The Impact of War on Child Human Capital: Evidence from Children in Ethiopia

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Abstract

In May 1998 a border dispute between Ethiopia and Eritrea resulted in a war lasting until June 2000, which came with significant economic cost and affected individual livelihoods in both countries. However, the specific effects on human capital of young children in the affected region of Ethiopia still remain unclear, partly because of limited availability of suitable data. This paper investigates the effect on child human capital outcomes using the Young Lives data set for Ethiopia. Identification of the effect of the war is based on a difference-in-difference approach, by tracking cohorts of children born before and after the war, in war affected and non-affected regions. The results show that exposure to the war between the age of 3-4 to 5-6 is associated with about a third of standard deviation reduction in average height-for-age z-score and an increased incidence of childhood stunting by about 11 percentage points. In addition, exposed children are more likely to complete fewer grades, less likely to be enrolled in school, and more likely to exhibit reading problems. These are disconcerting findings, especially for children from poor backgrounds, as early life outcomes can have lasting impacts during adulthood.

Keywords: conflict, war, child health, child education, Ethio-Eritrean War

JEL Classification: I15, I25, O15, J24

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I. Introduction

Many countries especially in Africa are exposed to both natural and human induced shocks. War is one such human-made shock that has reoccurred at an unfortunate frequency across Africa in recent history. According to the report "Understanding the Implications, Fulfilling the Obligations" by the United Nations Security Council, since decolonization, Africa has experienced some 80 coups d'état, 75 armed conflicts and 40 civil wars (Nduwimana, 2000).

Exposure to war (or conflict) can have severe implications (World Bank, 2011) both at the macroeconomic level and for individual wellbeing, in terms of both direct and indirect costs. The direct cost refers to the material damage of war, such as the destruction of infrastructure, health and education facilities, and utilities. The indirect cost can be expressed in terms of forgone economic growth, for example due to shifts in fiscal policy (Imai and Weinstein, 2000) with scarce resources being channelled to unproductive investments such as military expenses, slowing down infrastructure development.

Human capital may also be affected by war, especially for children, through increased malnutrition and ill-health, and reduction of education. The young are usually vulnerable to adverse shocks such as war because their attachment to their parents could be disrupted (Santa Barbara, 2006). They are also at an early stage of growth and many human capital investments are age-specific (Justino, Leone and Salardi, 2013). For instance, loss of a parent can cause both emotional and physical harm, and increase vulnerability to future risk (e.g., see Beegle, Weerdt and Dercon, 2006).

Thus, through its effect on child human capital, war can have a lasting impact which might perpetuate intergenerational poverty. There is substantial literature that concludes that ill-health, nutritional, and educational deficiency in early life can have lasting consequences during adulthood health, education, and labour market outcomes (Alderman, Hoddinott, and Kinsey, 2006; Currie, 2008; Currie and Vogl, 2012; Lucas, 1998, 1999; Martorell, 1999; Silventoinen, 2003; Duflo, 2001; Grantham-McGregor et al., 2007). Moreover, the literature on nutrition and productivity explains that nutrition increases productivity (Strauss, 1986; Haddad and Bouis, 1991), while there is also well established strong link between nutrition, health, and economic development (Strauss and Thomas, 1998). Grantham-McGregor and his co-authors argue that “disadvantaged children in developing countries who do not reach their developmental potential are less likely to be productive adults” (Grantham-McGregor et al., 2007). Therefore, shocks such as war can induce multiple equilibria poverty traps as exposure to war may bring permanent damage affecting intergenerational welfare.

War may have further long term intergenerational implications through the disruption of trust and social networks (Buvinic, Gupta and Shemyakina, 2013; Cassar, Grosjean and Whitt, 2011; Rohner, Thoenig and Zilibotti, 2012), which can raise barriers for people to reunify and work together for mutually beneficiary activities such as trade. It could also have a detrimental impact on depopulation by increasing the mortality rate of adults and hence subsequently decreasing fertility rates. This reduction in social capital and fertility rates could also affect (child) human capital (Coleman, 1998; Becker, Murphy and Tamura, 1994).

However, despite these potential effects of war on economic welfare and human capital, there is but a small yet recently growing body of literature. Most of these studies concentrate on the consequence of civil war (or conflict) *within* a country which is more likely to be endogenous to the country’s level of economic growth (Blattman and Miguel, 2010). The bulk of these studies look at micro-economic evidence using cross-sectional data that apply a difference-in-difference approach assuming that changes in outcomes between those children born after and before war (or conflict) would have been the same for war (or conflict) affected and non-affected areas in the absence of war (or conflict). Furthermore, studies that look at both macroeconomic and microeconomic evidence found mixed results on the effect of war on child human capital.

This study looks at the effect of Ethio-Eritrean war on child nutrition, health and schooling outcomes using a sample of children from Young Lives survey in Ethiopia. Child height, adjusted for age and sex, is used as a key outcome variable to proxy child nutrition and health. The height premium literature (Case and Paxson, 2006, Schultz, 2002) shows that height is a key indicator of nutrition and health status of children as well as adults. In addition, grade completion, school enrolment and reading ability of a child are examined.

Using a difference-in-difference approach, this study shows that children who were exposed to (and survived) the war between the age of 3-4 to 5-6 have, on average, about a third of a standard deviation lower height-for-age as compared to children that were not directly exposed to the war.

The impact is larger and has stronger statistical significance for the rural sub-sample. In addition, war exposure increases childhood stunting by about 11 percentage points. Moreover, exposed children are likely to complete fewer grades, less likely to be enrolled in school, and more likely to exhibit reading problems.

This paper makes three contributions to the existing literature. First, the analysis draws on a unique data set from the Young Lives survey to provide the first evidence on the impact of war on a range of child human capital outcomes – height (or stunting), grade completion, school enrolment, and reading ability. Second, it exploits panel data to compare children born before and after the war, focussing on outcomes for these old and young cohorts at exactly the same average age. This would be impossible using cross-section data only. Cross-sectional comparison of old and young cohorts will tend to overestimate the impact of war if the war-affected region is, for instance, naturally drought prone as old cohort children will have accumulated larger deficits than young cohorts (Martorell and Habicht, 1986). Third, it is the first evidence to identify the causal effect of Ethiopian-Eritrean war using sample of children from poor households in Ethiopia.

The rest of the paper is organized as follows. Section two describes the context by providing brief history of the war and potential mechanisms of its impact while section three briefly discusses the literature. The fourth section presents the data and descriptive summary. Section five outlines the identification strategy and addresses issues of potential bias while the sixth presents results and discussion. The final section concludes by inferring the predicted impact of the war on potential adult earnings.

II. The Eritrean-Ethiopian war

2.1 History

Eritrea was one of the regional states under the umbrella of Ethiopia and became an independent nation after a referendum in 1993 (Tronvoll, 1999). Five years later, a border conflict between Ethiopia and Eritrea led to a war lasting from May 1998 until June 2000 (Abbink, 1998).

According to a review by Gebru Tareke (2001), “the Eritrean-Ethiopian war began as a territorial dispute on May 6, 1988, at *Badme* (a district in Tigray region), an insignificant village on the western side of the international border”. Later on the war took place in two other locations – Tsorona-Zalambessa and Bure of the Tigray and Afar regions respectively. Most of the battles were going on in the Tigray region. Akresh et al. (2012) argue that both countries claimed sovereignty over these three areas of war due to the confusion over the border demarcation between the two countries.

The war led to significant loss of life and material damage for both nations. As documented in the report from Addis Ababa University (2012), both countries committed to large spending to mobilise military forces. It is estimated that the total cost of the conflict is about USD 280 and 397 million for Eritrea and Ethiopia, respectively, in addition to nearly 50 to 75 thousands of troops lost for each country (Addis Ababa University, 2012). Furthermore, a large number of people were internally displaced. As documented in the Internally Displaced Persons (IDP)[2] global database of Norwegian Refugee Council, about 315,000 Ethiopians were displaced by December 1998 and this number grew to more than 360,000 on May 2000, of whom 90 percent were in the Tigray region and about 30,000 in the Afar region (Global IDP, 2004). The foregone GDP growth and the human cost also imply a significant impact on the overall economy of both nations – Ethiopia and Eritrea.

However, due to geographic exposure, children who reside close to the war-affected region would be more affected than those in regions who are further from the battle field. In addition, after the war ended formally in June 2000, Ethiopia went through more or less a period of peaceful decade. This indicates children born after the war in both war-affected and non-affected regions are not directly exposed to the war. As a result, identification of effects is possible by comparing changes in outcomes for children born before and after the war in war-affected and non-affected regions. Furthermore, because the war was caused as a result of border dispute between these two countries, which can be claimed to be purely exogenous to child health and schooling outcomes in Ethiopia, identification of causal effects is possible.

2.2 Mechanisms

The war can affect child human capital through a number of direct and indirect channels. Primarily, the war led to large internal displacement of people and loss of life. This can further

[2] For additional information, visit: http://www.forcedmigration.org/research-resources/expert-guides/ethiopia/internally-displaced-persons-idps and http://www.internal-displacement.org/assets/library/Africa/Ethiopia/pdf/Ethiopia-July-2004.pdf

cause loss of crops, livestock, productive inputs and assets, especially for rural farmers. These could all decrease the stock of food available to children (Akresh et al., 2012).

In addition to displacement and loss of life, the war resulted in a direct form of destruction of health and education infrastructural facilities which are relevant environmental inputs to child growth, health and education outcomes (Lai and Thyne, 2007). For instance, it is documented that on 5 June 1998 the Eritrean Air Force bombed Ayder School in Mek'ele (the capital city of the war affected region) killing twelve children.[3] Most, if not all, of such destructions were happening in war-affected region comparing to the rest of the regions. Thus, such damage to physical infrastructure can significantly interrupt and decrease the process of child health and education accumulation.

Due to geographic proximity of the war affected region, children may hear the sound coming from the battle field, listen to parent's daily conversation about the war, and even worse feel bad news of loss of life. These could contribute to Post-war Trauma Stress Disorder (PTSD). Previous studies by Dyregrov et al. (2000), Papageorgiou et al. (2000), and Thabet and Vostanis (1999) found significant PTSD association with intrusion and avoidance for children exposed to Rwandan genocide, Bosnian and Palestine war respectively. There is evidence that PTSD is a potential risk factor for mental health of children that may further affect their health and educational outcomes (eg. Currie and Stabile, 2006).

Finally, war could affect child human capital through its general equilibrium effects. War induced-poverty could rise in war-affected region compared to the other regions. For instance, the rate of private investment (or demand for investment) could decrease in war-affected regions in response to the war. In addition, return on investment could also decrease due to an immediate interruption of daily business, destruction of infrastructure, or instability caused by the war (Bruck, Naude and Verwimp, 2013, Collier and Duponchel, 2013)[4]. Agricultural outputs may diminish due to lack of appropriate distribution of say inputs for reasons caused by the war. Consequently, war exposed regions might have relative increase in poverty which may then potentially affect child growth, nutrition, health, and education.

[3] See: http://www.nai.uu.se/library/resources/dossiers/local_history_of_ethiopia/

[4] Bruck, Naude and Verwimp (2013) argue the potential damage of violent conflict on firm business or individual entrepreneurs. Collier and Duponchel (2013) found negative impact of civil war using firm level evidence from Sierra Leone.

III. Literature review

Theoretically, the impact of war (or conflict) on long term economic performance of a country is not clear. Neoclassical economic theory predicts rapid recovery (convergence) in the aftermath of a war. Some empirical evidence that support this argument is found in Sierra Leone (Bellows and Miguel, 2006), Germany (Brakman, Garretsen, and Schramm, 2004.), Japan (Davis and Weinstein, 2002), and Vietnam (Miguel and Roland, 2005). Chen and his co-authors use cross country analysis and conclude that "when the end of war marks the beginning of lasting peace, recovery and improvement are achieved" (Chen et al., 2008).

However, war may still have detrimental consequence on health, education, and labour market outcomes of individuals and households at microeconomic level even if an economic growth converges at the aggregate level (Blattman and Miguel, 2010; Justino et.al., 2013; Serneels and Verpoorten, 2013; Collier and Duponche, 2013). This consequence is expected to be even larger for children as the young are usually vulnerable to adverse shocks because their attachments with their parents could be disrupted (Santa Barbara, 2006). They are also at an early stage of growth and many human capital investments are age-specific (Justino et. al., 2013). Thus, war may still have persistent impact on child human capital even if overall economy recovers afterwards.

Despite potentially substantial negative impact of war (or conflict), the microeconomic empirical literature that looks at the impact of civil war (or conflict) *within* and *between* nations especially on child human capital is limited although recently growing. In addition to several other methodological concerns such as measuring difficulty of young children, studies that focus on civil war (or conflict) *within* a nation could face problem of endogeneity since civil war (or conflict) is potentially endogenous to the country's level of economic growth. Areas of civil war (or conflict) tend to be economically poor making it difficult to find causal effects (Blattman and Miguel, 2010). This could also be the case for international war (between countries) if cause(s) of a war is (are) not exogenous to outcomes of interest. For example, prevalence of high poverty around the border could be causes of conflict or war. However, if a war is caused by exogenous forces (e.g., unrelated to prevalence of poverty around the border) such as geo-political interest of one or both countries, then endogeneity is not a serious concern. Furthermore, the empirical literature that deals with the causal effect of an *international* war on human capital of children, especially that uses microeconomic evidence is limited.

Studies that look at the effect of civil war within a country on child height-for-age using microeconomic evidence are conducted in countries such as Rwanda (Akresh, Verwimp, and Bundervoet, 2011), Burundi (Bundervoet, Verwimp, and Akresh, 2009) and Nigeria (Akresh et al, 2012). Akresh et al. (2011) looked at the effect of civil war and crop failure on child stunting using cross-sectional household data from Rwanda. They found that children (both boys and girls) exposed to conflict exhibited about one standard deviation lower height-for-age-z-scores. Similarly, Bundervoet et al. (2009) found 0.35 (0.047 for each additional month of conflict exposure) standard deviation lower height-for-age-z-scores for those exposed in civil war in rural Burundi. Akresh et al. (2012) looked at adults with and without exposure to the Nigerian civil war when these adults were children and adolescents. They found that adults exposed to (and survived) the war exhibited reduced stature (surprisingly the effect being larger for the exposure during adolescence than childhood) than unexposed adults 30 to 40 years later.

Microeconomic studies that focus on the effect of civil war on child schooling outcomes also show negative impacts. These include studies conducted in countries such as Burundi for boys (Verwimp and Van Bavel, 2013) Peru for all children (Leon, 2012), Guatemala for both disadvantaged rural Mayan males and females (Chamarbagwala and Morán, 2011), Tajikistan for girls but not for boys (Shemyakina, 2011). However, a more recent study by Valente (2013) found that conflict intensity is associated with an increase of female (although the abductions by Maoists had negative effect) and male schooling attainment using data from Nepal. In addition, study from Timor-Leste (Justino et al, 2013) using two waves of cross-sectional survey data found mixed short term effects and negative long term effect of exposure to conflict. Thus, the effect of conflict on education attainment of children seems to show mixed results.

Previous work that looks at the causal effect of international war (between countries) on (child) human capital includes from Eritrea (Akresh, Lucchetti and Thirumurthy, 2012), Croatia (Kecmanovic, 2012), and Germany (Akbulut-Yuksel, 2009). Akresh et al. (2012)[5] use the 2002 Eritrean DHS cross-sectional survey data to investigate the impact of Ethiopian-Eritrean war on child height-for-age z-scores by exploiting exogenous variation in geographic extent and timing of

[5] In their working paper version, Akresh, Lucchetti and Thirumurthy (2011) tried to look at the impact of Ethio-Eritrean war on Ethiopian children as well using the combined DHS 2000 and 2005 data. However, using the DHS data for Ethiopia in this context is quite unreliable because the DHS 2000 survey was essentially fielded during the war period making it less likely to be reliable.

conflict. They found that exposure to war decreases child height-for-age by about 0.45 standard deviations. However, using the 2002 DHS survey implies that the majority of the sampled children born after the war are very young (about one year old) at which measuring height could be difficult. A working paper by Akbulut-Yuksel (2009) found that German children exposed to World War II had 0.4 fewer years of schooling, 1 centimetre shorter stature and 6% lower earnings as adults. Similarly, Kecmanovic (2012) studied the impact of recent war in Croatia (1991–1995) and found negative effect on educational outcomes but small and positive effect on employment and earnings of 1971 birth cohorts of men.

Three important issues raised in the literature are worth noting. First, most of the studies that focus on microeconomic evidence use cross-sectional data (that include cohorts born before and after war) and apply a difference-in-difference approach using time and spatial variation. The key implicit assumption of these studies is that in the absence of war (or conflict), changes in outcomes between those children born after (young) and before (old) war (or conflict) would have been the same for conflict affected and non-affected areas. However, if poverty caused war (or conflict) or conflict-affected areas tend to be economically poor ex-ante, the key assumption may not hold as old cohorts may accumulate larger deficits than young cohorts, resulting potentially in an over-estimated impact of the conflict (Martorell and Habicht, 1986). Second, the empirical literature so far found mixed results not only on long term aggregate economic performance of countries but also on schooling outcomes of children (or individuals) at the micro level. Third, theoretically, the impact of war (or conflict) is not yet clear which suggests the need for more rigorous and robust theoretical as well as empirical studies.

The current study will contribute to fill these gaps by using the advantage of unique panel data from the Young Lives survey. This data set allows comparison of children's outcomes in war-affected and non-affected regions when both old (born before war) and young (born after war) cohorts of children have exactly the same average age. The nature of the panel in the data assists in tracking young children born after the war up to the age of those children born before the war when they were interviewed for the first wave of the survey. By doing so, if the assumption of parallel trend is satisfied, the young cohorts can accumulate as much deficit as the old cohorts when comparing the young at the later waves with the old at early waves. This helps in minimizing the bias of overestimating the impact of war that could have occurred because of non-linearity of age in growth process of children. To the best of our knowledge, none of the past studies have attempted to compare outcomes of children of similar age from different cohorts since these studies didn't use a separate panel data for both cohorts that were born before and after the war.

III. Data and Summary Statistics

3.1 The data set

The data set comes from the Young Lives panel data of three rounds – 2002, 2006 and 2009, collected by the Young Lives team of Oxford University in collaboration with the Ethiopian Development Research Institute and researchers from Addis Ababa University and save the children UK in Ethiopia (Alemu et al., 2003). Young Lives is a longitudinal childhood poverty study which tracks a sample of poor children in four developing countries – Ethiopia, Peru, Vietnam, and India (Outes-Leon and Sanchez, 2008). As of 2002, the study has followed two cohorts in each of these four countries. The younger cohort consists of 2,000 children per country with an average age of 1 year in 2002. The older cohort consists of 1,000 children per country aged between 7.5 and 8.5 in 2002 (Alemu et al., 2003; Outes-Leon and Sanchez, 2008; Woldehanna, Mekonnen, and Alemu, 2008; Woldehanna, Gudisa, Tafere, and Pankhurst, 2011).

Table 1: Survey data rounds and war exposure by birth year of cohorts

Years								Observation took place/ Data collected			
				War period				Round 1	Round 2	Round 3	War exposure by birth
94		96		**98**		**2000**		2002	2006	2009	
Young cohorts								1 years old	5 years old	8 years old	Not exposed
Old cohorts								8 year old	12 year old	15 year old	Exposed

The sample in Ethiopia was selected based on a multi-stage sampling design. Initially, the first stage included a selection of 5 out of 9 regions (Tigray, Amhara, SNNP, Addis Ababa, and Oromia). These five regions cover about 96 percent of the total population of the country. Of these regions, 20 sites (about 3-5 districts per region) were selected based on pro-poor bias, balancing Ethiopian regional and ethnic differences and also the cost of sampling. Areas of food deficiency were over-sampled and due to cost reasons the chance of excluding sites in remote areas was very high. In addition, at least one Peasant Association (PA) (in rural areas) or *kebele* (in urban areas) – the lowest level of administrative structure in the country – in each district was picked. Eventually, 100 children born between April 2001 and June 2002 (for the young cohort group) and 50 children born between April 1994 and June 1995 (for the old cohort group) were selected in each sentinel site using simple random sampling (Alemu et al., 2003; Outes-Leon and Sanchez, 2008; Woldehanna et al., 2008; Woldehanna et al., 2011).

3.2. Variables and summary statistics

The first outcome variable is standardized height-for-age z-score. It is calculated as the actual height of each child minus the median height of a WHO reference population of healthy children of same age and sex, divided by the standard deviation of this reference population. This implies that height-for-age z-score of zero for a given child would mean that the child is as well-nourished as the WHO reference group children, on average. The reason for selecting height (adjusted for age and sex) is that, among several other anthropometric health indicators such as weight (adjusted for age and sex) and body mass index, it is the most reliable long-term measure of nutrition and health used by several researchers (e.g., Deaton, 2007; Dercon, 2012; Hoddinott and Kinsey, 2001; Yamano, Alderman, and Christiaensen, 2005; Silventoinen, 2003; McCarron et al., 2002). In addition, it is an objective measure readily available in the dataset. The other outcomes include the number of highest grades completed by a child, whether a child is currently enrolled, and if a child has reading problems or not.

All of these outcomes are not fully observed in all the three survey rounds of both cohorts. However, fortunately, data on all of these outcome variables are fully available for the first round of the old and the third round of the young cohorts. These age overlapping cohorts of 8 year olds in 2002 and 2009 (hereafter referred to as the restricted sample) form the sample are required for the main analysis.

Table 2: Summary statistics of outcome variables by cohort and region of war exposure for the restricted sample

	Old cohort			Young cohort		
	Non-	war		Non-war	war	

	war					
	mean	mean	Diff	mean	mean	Diff
Panel A: child height outcomes						
Child height (cm)	118.57	116.13	2.44***	120.70	120.54	0.16
Height-for-age z-score	-1.41	-1.73	0.32**	-1.20	-1.21	0.01
Stunted (%)	0.30	0.40	-0.11**	0.22	0.18	0.04
Panel B: child schooling/literacy outcomes						
Highest grade completed	0.50	0.36	0.14**	0.54	1.08	-0.55***
Currently enrolled (%)	0.67	0.60	0.07	0.73	0.94	-0.21***
Problems with reading (%)	0.75	0.95	-0.19***	0.73	0.74	-0.01
No. of children	759	183		1494	376	

Note: *** p<0.01, ** p<0.05, * p<0.1 holds.

Summary statistics for the child height and educational outcomes by cohort and regions of war exposure are presented in table 2. Panel A shows that the mean difference of child height, height-for-age z-score, and proportion of stunted children between war affected and non-affected regions is statistically significant for children born before the war (the old cohorts). However, these three outcomes are not statistically different from zero between war affected and non-affected regions for children born after the war (the young cohorts). This could be one indication that in the absence of war, children of both war-affected and non-affected regions exhibit similar growth on average.

Panel B shows that old cohorts of the war-affected region exhibit fewer grades completed (statistically significant), are less likely to be enrolled in school (but not statistically significant), and are more likely to exhibit reading problems (statistically significant) than old cohorts of the non-war-affected regions. However, the young cohorts of war-affected region completed more grades, are more likely to be enrolled in school (statistically significant), and are not more (or less) likely to exhibit reading problems than young cohorts of non-war-affected regions. Unlike child height outcomes, the educational outcomes indicate that children of war-affected regions are different from non-affected regions even in the absence of war (i.e., for the young cohorts).

Table 3: Summary statistics of covariates by cohort and region of war exposure, all rounds pooled

	Old cohort					Young cohort				
	Non- war		war			Non- war		war		
	N	mean	N	mean	Diff	N	mean	N	mean	Diff
Urban	2352	0.42	602	0.26	0.16***	4627	0.41	1167	0.25	0.17***
Child is male	2352	0.51	602	0.49	0.02	4627	0.52	1167	0.55	-0.03
Age in months	2352	139.99	602	139.24	0.75	4627	56.45	1167	56.48	-0.03
Age of household head	2349	45.46	601	47.88	-2.42***	4618	40.66	1163	41.64	-0.97**
Head is male	2351	0.76	601	0.68	0.08***	4627	0.84	1166	0.76	0.08***
head education	2262	2.35	582	2.42	-0.08	4513	2.17	1136	1.68	0.49***
Mother's age	2118	37.49	561	38.69	-1.20**	4535	30.87	1151	31.78	-0.91***
Mother literate	2091	0.21	558	0.13	0.08***	4376	0.27	1121	0.13	0.14***
Wealth index	2348	0.30	599	0.25	0.04***	4598	0.28	1163	0.24	0.04***
owned any livestock	2352	0.68	602	0.77	-0.09***	4627	0.65	1167	0.77	-0.12***
Number of milk animals	2352	1.46	602	1.71	-0.26**	4627	1.30	1167	1.42	-0.12*
Land in hectares	2352	0.82	602	0.81	0.00	4627	0.70	1167	0.97	-0.27
Number of males aged 0-5	2352	0.34	602	0.45	-0.11***	4627	0.36	1167	0.46	-0.09***
Number of males aged 6-12	2352	0.56	602	0.65	-0.08*	4627	0.55	1167	0.63	-0.08***
Number of males aged 13-17	2352	0.43	602	0.39	0.05	4627	0.35	1167	0.43	-0.08***
Number of males aged 18-60	2352	1.60	602	1.33	0.26***	4627	1.37	1167	1.17	0.19***
Number of males aged 61+	2352	0.10	602	0.17	-0.07***	4627	0.08	1167	0.07	0.01
Number of females aged 0-5	2352	0.36	602	0.43	-0.07**	4627	0.35	1167	0.46	-0.11***
Number of females aged 6-12	2352	0.58	602	0.65	-0.07*	4627	0.57	1167	0.67	-0.10***
Number of females aged 13-17	2352	0.47	602	0.52	-0.05	4627	0.39	1167	0.45	-0.05*
Number of females aged 18-60	2352	1.75	602	1.71	0.04	4627	1.53	1167	1.33	0.20***
Number of females aged 61+	2352	0.09	602	0.10	-0.01	4627	0.07	1167	0.08	-0.00
household size	2352	6.39	602	6.58	-0.19	4627	5.93	1167	6.20	-0.27***
Share of monthly food exp.	1553	0.63	401	0.71	-0.08***	3027	0.63	767	0.71	-0.08***
drought	1553	0.26	401	0.63	-0.37***	3028	0.26	767	0.53	-0.27***

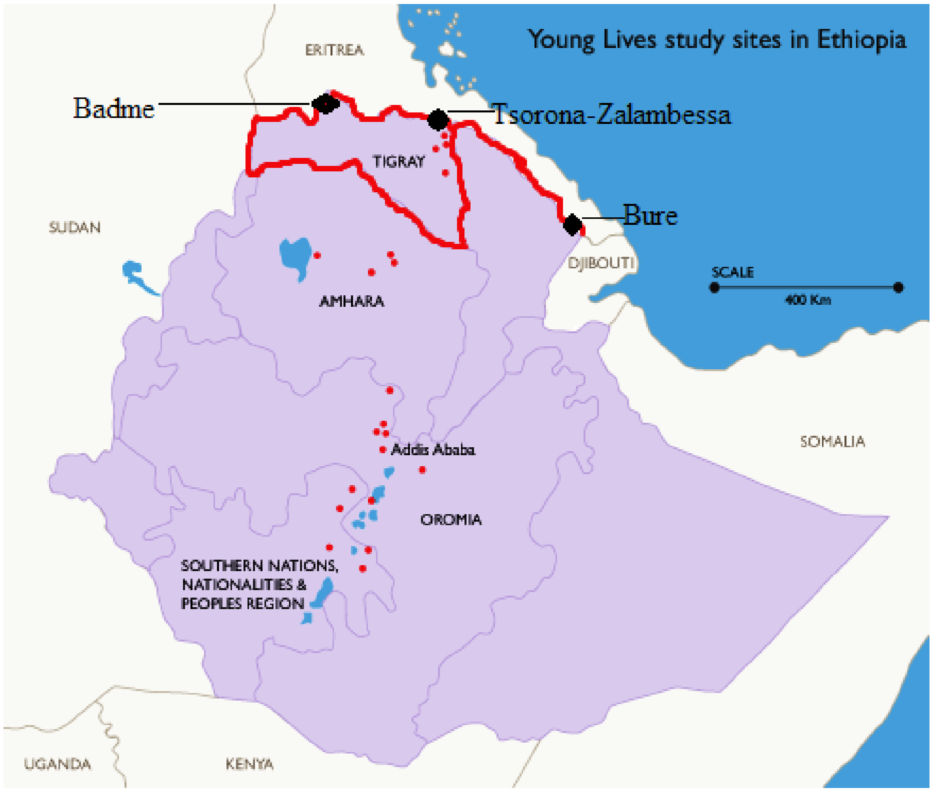
Note: *** p<0.01, ** p<0.05, * p<0.1 holds.

The summary statistics for child and household covariates by cohort and region of war exposure show that even though the war-affected and non-affected regions are different across a range of observable dimensions; these differences are the same for both cohorts. For instance, the war-affected region has on average slightly older and smaller proportion of literate parents, lower value of wealth index, more ownership of livestock and milk animals, and higher share of expenditure on food and incidence of drought. And these all applies to both young and old cohorts.

IV. Identification Strategy and Potential bias

Children's exposure to the war varies across time and geographic location. First, the old cohort of sampled children were born 3 to 4 years (from April 1994 to June 1995) before the war starts and they experienced the full two-year war period (from May 1998 to June 2000), while the young were born just after the war (from April 2001 to June 2002). Second, the war cannot affect all children of old cohorts equally since it was concentrated in the northern and north east part of the country: in Badme, Tsorona-Zalambessa and Bure of Tigray and Afar regions. Since the Young Lives data set doesn't include a sample from Afar region, the area of war incidence in this study is Tigray region while the rest of regions in the sample are considered less war-intense regions. Figure 1 shows the approximate location of the sentinel sites of Young Lives with the small dots while the bold line indicates Tigray and the boundary of Ethiopia with Eritrea. The districts of the main battle fields are indicated by bigger dots approximately in the map. The combination of time and spatial dimensions of war exposure implies that a child is considered to be exposed to the war if born before the war (i.e. belongs to the old cohort) and is from the Tigray region. Thus, changes in outcomes between old and young cohorts for the non-war affected regions effectively serve as control group to the changes in outcomes between old and young cohorts in the war-affected region.

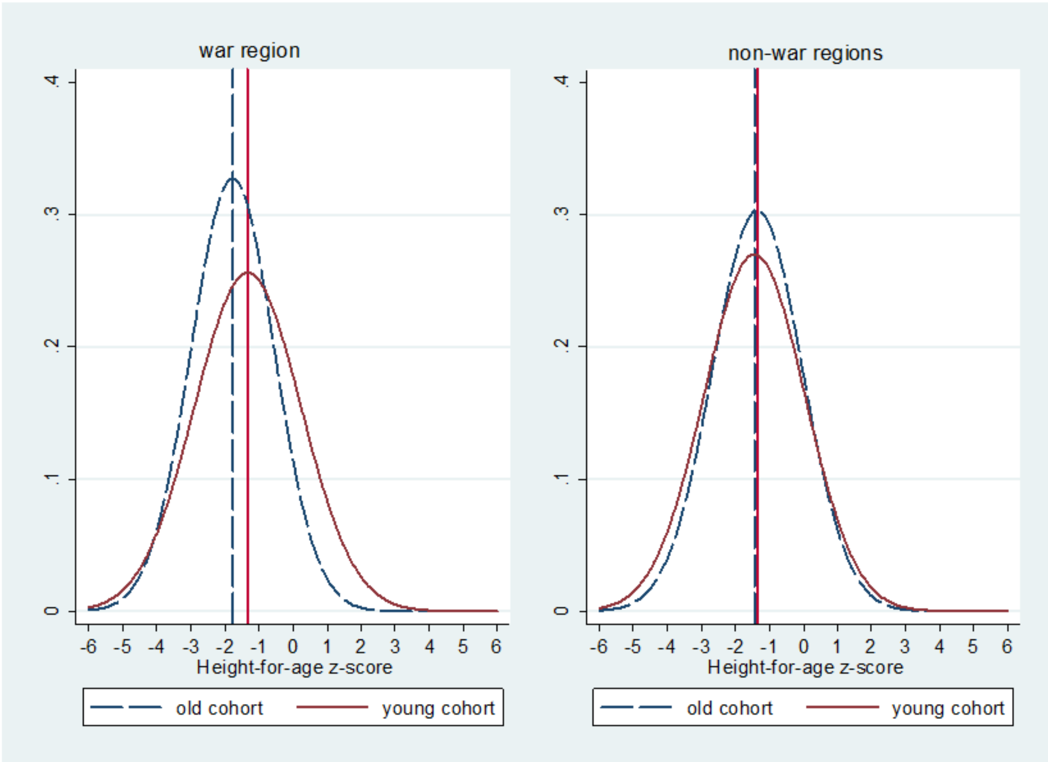
Figure1: Map showing Young Lives Study sites in Ethiopia



Source: Young Lives Study website:
http://www.younglives.org.uk/images/maps-logos-and-graphs/maps-of-study-sites/ethiopia-study-sites

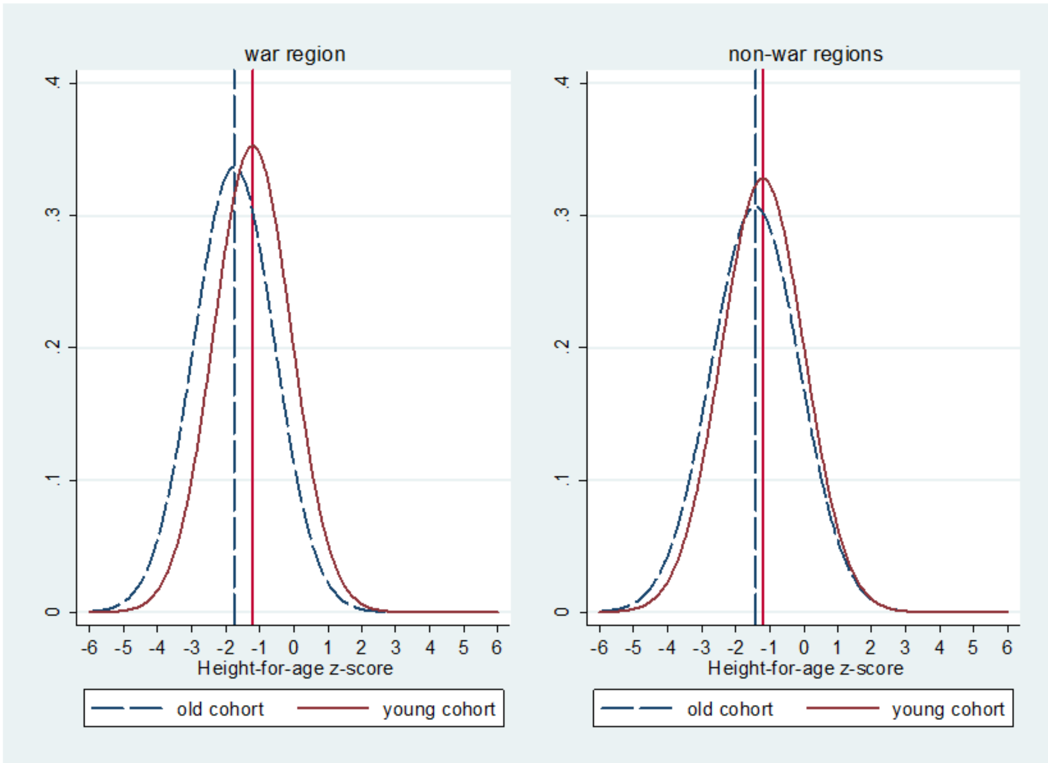
Figure 2 shows the distribution of height-for-age z-score by cohort and region of war exposure using the panel data pooled for all children. First, it is clear that all cohorts in both regions have, on average, a negatively skewed distribution suggesting that the sampled children are on average of lower height relative to the WHO reference population of healthy children. However, there is a significant difference in the gap of the distribution in height-for-age z scores between old and young cohorts for war-affected and non-affected regions. In the war-affected region, old cohorts show a relatively higher incidence of stunting compared to the young cohorts, while both cohorts have nearly the same distribution in the non-war affected regions, on average.

Figure2: Height-for-age z-score distribution by cohort and region of war exposure, all rounds sample



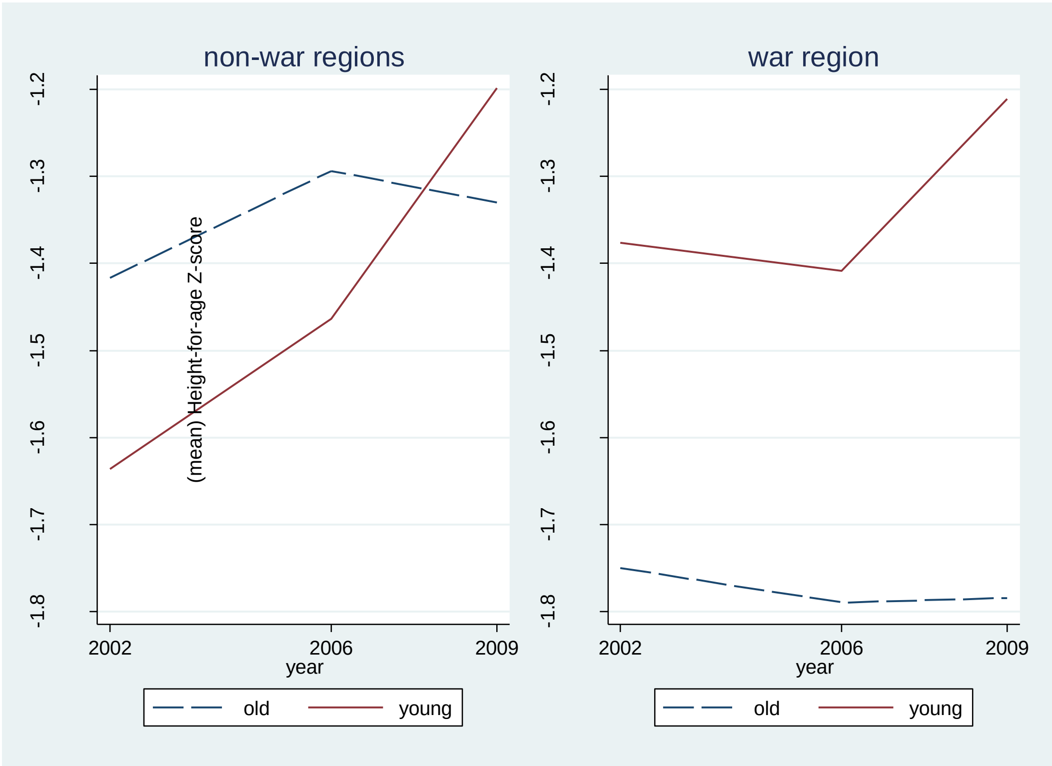
Even though height-for-age z-score is calculated by adjusting for age and sex of the child, comparing children of same age would be more convincing due to non-linearity of child growth. Figure 3 shows the distribution of 'young' of the old (age 8 in 2002 survey round) and 'old' of the young (age 8 in 2009 survey round) cohorts. It is again clear that the gap of the distribution in height-for-age z scores between young and old cohorts is higher in the war-affected region as compared to the non-war affected regions, confirming similar observation to the unrestricted sample. If changes between young and old cohorts are only due to the cohort effect only (or not due to the conflict), then we should have seen similar differences for both the war-affected and non-affected regions, on average.

Figure3: Height-for-age z-score distribution by cohort and region of war exposure, restricted sample



Furthermore, figure 4 shows how mean height-for-age z-score of the young cohorts in the non-war-affected regions converges to mean height-for-age z-score of the war-affected region over time despite initial differences. In the third round of survey, young cohorts from the war-affected region don't exhibit differences in their height-for-age z scores with that of the same cohorts from non-war-affected regions, on average. However, this difference is substantial and persistent for the old cohorts.

Figure4: Trends in mean height-for-age z-score by cohort and region of war exposure



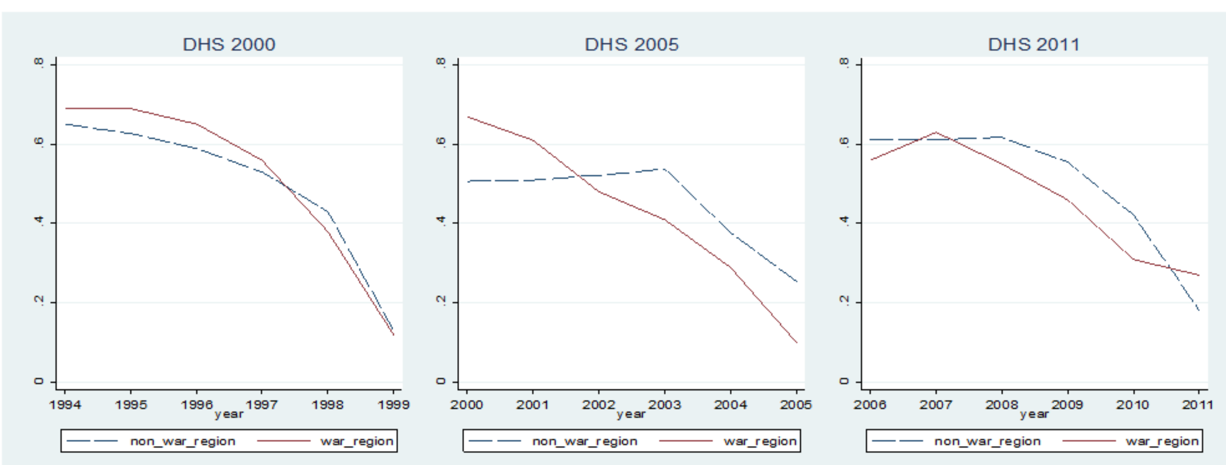
Using time and spatial variation, a given child will fall in either of four categories – born before war from war-affected region, born before war from non-war-affected region, born after war from war-affected region and finally born after war from non-war-affected region. Thus, it is possible to find causal effects using difference-in-difference method (using equation 1 below); under the assumption that the war-affected and non-affected regions are following a parallel trend on average. That is, in the absence of war, both regions should have followed similar patterns with regard to any observables and unobservables that potentially affect child outcomes, for θ to be unbiased and consistent estimator.

$$\hat{\theta} = \left[\left(\bar{y}_{w,o} - \bar{y}_{w,y}\right) - \left(\bar{y}_{nw,o} - \bar{y}_{nw,y}\right)\right] \qquad 1$$

Where $\bar{y}_{w,o}, \bar{y}_{w,y}, \bar{y}_{nw,o}, \bar{y}_{nw,y}$ are the averages of each outcome for: old cohorts from war-affected region, young cohorts from war-affected region, old cohorts from non-war-affected regions, and young cohorts from non-war-affected regions respectively.

The first threat to this method is that it assumes a parallel trend – in the absence of war, changes between old and young cohorts in war-affected and non-affected regions would have been the same. The presence of unobserved heterogeneity across regions becomes a problem only if such factors are time variant (Khandker, Koolwal, and Samad, 2010; Bertrand, Duflo and Mullainathan, 2004). For instance, unobservable investments in health and education in these regions could vary systematically for reasons other than the war. An example of these could be that old cohorts may not have received appropriate vaccination whereas the young cohorts did and this varies across regions. Child vaccination is one of the most important determinants of childhood growth and health (Ami, 1996; Agadjanian and Prata, 2003) reflecting policy decision of the government. For this reason, I looked into vaccination trends for cohorts of children born from 1994 to 2011 in war-affected and non-affected regions using the three DHS survey rounds: 2000, 2005 and 2011 (results available in figure 5). It shows that there is no such systematic variation in percentage of children who had received any vaccination across regions and cohorts.

Figure 5: Trends in vaccination rate of cohorts of children born from 1994 to 2011 using DHS survey rounds by region of war exposure



Second, using height as measure of health outcome by itself could be a threat to the identification strategy since the older children in relatively poor regions could be shorter than older children in the non-poor regions because the former could a accumulate large poverty induced height deficit while the young cohorts may tend to lookalike (Martorell and Habicht, 1986; Duflo, 2003). This phenomenon might lead for an upward bias of the impact estimate even if the parallel trend assumption is satisfied. To mitigate this, the main analysis will focus on the restricted sample.

Third, another potential bias could come from either idiosyncratic or covariate shocks such as drought that has nothing to do with the war and yet may vary systematically between regions and cohorts. This could bias estimates upward or downward depending on which region is affected by such shocks. For this reason, the analysis controls for household reported shocks (at least for post war period) and village (community) level fixed effects. Usually, shocks such as drought and other natural disasters, in Ethiopia, are covariate shocks for households within a given village (or community) (Dercon, Hoddinott, and Woldehanna, 2005).

Fourth, due to the war, it is also more likely that people were displaced from their initial settlement. However, this is not a threat to the identification strategy for two primary reasons. First, most of such displacements took place *within* a region (Global IDP Project, 2004b). Second, the Young Lives team were able to track most sampled children with a minimal attrition of as low as less than 3% throughout the three waves which indicates good signal of stable migration pattern. Therefore, the impact estimate can still be internally valid for sampled children.

Fifth, mothers exposed to the war may be affected by post-war trauma and stress. Mulder et al. (2002) conclude that "maternal psychological factors may significantly contribute to pregnancy complications and unfavourable development of the (unborn) child". If such stress persists until mothers are pregnant of the young cohort children, this will potentially underestimate the true impact of war.

Sixth, additional concern could be sample selection bias due to differences in mortality rates across regions overtime either because of the war itself or any other observed and unobserved shocks. A child with better inherent health is more likely to survive than a child of similar characteristics with lower inherent health. This is because an inherently more healthy child needs a relatively smaller threshold stock of health to be able to survive a given shock or catastrophic event relative to an inherently less healthy child (Maccini and Yang, 2009). However, if such selection bias exists, this will potentially underestimate the impact.

Finally, measurement errors in child age, height, and education outcomes could be an issue. Parents may probably underreport the age of a relatively shorter child (Akresh et al., 2011). However, the Young Lives data collection procedure asked for exact child date of birth which minimizes this error. Measuring height of one year old children for young cohorts may be difficult (Ulijaszek and Kerr, 1999) but the main analysis of this study considers outcomes of children with an average age of 8 years old. In addition, public servants may over report better education outcomes. However, there is no reason to expect systematic correlation of all such errors across regions and cohorts.

Moulton (1986) argues that in a regression model where data are drawn from a population with grouped structure, the regression errors are often correlated within groups. These errors for children living in the same environment, and hence undergo similar events that potentially affect outcome variables, are more likely to be correlated. Consequently, assumptions of independent errors may not hold and hence unadjusted OLS standard errors may produce substantial downward bias. For this reason, standard errors are clustered at Woreda (or community) level to allow correlations across children within Woreda (or community) and are robust to heteroscedasticity.

In general, while it is not possible to test the parallel trend assumption directly, the data set contains a rich set of information on child and household specific covariates which helps to control for several observables. These include child age and sex, parental literacy, age, sex, and education level of household head, wealth index[6], share of food expenditure, ownership of land, milk and livestock animals, household composition and size, and whether a household faced a drought shock.

The difference-in-difference model for estimating the impacts of the war for the restricted sample is specified as

$$y = \alpha + \beta_1 * old\ cohort_c + \sum_i \beta_i * region_i + \theta * old\ cohort_c * war\ region_g + \varphi * x + \delta * v + \epsilon \qquad 2$$

Where y is the outcome variable of interest, $old\ cohort_c$ is a cohort fixed effect, $region_i$ is the set of region dummy variables, $war\ region_g$ takes value 1 if a child is from a war-affected region

[6] The wealth index is constructed by the Young Lives team from three dimensions of household wellbeing: (i) housing quality, rooms per person, floor, roof and wall, (ii) the value in consumer durables, and (iii) the value in services, average of drinking water, electricity, sanitation facilities and fuel.

and 0 otherwise, x is a vector of child, parental, and household covariates, v is village level fixed effects and ϵ is a normally distributed error term.

V. Regression results and discussion

4.2.1 Child health and nutrition

Tables 4 and 5 present results for impact of war on child height-for-age z-score and child stuntedness. The first columns (in all regressions) only control for region and cohort fixed effects, providing the basic difference-in-difference results. The preferred specification is column 4, which controls for all possible covariates and fixed effects.

Controlling for region and cohort fixed effects, the impact estimate (column 1 table 4) shows that a child exposed to the war has an average reduction of about a third of a standard deviation in the height-for-age z-score when looking at the full sample. This coefficient remains robust to choice of specification, both in magnitude and statistical significance. The preferred specification, in column 4, yields an impact estimate of -0.37 standard deviation and is statistically significant at 5% level. Looking at urban and rural sub-samples separately, the results are mainly driven by the rural sample. Unlike the rural sample, none of the coefficients for the urban sample are statistically significant. This could be due to two reasons. First, the rural residents could be geographically closer to the war and hence more affected. Second, possibilities for recovery could be relatively better for urban dwellers than rural farmers. At least, health and education infrastructure would be better in urban than in rural areas. There is no clear difference between the female and male samples. The coefficients are of similar sign and magnitude as for the full sample, but estimated imprecise.[7]

Table 4: The impact of war on child health and nutrition

Dependent Variable: Height-for-age z-scores

All Sample	1	2	3	4
born before war*war region	-0.31*	-0.30**	-0.39**	-0.37**
	[0.15]	[0.15]	[0.17]	[0.16]
N	2,812	2,812	2,170	2,141
Rural Sample				
born before war*war region	-0.43**	-0.44**	-0.43**	-0.43**

[7] In fact, since height-for-age is adjusted for age and sex of child, estimating for boys and girls separately is merely additional robustness. One shouldn't be obliged to estimate separately.

	[0.17]	[0.18]	[0.20]	[0.18]
N	1,730	1,730	1,439	1,423
Urban Sample				
born before war*war region	-0.11	0.03	-0.18	-0.11
	[0.21]	[0.19]	[0.13]	[0.14]
N	1,082	1,082	731	718
Girls Sample				
born before war*war region	-0.33	-0.26	-0.38	-0.30
	[0.19]	[0.18]	[0.23]	[0.22]
N	1,341	1,341	1,005	992
Boys Sample				
born before war*war region	-0.29	-0.31	-0.34	-0.38
	[0.26]	[0.26]	[0.23]	[0.24]
N	1,471	1,471	1,165	1,149
Region FE	Y	Y	Y	Y
Cohort FE	Y	Y	Y	Y
Community FE		Y	Y	Y
Child age FE		Y	Y	Y
Child sex dummy		Y	Y	Y
Urban dummy		Y	Y	Y
Parent's age and literacy			Y	Y
Head age, sex, & education			Y	Y
Additional controls				Y

Note that *** p<0.01, ** p<0.05, * p<0.1 holds. In all regression results robust standard errors are reported. Standard errors are clustered at the district (Woreda) level for column 1. For columns 2, 3, and 4, which include community fixed effects, they are clustered at community (Kebele) level. Additional controls include wealth index, household size, land ownership in hectare, no. of milk animals, no. of livestock, at each of 2002, 2006, and 2009 survey rounds. Also, household reported share of food expenditure and drought shock at 2006 and 2009 survey rounds are included. These two variables are not observed at 2002 survey round. Urban dummy for the 2nd and 3rd child sex dummy for 4th and 5th rows are automatically dropped. Results from the unrestricted sample of the pooled panel data provide larger coefficients but are not reported. The same note applies to all tables unless otherwise mentioned.

While child height is often used to proxy child health and nutrition, whether a child is stunted or not can be modelled as binary outcome variable that indicates a child's height for age falls below a threshold defined by a WHO reference group of normally healthy children (WHO, 2006)[8]. A small reduction in the height-for-age z-score does not necessarily imply stunting unless that reduction is large enough that a child's height falls below -2 or -3 standard deviations. The probability of stunting is therefore estimated as a probit model. Accordingly, exposure to war increases the probability of child stunting by about 11-14 percentage points. This effect is statistically

[8] A child is (severely) stunted if its height-for-age z-score is less than (-3) -2 standard deviations using WHO standard.

significant and robust to including community fixed effects and child and household covariates. Similar to the previous results (using child height-for-age z-score), the effect of war is larger and statistically significant for the rural sample compared to the urban sample. The correlation between stunting and war is higher for girls than for boys, but this difference disappears for the specification that includes all covariates (4th column).

Table 5: The impact of war on child health and nutrition: Probit marginal effects[9]

Dependent Variable: 1 if child is stunted, 0 otherwise				
All Sample	1	2	3	4
born before war*war region	0.13**	0.14**	0.13**	0.11**
	[0.06]	[0.05]	[0.06]	[0.06]
N	2,812	2,812	2,170	2,141
Rural Sample				
born before war*war region	0.19**	0.19**	0.15*	0.13*
	[0.08]	[0.07]	[0.08]	[0.08]
N	1,730	1,730	1,439	1,423
Urban Sample				
born before war*war region	0.05	0.03	0.11**	0.06
	[0.06]	[0.04]	[0.06]	[0.05]
N	1,082	1,082	731	718
Girls Sample				
born before war*war region	0.16**	0.16**	0.15	0.13
	[0.08]	[0.08]	[0.10]	[0.09]
N	1,341	1,341	1,005	992
Boys Sample				
born before war*war region	0.11	0.11	0.11	0.12*
	[0.08]	[0.07]	[0.07]	[0.07]
N	1,471	1,471	1,165	1,149
Region FE	Y	Y	Y	Y
Cohort FE	Y	Y	Y	Y
Community FE		Y	Y	Y
Child age FE		Y	Y	Y
Child sex dummy		Y	Y	Y
Urban dummy		Y	Y	Y
Parent's age and literacy			Y	Y
Head age, sex, & education			Y	Y
Additional controls				Y

[9] Marginal effects are dy/dx at mean values of x's. Coefficients from OLS or LPM (not reported) are similar to the probit marginal effects.

4.2.2 Child education outcomes

The impact of war on child education outcomes are presented in tables 6 to 8. The OLS estimates from table 6 indicate that a child exposed to war completes about 0.7 fewer grades. This effect is insensitive to including any of the covariates and robust to estimating sub-samples separately by gender and rural-urban location.

Table 7 shows that children exposed to war are less likely to be enrolled by 37 percentage points, following the preferred specification, and this effect is statistically significant at 1% level. Similar to grade completion, this effect remains robust to using sub-samples for boys and girls separately. However, the effect of war on child enrolment is relatively small for the urban sub-sample as compared to the rural sub-sample.

Table 6: The impact of war on child schooling outcomes: OLS coefficients

Dependent Variable: No. of highest grades completed by child				
All Sample	1	2	3	4
born before war*war region	-0.69***	-0.68***	-0.70***	-0.69***
	[0.14]	[0.15]	[0.19]	[0.19]
N	2,812	2,812	2,170	2,141
Rural Sample				
born before war*war region	-0.71***	-0.72***	-0.70***	-0.70***
	[0.16]	[0.17]	[0.22]	[0.23]
N	1,730	1,730	1,439	1,423
Urban Sample				
born before war*war region	-0.63***	-0.46***	-0.55***	-0.53***
	[0.13]	[0.14]	[0.14]	[0.14]
N	1,082	1,082	731	718
Girls Sample				
born before war*war region	-0.68***	-0.67***	-0.69***	-0.66***
	[0.12]	[0.13]	[0.15]	[0.14]
N	1,341	1,341	1,005	992
Boys Sample				
born before war*war region	-0.69***	-0.69***	-0.73***	-0.72**
	[0.19]	[0.22]	[0.26]	[0.27]
N	1,471	1,471	1,165	1,149
Region FE	Y	Y	Y	Y
Cohort FE	Y	Y	Y	Y
Community FE		Y	Y	Y
Child age FE		Y	Y	Y
Child sex dummy		Y	Y	Y
Urban dummy		Y	Y	Y

Parent's age and literacy			Y	Y
Head age, sex, & education			Y	Y
Additional controls				Y

Table 7: The impact of war on child schooling outcomes: Probit marginal effects[10]

Dependent Variable: 1 if child is currently enrolled in school, 0 otherwise

All Sample	1	2	3	4
born before war*war region	-0.32***	-0.36***	-0.38***	-0.37***
	[0.11]	[0.10]	[0.10]	[0.09]
N	2,812	2,812	2,170	2,141
Rural Sample				
born before war*war region	-0.45***	-0.44***	-0.45***	-0.45***
	[0.14]	[0.15]	[0.14]	[0.12]
N	1,730	1,730	1,439	1,423
Urban Sample				
born before war*war region	-0.09**	-0.06	-0.12***	-0.10**
	[0.05]	[0.05]	[0.05]	[0.05]
N	1,082	1,082	731	718
Girls Sample				
born before war*war region	-0.39***	-0.37***	-0.43***	-0.39***
	[0.11]	[0.12]	[0.09]	[0.09]
N	1,341	1,341	1,005	992
Boys Sample				
born before war*war region	-0.28**	-0.35***	-0.35***	-0.37***
	[0.12]	[0.12]	[0.12]	[0.11]
N	1,471	1,471	1,165	1,149
Region FE	Y	Y	Y	Y
Cohort FE	Y	Y	Y	Y
Community FE		Y	Y	Y
Child age FE		Y	Y	Y
Child sex dummy		Y	Y	Y
Urban dummy		Y	Y	Y
Parent's age and literacy			Y	Y
Head age, sex, & education			Y	Y
Additional controls				Y

Looking at child literacy outcomes, exposure to war increases the probability of child to having reading problem by about 23 percentage points (table 8). This effect is similar for all specifications (columns 1-4) and for all sub-samples. These worsening learning outcomes could be driven by the

[10] Marginal effects are dy/dx at mean values of x's. Coefficients from OLS or LPM (not reported) are similar to the probit marginal effects.

reductions in school enrolment and grade completion, but might also be due to deteriorating quality of schooling or related to psychological stresses of the war experience.

Table 8: The impact of war on child literacy outcomes: Probit marginal effects[11]

Dependent Variable: 1 if child has problems with reading, 0 otherwise				
All Sample	1	2	3	4
born before war*war region	0.21***	0.23***	0.24***	0.23***
	[0.06]	[0.06]	[0.07]	[0.07]
N	2,812	2,812	2,170	2,141
Rural Sample				
born before war*war region	0.24***	0.23***	0.20**	0.19**
	[0.09]	[0.08]	[0.09]	[0.09]
N	1,730	1,730	1,439	1,423
Urban Sample				
born before war*war region	0.21***	0.17***	0.24***	0.24***
	[0.06]	[0.04]	[0.05]	[0.05]
N	1,082	1,082	731	718
Girls Sample				
born before war*war region	0.22***	0.21***	0.22***	0.23***
	[0.08]	[0.07]	[0.08]	[0.09]
N	1,341	1,341	1,005	992
Boys Sample				
born before war*war region	0.19***	0.24***	0.24***	0.22***
	[0.06]	[0.06]	[0.06]	[0.05]
N	1,471	1,471	1,165	1,149
Region FE	Y	Y	Y	Y
Cohort FE	Y	Y	Y	Y
Community FE		Y	Y	Y
Child age FE		Y	Y	Y
Child sex dummy		Y	Y	Y
Urban dummy		Y	Y	Y
Parent's age and literacy			Y	Y
Head age, sex, & education			Y	Y
Additional controls				Y

Overall, the impacts of war (conflict) on child health or nutrition that are found in this study are consistent to other studies for different countries. For instance, Bundervoet et al., (2009) found about -0.35 standard deviations of height-for-age impact of civil war in rural Burundi. A more recent study by Akresh et al., (2012) also found the same impact of a two-year Ethiopian-Eritrean

[11] Marginal effects are dy/dx at mean values of x's. Coefficients from OLS or LPM (not reported) are similar to the probit marginal effects.

war on children from Eritrea. This study found about -0.31 to -0.37 standard deviations of height-for-age. These similar findings suggest quite additional evidence of convincing external validity in the literature on the impact of war on child human capital.

Coming to the second outcome variable there are limited microeconomic studies that looked at the impact of war on child educational outcomes particularly on grade completion, school enrolment and literacy outcomes using household data (some evidences include: Verwimp and Van Bavel, 2013 and Justino et.al., 2013). This study provides more consistent negative impact of war on child educational outcomes.

VII. Conclusion

Many countries especially in Africa are confronted with armed conflict or war. This may have long term intergenerational implications since war can diminish early childhood human capital that could be manifested in terms of reduced child health, nutrition, and education outcomes. These can have potentially lasting impacts on adulthood outcomes such as earning capacity, inducing intergenerational poverty traps. Despite substantial occurrence of war and armed conflict in many parts of the world, there has been relatively little albeit growing attention in the empirical literature.

This paper investigated one of the channels through which the Eritrean-Ethiopian war may have negative intergenerational economic impacts – childhood human capital. Using the Young Lives data set of children from poor households in Ethiopia and combining event data with location, this study compares changes in outcomes between old (war exposed) and young (not war exposed) cohorts at the age of eight, in war-affected and non-affected regions after controlling for possible observables. This difference-in-difference approach provides two primary benefits for identifying causal impact estimates of the war. First, this method inherently avoids any bias that could come as a result of regional unobserved heterogeneity as long as parallel trend assumption is satisfied. Second, after controlling for possible observable trends, the analysis compares cohorts of the same average ages. This minimizes the bias that comes as a result of non-linearity of ages in the growth process of children.

Findings from this study show that children who were exposed to the war have on average about 0.31 standard deviation lower height-for-age z-scores and 11 to 14 percentage points lower incidence of stunting than children that were not directly exposed to the war. In addition, exposed children completed 0.7 fewer grades, are 37 percentage points less likely to be enrolled in school, and 23 percentage points more likely to show reading problems. These are substantial impacts especially for children from poor backgrounds as poverty may limit their potential of recovery.

Girma and Kedir (2005) estimate average returns to an additional year of schooling in Ethiopia to range from 9.2% to 19.6% in terms of wages.[12] Assuming one year of schooling is equivalent to one grade completed, these estimates suggest that in the long term war may reduce wage by about 10% during adulthood for war exposed children.

Evidence of the detrimental impact of war on human capital of children emphasizes that interventions that protect welfare of children growing up in war-affected regions need to be available and further encouraged. These interventions include immediate policy responses as well as post-war rehabilitation programs. First, governments and other responsible international organizations[13] need to develop interventions or programs to ensure that children are physically protected or evacuated from conflict areas. Second, priority should be placed with targeting children at risk of malnutrition because of family displacement or loss of life. Third, appropriate psychological interventions to healing post-war trauma should be considered. Fourth, various post-war infrastructural developments could also help to recover aftermath. For instance, repatriation programs may help improve physical and psychological welfare of children. In addition, (re-) constructing schools, health centres, and roads may also improve health and education of children.

The speed and coordination with which these organizations respond to such crises is important in protecting children during war and armed conflict By having immediate (emergency) interventions in the short run and long term objective of avoiding war, the intergenerational impacts of war may be minimized.

While this paper has quantified the total effect of war on children's human capital, it remains difficult to flesh out the exact mechanisms driving the impacts of war due the complexity of the war context and limited data availability (especially pre-war). Future research that focusses on

[12] Girma and Kedir (2005) argue that education is even more beneficial at the lower end of the income distribution, suggesting a return of one year of schooling for lowest income group of almost 20%.
[13] International Organization such as IOM, IRC, and UNHCR, provide humanitarian assistance in the Ethiopian-Eritrean border areas to people including children confronted with war and other catastrophes.

mechanisms by which war affects children may improve the design of appropriate policy on how to target and support children confronted with war.

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