertility, and mortality are among the major reasons why the results presented so far might not accurately capture the true causal effects of the war. In this section, we examine the role of each of these issues and present evidence that the main results are unlikely to be strongly influenced by them.

We first examine the issue of endogenous migration. Due to the war, thousands of people were internally displaced in both countries. Migration of this nature, particularly if people moved across regions, may bias our estimates because we would incorrectly determine a child's war exposure based on the child's current region of residence. If well-off households with healthier children migrated from war to non-war regions, for example, our results would over-estimate the impact of the conflict. In both countries, we have compared the characteristics of mothers who migrated after the war started to those of other non-migrant mothers. Migrants are certainly different from non-migrants in age, education, height, and gender and age of the household head, but these women may have migrated for other reasons unrelated to the war. In Eritrea, where the DHS recorded the reasons for migration, we can directly address the question of whether mothers who migrated from war to non-war regions after the war started *due* to the war have different characteristics compared to mothers in the war regions that did not migrate. The number of migrants who moved due to war reasons and went across regions is very limited, and with the exception of education, for most characteristics such as age, height, and gender and age of the household head, we find no difference between these cross-region war migrants and non-migrants who stayed behind in the war regions. Given how small the fraction of women who moved from war regions to non-war regions is and the fact that on many dimensions they look similar to the non-migrants who did not leave the war regions, it is unlikely that such migration leads to a large bias in our results.

To further explore whether migration influences the estimated impacts of the conflict, in Table 5 we estimate the effects of the conflict when migrants are excluded from the sample and also (in the case of Eritrea) when children whose households migrated are classified according to their previous region of residence. If children of migrant households were systematically different than children in non-migrant households, then excluding these migrant households from the regressions should alter the measured impact of the conflict. The regressions indicate that excluding children whose families moved after the war began does not change the main results (columns 1 and 4 of Table 5 compared to columns 2, 3, 6, and 7 of Table 2, respectively). In Eritrea, we also show that excluding children whose families moved explicitly due to the war does not alter the results (column 2).[23] Similarly in Column 3, when the residence of migrating children is re-classified correctly according to their previous region of residence, which only can be done with the Eritrea data, we find that the estimated impact of the war remains unchanged.

To address the concern about endogenous fertility, we use birth history data to calculate, for each of the three time periods (before, during, and after the war), the percentage of children who were born in war and non-war regions. We find that the proportion of children born in war regions is smaller during the war compared to before the war (50.7 compared to 54.2 percent in Eritrea, and 15.6 compared to 17.1 percent in Ethiopia). This suggests that women in war regions had fewer births during the war. However, as Appendix Table 1 shows, we find no significant differences between war and non-war regions across most characteristics of women who had a child during the war (we examined mother's age, education, number of births, and height, as well as household head's age and gender). In fact, in Ethiopia, we find that women in war regions who had a child during the war actually have more education than women in non-war regions who had a child during the war, which suggests that if anything, we might be under-estimating the impact of the war as a result of such selection.

[23] It is also possible that households experiencing negative shocks sent out children to live with other relatives (see Akresh (2009) for evidence on the link between negative income shocks and child fostering). Although we do not have any information in the survey about this, we are unable to tell which direction, if any, this might bias the results depending on whether the most healthy or the least healthy child was fostered, but most of the child fostering literature finds the rate of fostering for children under age five to be extremely low.

Differences in child mortality between war and non-war regions may also result in a biased estimate of the impacts of the war. Here, it is likely that the deceased children were those with poorer health (and from poorer households) to begin with, which means that we would underestimate the impact of the conflict. In Appendix Table 2, we use birth history data for every mother to directly examine the impact of war exposure on child mortality. The regression samples include all children ever born during the 60 months prior to the survey, and the dependent variable indicates whether a child died prior to the survey. The war exposure variables are measured as in Table 2 (war region interacted with born during or before war, close to war site interacted with born during or before war, and war intensity interacted with born during or before war). The results show that overall there is no significant increase in the likelihood of child mortality due to war exposure, with only the variable "Close to War Site * Born Before War" being significant at the ten percent level in Eritrea. This lack of relationship between war exposure and mortality should be understood in the context of an environment with already extremely high under-5 mortality (pre-war under-5 mortality rates in Eritrea and Ethiopia are respectively 121 and 211 deaths per 1000 live births).

Finally, given our focus on accurately measuring geographic exposure to the war, we also estimate robustness regressions (results not shown) that use alternative distance cut-offs for the variable indicating villages close to any of the three conflict sites. The current variable is based on the mean distance to the closest conflict site within the war regions (75 kilometers in Eritrea and 125 kilometers in Ethiopia). Results are quantitatively similar using 100 or 125 kilometers as the distance cut-off for Eritrea or 150 or 250 kilometers in Ethiopia. Finally, we estimate regressions using a continuous measure of distance. Results are consistent; children born during the war and living closer to a conflict site have significantly lower height-for-age Z-scores.

5.4 Comparison of War Impact in Eritrea and Ethiopia

To the best of our knowledge, this is the first paper to use data from both countries involved in an international war to measure the impact of a conflict on children's health. Given this unique characteristic of the paper, in this section we attempt to compare the war's impact in Eritrea with its impact in Ethiopia. In Appendix Table 3, we combine the datasets from both countries and estimate some of the previous specifications from Tables 2 and 4. To capture the differential impact of the war in Ethiopia and Eritrea, in all specifications we include an interaction term of the main variables with an indicator variable for living in Ethiopia. All specifications include region and year of birth fixed effects, region-specific time trends, and control for child gender. For children living close to a conflict site, those alive during the war (column 1) or born during the war (column 2) show negative impacts of the conflict, although the impact on children in Ethiopia is not found to be significantly different than in Eritrea. Consistent with the earlier regressions in Table 2, children in Ethiopia born before the war appear worse off. The results in Columns 3 and 4, which use the number of IDPs per capita as a measure of war intensity, suggest that the impacts on children were significantly greater in Ethiopia. This is the case for children born before or during the war, and the reasons for this may have to do with the age at which war-exposed children were measured (as we mentioned in the Table 2 discussion).

5.5 Discussion of the War Impact Mechanisms

Understanding the specific mechanisms by which conflict impacts child health is critical for developing adequate policy responses to protect children from the negative effects of war. In order to fully answer this question, we would require detailed household level data on crop production and assets, information on the extent and duration of displacement (including changes in nutrition and exposure to disease and unclean water), and detailed conflict event data at the household level to accurately measure war exposure. Despite the lack of such data, our results provide some suggestive indication of the likely mechanisms by which war impacts child health.

A first possible mechanism is that the war hindered the provision of food aid distributed by the international community. However, there is evidence that donors did not restrict food aid provision, at least in Ethiopia, and in fact, some countries began to help these nations for the first time (Biles, 2000). Reports also indicate the war did not interfere with food aid distribution. While we do not have data on the amount of relief aid disaggregated by region, if such aid were targeted disproportionately to war-affected regions, then this paper's results would underestimate the true impact of the conflict. A second possible mechanism, one that is more common in civil wars in Africa, is the theft of assets, including livestock. Since it takes time to reverse such a loss, poverty generated by asset theft would affect all children in the household, regardless of if they are born during or after the war. Our results suggest this mechanism might not have been salient, as only children born before the war ended are impacted. In addition, there is some anecdotal evidence of stray Eritrean cattle returned by the Ethiopian army and vice versa.

While displacement of households within regions might be a key mechanism by which the war impacted children's health status, the absence of detailed survey information on the movement of households limits our ability to examine this issue thoroughly. Many families were internally displaced in both countries due to the war. Because of this, households could have been directly worse off through loss of harvests and assets, disruption of businesses, and reduced access to medicines and clean water. Consistent with our results, a child exposed to displacement would be worse-off compared to a non-exposed child, and the impact should be larger the longer the child is exposed to these events. There were also effects on children who were not displaced by the war but were residing in areas with many displaced individuals (Baez, 2011; Maystadt and

Verwimp, 2009). The similarity between our main results and the results for the sample of children whose households report that they have never moved suggests that displacement due to the war may indeed have affected both displaced and non-displaced children.

6. Conclusion

This is the first paper able to measure the welfare impacts on both sides involved in a conflict, thus providing a more thorough understanding of how wars impact well-being. We use nationally representative Demographic Health Survey data to assess the short- and medium-term impacts of the 1998-2000 Eritrean-Ethiopian war on the health status of young children in both countries. The war between Eritrea and Ethiopia led to thousands of people being displaced from their homes, as is the case for many conflicts in sub-Saharan Africa. Our identification strategy exploits exogenous variation in the conflict's geographic extent and timing and the subsequent exposure of different children's birth cohorts to the fighting. Using alternative measures of war exposure and conflict intensity, we find that war has a large negative impact on height-for-age Z-scores of children in both the winning and losing nations. Our main results indicate that children born during the war and living in a war region have 0.39 and 0.45 standard deviations lower height-for-age Z-scores in Eritrea and Ethiopia, respectively. War impacts are of similar magnitude for boys and girls, and our results are robust to consideration of various issues such as endogenous migration, fertility, and mortality among war-affected households.

A critical reason for studying the impact of war on children's height is that this health indicator is known to influence future health, education, and economic outcomes. Based on other estimates of the links between height-for-age Z-scores and schooling attainment and wages, we can speculate on the long-term consequences that follow from our estimates of a negative health impact of the Eritrea-Ethiopia war. Specifically, we base our calculation on the estimate that a one standard deviation reduction in height correlates with 0.678 fewer grades completed in Zimbabwe (Alderman, Hoddinott, and Kinsey, 2006) and that the return to an extra year of school in Ethiopia is 15 percent (Krishnan, Selassie, and Dercon, 1998). Using these estimated links and the magnitude of the impacts discussed above, we find that for children born during the war in Eritrea and Ethiopia, wages in adulthood will be, 4.0 and 4.6 percent lower, respectively.

The results in this paper contribute to a growing literature that estimates the welfare impacts of wars. The external validity of results in this literature is often contested because each war is different in its scale and scope. However, the case of the Eritrea-Ethiopia war and our estimation of similar negative impacts on children's health in both countries suggest that wars often result in adverse effects on young children. The findings in this paper also help improve our understanding of a broader issue, which are the long-term growth and development consequences of wars. As undernourishment during early years has been linked to worse economic outcomes in adulthood, the long-term legacy of war, for both the winning and losing nations, is a problem that may need to be addressed with various educational and economic interventions in the future.

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Table 1: Child and Household Characteristics, By Region

	Eritrea (Year 2002)			Ethiopia (Year 2000 and 2005)		
	Non-war Region	War Region	Difference	Non-war Region	War Region	Difference
	[1]	[2]	[3]	[4]	[5]	[6]
Panel A: Household Characteristics						
Household Head Is Male	0.657	0.592	0.064***	0.865	0.807	0.058***
	[0.017]	[0.017]	[0.024]	[0.005]	[0.012]	[0.013]
Household Head Age	42.150	40.808	1.342**	38.434	40.591	-2.157***
	[0.380]	[0.382]	[0.539]	[0.154]	[0.377]	[0.407]
Household Head Years School	2.143	1.556	0.587**	2.220	0.674	1.546***
	[0.199]	[0.144]	[0.246]	[0.081]	[0.085]	[0.117]
Urban Area	0.354	0.202	0.152***	0.167	0.078	0.090***
	[0.037]	[0.030]	[0.048]	[0.012]	[0.019]	[0.023]
Panel B: Child Characteristics						
Height-for-age Z-score	-1.527	-1.599	0.073	-1.796	-1.944	0.148***
	[0.052]	[0.039]	[0.064]	[0.026]	[0.050]	[0.056]
Proportion Stunted	0.377	0.413	-0.036*	0.456	0.497	-0.041***
	[0.015]	[0.011]	[0.019]	[0.007]	[0.014]	[0.015]
Proportion Severely Stunted	0.173	0.176	-0.003	0.230	0.245	-0.014
	[0.011]	[0.008]	[0.014]	[0.006]	[0.012]	[0.013]
Age in Months	29.861	29.248	0.613	29.345	30.508	-1.163***
	[0.281]	[0.294]	[0.407]	[0.150]	[0.314]	[0.348]
Male	0.520	0.519	0.000	0.506	0.497	0.008
	[0.009]	[0.009]	[0.013]	[0.005]	[0.011]	[0.012]
Panel C: Height-for-age Z-score by Birth Cohorts						
Born After the War	-0.682	-0.731	0.049	-1.593	-1.576	-0.017
	[0.064]	[0.060]	[0.088]	[0.044]	[0.094]	[0.104]
Born During the War	-1.908	-2.089	0.182**	-1.430	-1.723	0.294***
	[0.064]	[0.047]	[0.079]	[0.039]	[0.077]	[0.086]
Born Before the War	-1.773	-1.803	0.031	-2.193	-2.321	0.128*
	[0.075]	[0.057]	[0.094]	[0.035]	[0.059]	[0.069]
Observations	2,586	2,755		10,388	2,077	

Note: Robust standard errors in brackets, clustered at the enumeration level. * significant at 10%, ** significant at 5%, and *** significant at 1%. Children with a height-for-age Z-score below -2 are considered stunted, while children with a height-for-age Z-score below -3 are considered severely stunted. Data source: 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys.

Table 2: Measuring the Impact of War Exposure on Children's Height-for-age Z-score

Dependent Variable: Height-for-age Z-score	Eritrea				Ethiopia			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
War Region * Alive During War	-0.427***				-0.519***			
	[0.105]				[0.103]			
War Region * Born During War		-0.385***				-0.446***		
		[0.112]				[0.106]		
War Region * Born Before War		-0.253				-0.574***		
		[0.191]				[0.122]		
Close to War Site * Born During War			-0.373***				-0.343**	
			[0.105]				[0.137]	
Close to War Site * Born Before War			-0.161				-0.540***	
			[0.135]				[0.140]	
Close to War Site			0.177				0.135	
			[0.112]				[0.140]	
Months of War Exposure				-0.037***				-0.029***
				[0.009]				[0.005]
P-value Testing Equality Between Born During and Born Before War		0.277	0.061			0.223	0.102	
Child Age Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-Specific Time Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,341	5,341	5,279	5,341	12,465	12,465	12,418	12,465

Notes: Robust standard errors in brackets, clustered at the enumeration level. * significant at 10%, ** significant at 5%, and *** significant at 1%. All specifications include child age fixed effects, region fixed effects, child gender controls, and region-specific time trends. In Eritrea, the war regions are Gash Barka, Debub, and Debubawi Keyih Bahri. In Ethiopia, the war regions are Tigray and Afar. "War Region*Alive During War" indicates a child living in a region affected by the war who was alive during the war. "War Region*Born During War" indicates a child living in a region affected by the war who was born during the war. "War Region*Born Before War" indicates a child living in a region affected by the war who was born before the war started. "Close to War Site*Born During War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born during the war. "Close to War Site*Born Before War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born before the war started. "Months of War Exposure" measures the number of months a child was alive during the war in a region affected by the war. Data source: 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys.

Table 3: Measuring the Impact of War Exposure on Children's Height-for-age Z-score, By Gender

	Eritrea		Ethiopia	
Dependent Variable: Height-for-age Z-score	Boys	Girls	Boys	Girls
	[1]	[2]	[3]	[4]
Close to War Site * Born During War	-0.439***	-0.309**	-0.414**	-0.264
	[0.152]	[0.148]	[0.174]	[0.188]
Close to War Site * Born Before War	-0.202	-0.133	-0.589***	-0.483***
	[0.197]	[0.189]	[0.169]	[0.178]
Close to War Site	0.221	0.136	0.196	0.055
	[0.151]	[0.135]	[0.161]	[0.172]
P-value Testing Equality Between Born During War and Born Before War	0.114	0.339	0.265	0.221
Child Age Fixed Effects	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes
Region-Specific Time Trends	Yes	Yes	Yes	Yes
Observations	2,739	2,540	6,259	6,159

Notes: Robust standard errors in brackets, clustered at the enumeration level. * significant at 10%, ** significant at 5%, and *** significant at 1%. All specifications include child age fixed effects, region fixed effects, and region-specific time trends. "Close to War Site*Born During War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born during the war. "Close to War Site*Born Before War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born before the war started. Data source: 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys.

Table 4: Measuring the Impact of War Exposure on Children's Height-for-age Z-score, Using War Intensity

Dependent Variable: Height-for-age Z-score	Eritrea [1]	Ethiopia [2]
War Intensity * Born During War	-0.015***	-0.042***
	[0.005]	[0.011]
War Intensity * Born Before War	-0.012	-0.060***
	[0.009]	[0.012]
P-value Testing Equality Between Born During and Born Before War	0.584	0.087
Child Age Fixed Effects	Yes	Yes
Region Fixed Effects	Yes	Yes
Region-Specific Time Trend	Yes	Yes
Observations	5,341	12,465

Notes: Robust standard errors in brackets, clustered at the enumeration level. * significant at 10%, ** significant at 5%, and *** significant at 1%. All specifications include child age fixed effects, region fixed effects, child gender controls, and region-specific time trends. "War Intensity" indicates for each region the number of internally displaced individuals as a percentage of the region's pre-war population. Displacement data for Eritrea and Ethiopia come from the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA). Data source: 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys.

Table 5: Measuring Impact of War Exposure on Children's Height-for-age Z-score, By Residency Status

Dependent Variable: Height-for-age Z-score	Eritrea			Ethiopia
	1st Definition [1]	2nd Definition [2]	3rd Definition [3]	1st Definition [4]
Panel A: War Region				
War Region * Born During War	-0.393***	-0.366***	-0.401***	-0.506***
	[0.123]	[0.118]	[0.112]	[0.113]
War Region * Born Before War	-0.281	-0.217	-0.299	-0.652***
	[0.207]	[0.200]	[0.191]	[0.122]
Child Age Fixed Effects	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes
Region-Specific Time Trends	Yes	Yes	Yes	Yes
Observations Panel A	4,654	5,124	5,289	11,449
Panel B: Distance to War				
Close to War Site * Born During War	-0.386***	-0.394***		-0.371***
	[0.108]	[0.107]		[0.139]
Close to War Site * Born Before War	-0.202	-0.181		-0.564***
	[0.144]	[0.136]		[0.131]
Close to War Site	0.214*	0.227**		0.164
	[0.110]	[0.112]		[0.137]
Child Age Fixed Effects	Yes	Yes		Yes
Region Fixed Effects	Yes	Yes		Yes
Region-Specific Time Trends	Yes	Yes		Yes
Observations Panel B	4,596	5,062		11,409
Panel C: Intensity				
War Intensity * Born During War	-0.015***	-0.015***	-0.008**	-0.045***
	[0.006]	[0.005]	[0.004]	[0.012]
War Intensity * Born Before War	-0.012	-0.011	0.002	-0.064***
	[0.010]	[0.009]	[0.006]	[0.011]
Child Age Fixed Effects	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes
Region-Specific Time Trends	Yes	Yes	Yes	Yes
Observations Panel C	4,654	5,124	5,289	11,449

Notes: Robust standard errors in brackets, clustered at the enumeration level. * significant at 10%, ** significant at 5%, and *** significant at 1%. All specifications include child age fixed effects, region fixed effects, child gender controls, and region-specific time trends. Columns 1 and 4 exclude children whose families moved after the war started. Column 2 excludes children whose families move after the war started due to the war. Column 3 replaces current region of residence (and intensity measure from current region of residence) by previous region of residence (and intensity measure from previous region of residence). "Close to War Site*Born During War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born during the war. "Close to War Site*Born Before War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born before the war started. "War Intensity" indicates for each region the number of internally displaced individuals as a percentage of the region's pre-war population. Displacement data for Eritrea and Ethiopia come from the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA). Data source: 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys.

Appendix Table 1: Endogenous Fertility: Characteristics of Women Having a Child During War

	Women's Characteristics				Household Heads' Characteristics	
Dependent Variables:	Years of Education	Number of Births	Height in cm	Age	Age	Gender
	[1]	[2]	[3]	[4]	[5]	[6]
Panel A: Eritrea						
War Region * Has a Child Born During War	-0.200	0.205	0.169	0.887*	0.320	-0.050
	[0.232]	[0.172]	[0.393]	[0.513]	[0.947]	[0.033]
War Region	-0.771**	0.053	-0.067	-0.660	-1.587*	-0.013
	[0.322]	[0.143]	[0.391]	[0.438]	[0.877]	[0.033]
Has a Child Born During War	-0.312*	0.650***	-0.540*	0.471	-1.228*	0.036
	[0.188]	[0.126]	[0.295]	[0.380]	[0.719]	[0.025]
Constant	2.431***	3.478***	156.594***	30.122***	43.088***	0.603***
	[0.264]	[0.103]	[0.310]	[0.328]	[0.691]	[0.023]
Observations in Panel A	4,114	4,116	4,070	4,116	4,101	4,116
Panel B: Ethiopia						
War Region * Has a Child Born During War	0.235**	0.171	-0.111	0.166	-0.585	0.057***
	[0.115]	[0.173]	[0.400]	[0.517]	[0.618]	[0.020]
War Region	-0.982***	0.030	-1.403***	0.431	2.495***	-0.098***
	[0.144]	[0.126]	[0.359]	[0.372]	[0.537]	[0.018]
Has a Child Born During War	-0.617***	0.971***	0.089	0.640***	0.018	0.053***
	[0.073]	[0.070]	[0.159]	[0.192]	[0.247]	[0.007]
Constant	1.761***	3.591***	157.409***	28.845***	38.557***	0.824***
	[0.092]	[0.052]	[0.164]	[0.144]	[0.212]	[0.006]
Observations in Panel B	13,166	13,166	9,874	13,166	13,165	13,166

Notes: Robust standard errors in brackets, clustered at the enumeration level. * significant at 10%, ** significant at 5%, and *** significant at 1%. In Eritrea, the war regions are Gash Barka, Debub, and Debubawi Keyih Bahri. In Ethiopia, the war regions are Tigray and Afar. Data source: 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys.

Appendix Table 2: Measuring the Impact of War Exposure on Child Mortality

Dependent Variable: Child Mortality	Eritrea			Ethiopia		
	[1]	[2]	[3]	[4]	[5]	[6]
War Region * Born During War	-0.010			-0.014		
	[0.024]			[0.022]		
War Region * Born Before War	-0.032			-0.025		
	[0.041]			[0.021]		
Close to War Site * Born During War		0.000			0.005	
		[0.022]			[0.029]	
Close to War Site * Born Before War		-0.049*			0.006	
		[0.028]			[0.025]	
Close to War Site		0.023			-0.075***	
		[0.014]			[0.021]	
War Intensity * Born During War			0.000			-0.002
			[0.001]			[0.002]
War Intensity * Born Before War			0.000			-0.003
			[0.002]			[0.002]
Child Age Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Region-Specific Time Trends	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,814	5,748	5,752	14,637	14,582	14,590

Notes: Robust standard errors in brackets, clustered at the enumeration level. * significant at 10%, ** significant at 5%, and *** significant at 1%. The regression samples include all children ever born during the 60 months prior to the survey, and the dependent variable indicates whether the child died prior to the survey. All specifications include child age fixed effects, region fixed effects, child gender controls, and region-specific time trends. In Eritrea, the war regions are Gash Barka, Debub, and Debubawi Keyih Bahri. In Ethiopia, the war regions are Tigray and Afar. "War Region*Born During War" indicates a child living in a region affected by the war who was born during the war. "War Region*Born Before War" indicates a child living in a region affected by the war who was born before the war started. "Close to War Site*Born During War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born during the war. "Close to War Site*Born Before War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born before the war started. "War Intensity" indicates for each region the number of internally displaced individuals as a percentage of the region's pre-war population. Displacement data for Eritrea and Ethiopia come from the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA). Data source: 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys.

Appendix Table 3: Comparing the Impact in Eritrea and Ethiopia of War Exposure on Children's Height-for-age Z-score

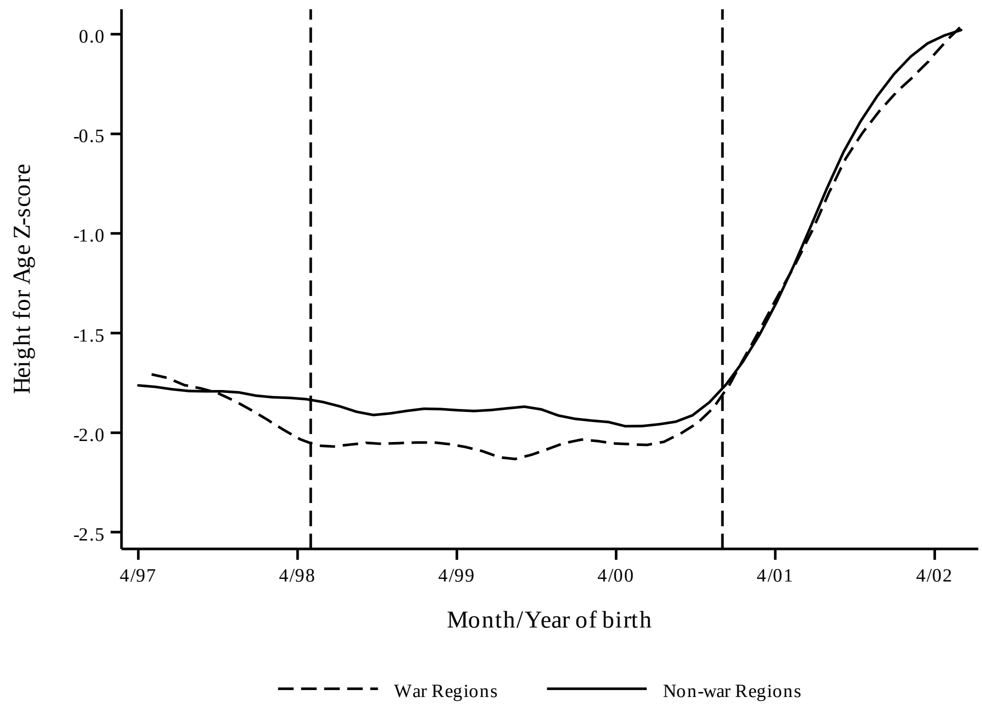
Dependent Variable: Height-for-age Z-score	Distance		War Intensity	
	[1]	[2]	[3]	[4]
Close to War Site * Alive During War	-0.403***			
	[0.100]			
Close to War Site * Alive During War * Ethiopia	-0.056			
	[0.162]			
Close to War Site * Born During War		-0.430***		
		[0.101]		
Close to War Site * Born During War * Ethiopia		0.073		
		[0.172]		
Close to War Site * Born Before War		-0.154		
		[0.132]		
Close to War Site * Born Before War * Ethiopia		-0.378*		
		[0.193]		
War Intensity * Alive During War			-0.021***	
			[0.004]	
War Intensity * Alive During War * Ethiopia			-0.031***	
			[0.011]	
War Intensity * Born During War				-0.018***
				[0.005]
War Intensity * Born During War * Ethiopia				-0.025**
				[0.012]
War Intensity * Born Before War				-0.013
				[0.009]
War Intensity * Born Before War * Ethiopia				-0.046***
				[0.014]
Child Age Fixed Effects	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes
Region-Specific Time Trends	Yes	Yes	Yes	Yes
Observations	17,697	17,697	17,806	17,806

Notes: Robust standard errors in brackets, clustered at the enumeration level. * significant at 10%, ** significant at 5%, and *** significant at 1%. All specifications include child age fixed effects, region fixed effects, child gender controls, and region-specific time trends. Column 1 and 2 also include "Close to War Site" and "Close to War Site * Ethiopia". "Close to War Site*Alive During War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was alive during the war. "Close to War Site*Born During War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born during the war. "Close to War Site*Born Before War" indicates a child living within 75 km in Eritrea and within 125 km in Ethiopia from any of the three conflict sites and who was born before the war started. "War Intensity" indicates for each region the number of internally displaced individuals as a percentage of the region's pre-war population. Displacement data for Eritrea and Ethiopia come from the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA). Data source: 2002 Eritrea and 2000 and 2005 Ethiopia Demographic and Health Surveys.

Figure 1: Eritrea and Ethiopia Regional Map Indicating Conflict Sites

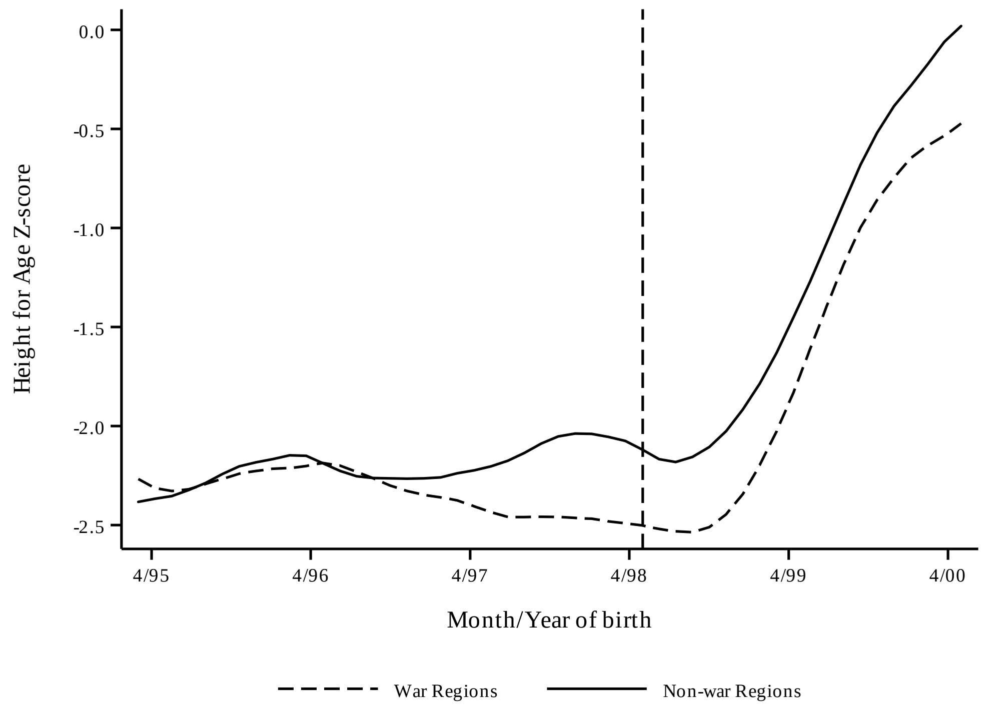
Notes: The main fighting between Eritrea and Ethiopia occurred around the areas of Badme, Tsorona-Zalambessa, and Bure, which are noted on the map. Map source: Constructed by Rafael Garduño-Rivera in ArcGIS.

Figure 2: Height-for-age Z-scores by Month and Year of Birth and War Exposure in Eritrea in 2002 (War and Post-War Period)



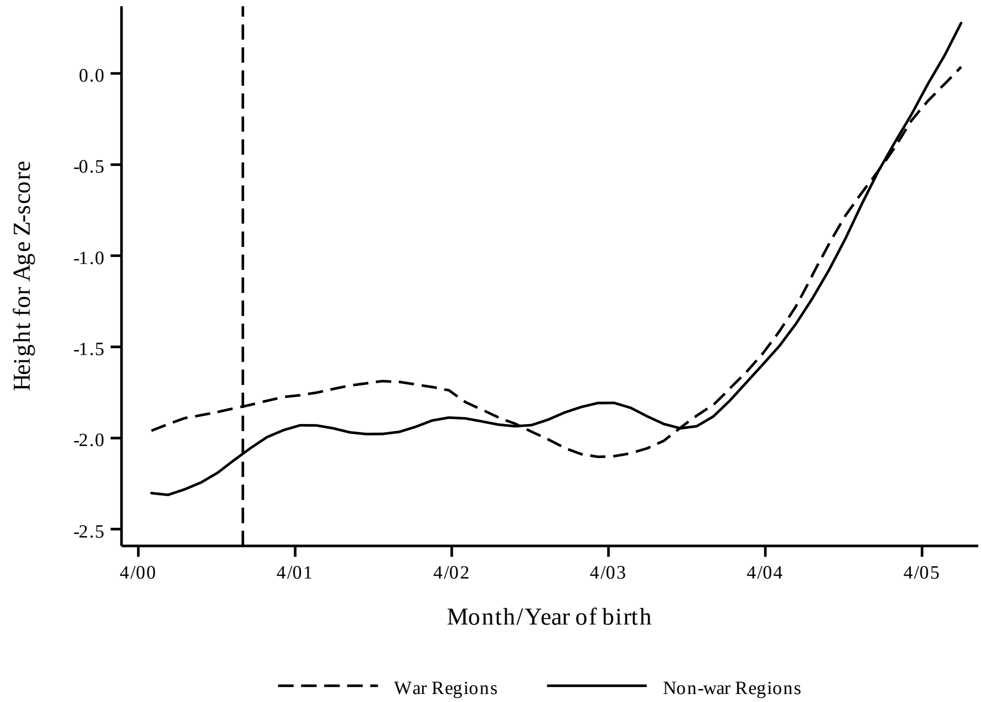
Notes: Kernel-weighted local polynomial regression (using Epanechnikov kernel) of height-for-age Z-score on month and year of birth. Dashed line indicates children living in war regions. Solid line indicates children living in non-war regions. Vertical dashed lines show the starting (May 1998) and the ending dates (December 2000) of the war. Birth cohorts were either born before the war started, during the war, or after the war ended. Data source: 2002 Eritrea Demographic and Health Survey.

Figure 3: Height-for-age Z-scores by Month and Year of Birth and by War Exposure in Ethiopia in 2000 (War Period)



Notes: Kernel-weighted local polynomial regression (using Epanechnikov kernel) of height-for-age Z-score on month and year of birth. Dashed line indicates children living in war regions. Solid line indicates children living in non-war regions. Vertical dashed line shows the starting date (May 1998) of the war. All birth cohorts were either born before the war started or during the war. Data source: 2000 Ethiopia Demographic and Health Survey.

Figure 4: Height-for-age Z-scores by Month and Year of Birth and by War Exposure in Ethiopia in 2005 (War and Post-War Period)



Notes: Kernel-weighted local polynomial regression (using Epanechnikov kernel) of height-for-age Z-score on month and year of birth. Dashed line indicates children living in war regions. Solid line indicates children living in non-war regions. Vertical dashed line shows the ending date (December 2000) of the war. Data source: 2005 Ethiopia Demographic and Health Survey.