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On War Intensity and Schooling Attainment: The Case of Bosnia and Herzegovina

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Abstract

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1. Introduction

The subject of civil war has received significant attention in recent years, due to numerous episodes of intrastate armed conflict around the world, especially in Africa, Caucasia, the Balkans, and the Middle East. According to Collier, Hoeffler, and Rohner (2009), there were 84 civil wars across the globe in the period 1965–2004. More than 50 countries have been involved, of which 23 have experienced repeat civil wars.[1] The demographic consequences of civil wars are tremendous, as millions of people are killed or displaced from their homes. Stewart, Huang, and Wang (2001), for instance, estimate that over 12 million people – mostly civilians – were killed in 25 major civil wars, while the UNHCR (2008) reports that more than 20 million people have been internally displaced by civil wars by the end of 2007.[2]

Despite the prevalence of civil wars, the relationship between violent conflict and the welfare of individuals has received relatively little attention. In the past few years, however, the emergence of several micro data sets among war-torn countries has fueled a growing literature on the microeconomic consequences of war. In particular, recent research suggests that children who are born in regions experiencing civil conflict are impacted with lower height for age z-scores (Bundervoet, Verwimp, and Akresh, 2008; Akresh, Verwimp, and Bundervoet, 2011), while exposure to civil conflict is found to have adverse effects on school enrollment and attainment (Merrouche, 2006; Akresh and de Walque, 2008; Akbulut-Yuksel, 2009; Rodriguez and Sanchez, 2009; Shemyakina, 2011; Valente, 2011). Researchers also examine the impact on other microeconomic outcomes. For example, exposure to war violence in Sierra Leone is associated with increased political awareness (Bellows and Miguel, 2006), while the Angolan civil war may

[1] Collier, Hoeffler, and Rohner's (2009) figures rely on data from the Correlates of War (COW) Project, which is originally provided by Singer and Small (1994) and recently updated by Gleditsch (2004). Civil wars are defined by armed conflicts that are not interstate, and which result in at least 1,000 battle deaths per year.

[2] Stewart, Huang, and Wang's (2001) estimate of war casualties reflects 25 major civil wars – in countries where over 0.5 percent of the population were killed – during the period 1970–1995, according to data provided by Sivard (1996). The exact number of displaced persons reported by the UNHCR (2008) is 26 million, of which approximately 23 million are displaced by civil wars.

have benefited incumbent diamond mining companies through the construction of entry barriers (Guidolin and Ferrara, 2007).[3] Nevertheless, more work remains to be done in terms of quantifying the effects of civil wars on individuals' welfare, as well as in uncovering the precise mechanisms through which the relationship operates.

My main contribution in this paper is the identification of war intensity effects of the 1992–1995 civil war in Bosnia and Herzegovina (hereafter, the Bosnian War) on schooling attainment. Unlike most papers in the existing literature that focus on the incidence of conflict, I quantify effects by the extent of conflict by using a unique data set that contains information on war casualties at the intrastate level. Analyzing war intensity effects with casualty data introduces objectivity to the spatial variation in war, and provides precise intrastate estimates that are policy-relevant. My empirical strategy exploits municipality-level variation in war intensity – represented by the number of war casualties per capita – and the variation in birth cohorts of children, which determines whether they were in primary and secondary schools during the war.[4] A secondary contribution of this paper is the ability to discuss possible mechanisms through which civil war affects schooling attainment, given the variety of supplementary data on individuals' physical and mental health, war damage and repair, and displacement during the war.

My empirical results suggest that individuals in the affected cohorts are less likely to complete secondary schooling if they resided in municipalities that experienced higher war intensity. In particular, I estimate that a one standard deviation increase in the number of war casualties per capita decreases the likelihood of secondary school attainment by 4 percentage points. On the other hand, I find no significant effect of war on the attainment of primary schooling. These war intensity effects are over and above biases that are due to self selection, which are relatively small. Ancillary evidence suggests that my estimates are picking up immediate, rather than aftermath effects. Furthermore, I find that the war intensity effects are mostly realized via direct channels,

[3] At the aggregate level, however, researchers find little evidence of macroeconomic effects in the long run (Davis and Weinstein, 2002; Brakman, Garretsen, and Schramm, 2004; Miguel and Roland, 2011).

[4] Kondylis (2008) adopts a similar approach by using the Bosnian war casualty data to construct a measure of conflict severity. However, our measures may differ slightly given that I use the updated version (September 2008) of the data.

although usual candidates such as the destruction of infrastructure and the displacement of teachers do not seem to matter. There is also empirical evidence that points to the military draft as being a primary driver of the adverse effects on secondary schooling attainment.

In general, the findings in this paper resonate with the existing literature. For instance, Ichino and Winter-Ebmer (2004) and Akbulut-Yuksel (2009) find that Germans who were in the schooling cohorts during World War II received less education than their counterparts. As well, Merrouche (2006), Shemyakina (2011), Akresh and de Walque (2008), and Rodriguez and Sanchez (2009) find that exposure to civil war reduces schooling attainment in Cambodia, Tajikistan, Rwanda and Columbia respectively. Overall, the congruency of these findings should not be taken lightly. Apart from the loss of human lives, civil wars can also significantly decrease the schooling attainment of children, which may worsen their longer term welfare and impede the economic growth of their countries [see Krueger and Lindahl (2001) for a literature review of the long-run effects of education on growth].

The rest of this paper is organized as follows. Section 2 constitutes a brief background to the Bosnian War and a discussion on the possible channels through which it may have affected schooling attainment. A description of the data and the identification strategy are laid out in Sections 3 and 4 respectively. Section 5 provides the empirical analyses. Section 6 concludes.

2. War and Schooling Attainment

2.1 Background

Bosnia is a country on the Balkan peninsula of Southern Europe, with a long history of ethnic diversity and conflict. Being strategically located at the crossroads between east and west, it has historically been a battleground for major military powers, including the Illyrians, Romans, Hungarians, and Ottomans, before finally being established by Josip Broz Tito as one of the six federal units – Bosnia, Croatia, Macedonia, Montenegro, Serbia and Slovenia – under the Socialist Federal Republic of Yugoslavia in 1943.

According to the 1991 Yugoslav census, the population of Bosnia was 4.4 million, containing large groups of Bosniaks (44 percent), Serbs (31 percent) and Croats (17 percent). Although ethnic

diversity was also analogous to religious diversity – as the majority of Bosniaks are Muslims, and almost all Serbs and Croats are Orthodox Christians and Roman Catholics respectively – all Bosnians share the same heritage of being South Slavs and speak essentially one language.

In general, inter-ethnic relations in pre-war Bosnia were amicable, as Tito managed to enforce a strict policy of "brotherhood and unity" by suppressing ethno-nationalism among the various *narods* ("nationalities" or "ethnicities"). In fact, to cement the multi-ethnic state, the central government retained a firm control over education by instituting eight years of free, mandatory primary schooling for those aged 7–15. This ensured that the completion of primary schooling was virtually universal, while very few attended secondary and post-secondary institutions.[5]

According to Vulliamy (1994), Bosnians who lived in towns and cities were more tolerant for a multi-ethnic state than those living in rural areas, and those who could not assimilate to the urban lifestyle were waiting for the right moment to reignite the spirit of ethno-nationalism. Sarajevans also regard the Bosnian War as one between the *raja* ("urbane and tolerant person") and the *papak* ("hillbilly"), which suggests that the likelihood of conflict is systematically different across rural and urban regions.

Shortly after Croatia, Macedonia and Slovenia declared independence in 1991, Yugoslavia began to dissolve and civil war broke out in Bosnia between the pro-independence Bosniak-Croat coalition and the Serbs who boycotted the referendum for independence. When the Bosnian War began in April 1992, the Serbs were led by Radovan Karadžić, the leader of the Serbian Democratic Party (SDS), who was a strong proponent of the Greater Serbia agenda, alongside the President of Serbia, Slobodan Milošević. While the agenda called for an end to the oppression and exploitation of Yugoslav Serbs, it was later used as a propagandistic tool to incite "ethnic cleansing" in Serb-controlled territories (Burg and Shoup, 1999). As a result, the Bosnian Serb forces carried

[5]Since 2004, mandatory schooling has been increased to nine years, which effectively lowers the level of difficulty for the first two years (although many schools continue to abide by the eight-year system). This, however, bears no empirical relevance for my sample of individuals (aged 15 or older in 2001) who would have started primary school under the eight-year system.

out waves of aggression that marked the earliest events of the Bosnian War, killing and displacing thousands of Bosniaks and Croats (Vulliamy, 1994). Soon, however, the Bosniak-Croat alliance fell apart – due partly to the increasing call for a Croatian Union of Herzeg-Bosna among the Croat leaders – and the war was officially fought on three fronts.

By and large, most of the fighting took place in the eastern, northeastern and northwestern regions of Bosnia. These regions were vital to the Serb nationalists because they were adjacent to Serbia and served as a corridor to the Serb-dominated enclaves in Croatia. Notably, both regions had a substantial non-Serb population prior to the war, which presented itself as an obstacle to the Serb aggressors. In the later stages of the war, central Bosnia also became a war zone as it was important to the Croat nationalists who wanted to establish the Croatian Union of Herzeg-Bosna in that region.

In August 1995, the North Atlantic Treaty Organization, prompted by widespread massacres, conducted sustained air strikes against the Serb strongholds, thus internationalizing the conflict in its final stages (Owen, 1997a; Owen, 1997b). Subsequently, all three ethnic groups signed the Dayton Peace Agreement in December 1995, concluding four years of conflict in Bosnia. The agreement partitioned Bosnia by an Inter-Entity Boundary Line (IEBL) into two ethnically-divided entities – the Bosniak-Croat Federation of Bosnia and Herzegovina (FBiH) and the Serb Republika Srpska (RS). Overall, the human cost of the war was tremendous. The Research and Documentation Center (RDC) reports that approximately 96,000 civilians and soldiers were killed or missing, and the Bosnian Ministry for Human Rights and Refugees estimates that 2.2 million people were displaced from their homes, half of whom sought refugee protection outside Bosnia. These figures imply a startling casualty rate of 22 deaths per thousand, and a displacement rate of one in every two people, making the Bosnian War one of the most violent conflicts in recent history.

2.2 Mechanisms

The Bosnian War was undoubtedly prolonged and violent; as such, it may have affected schooling attainment through several channels. In this section, I discuss a variety of possible mechanisms and explain their relevance to Bosnia.

2.2.1 Direct and Indirect

One direct channel of impact is reduced accessibility to education. According to the UNHCR, approximately 34 percent of housing units were damaged by artillery shells during the war, of which many were completely destroyed. This suggests that many school buildings and other educational facilities may have also been damaged or destroyed. Furthermore, many localities were forced to convert schools into refugee centres or hospitals to accommodate displaced persons who fled their homes in search of safer areas within Bosnia (Mazowiecki, 1994). Apart from the destruction and dispossession of school infrastructure, the displacement of teachers may have also impacted the supply of schooling. In fact, the UNHCR estimates that more than one million people sought refugee protection overseas, and some of these may have included teachers and other educators.

The impact of damaged infrastructure and the displacement of teachers is perhaps best illustrated by the case of "war schools". These schools were conducted in makeshift classrooms in homes, cafes, garages and basement shelters, often without proper equipment, electricity or heat, as the danger from artillery shelling and the destruction of school infrastructure forced schooling to go underground.[6] Moreover, war schools were extremely difficult to organize in cities and enclaves under siege, as the school year was truncated and class schedule was irregular – due to the variability in the intensity of shelling and sniper fire. Teachers were also scarce; not only were they shared among two or more schools, they also had to take on multiple administrative duties such as coordinating class schedules and securing premises (Berman, 2001). In particular, while it was possible to organize classes for primary education with a standardized curriculum, coordinating

[6]During the war, an incredible network of coordination was built on the enduring cooperation between parents, teachers, students, municipal and local government bodies, to ensure that students continued their schooling, and importantly, a sense of normalcy was maintained. Specifically, schools operated at the local level, with a fair bit of centralized initiatives developed or sanctioned by the Ministry of Education and the Pedagogical Institute. In fact, explicit guidelines – which contained the "Basic Work Programs" that laid out the abbreviated school curricula and instructions for adapting to local conditions – were pre-tested in focus groups and passed down to teachers (Berman, 2007).

secondary education was incredibly challenging, because the variety of subjects across general and technical vocations meant that (i) secondary schools could not benefit from resource-sharing and (ii) finding the appropriate teachers for every subject was difficult. That said, these efforts ensured that the education system was not completely incapacitated during the war.

Another direct channel is lower demand for schooling. For instance, to attend school during the war meant having to commute amidst constant artillery shelling and sniper fire; therefore, parents, who inevitably fear for the safety of their children, may have discouraged them from going. There is also the possibility that parents substituted away from schooling expenditure towards the consumption of basic necessities, especially when livelihoods were taken away, as suggested by Shemyakina (2011) and Akresh and de Walque (2008). The military draft, which affected males who turn 18 during the war, would also have reduced the demand for secondary schooling.[7]

Other than direct channels, there may be indirect ones too. For example, the fact that half the Bosnian population was displaced during the war suggests that many displaced families would have experienced difficulty in sending their children to school in destination municipalities. This type of impact is due to schooling conditions in destination municipalities and could potentially be unrelated to displacement, but it could also be driven by factors associated with displacement itself. For instance, displaced parents may be in a state of shock or feel uncertain about the duration of their stay, and thus feel less inclined to send their children to school. Even if they wish to send their children to school, their lack of knowledge about school location and enrollment procedure will probably pose as a significant barrier to entry.

2.2.2 Immediate and Aftermath

The channels discussed hitherto are those of an immediate nature, that is, the effects to which they are related are felt during the war. For instance, damaged schooling infrastructure would instantly

[7]For many years, the military draft was in effect in Bosnia as the Yugoslav People's Army was primarily a conscripted army. However, the effect of the draft was especially forceful during the Bosnian War as deferment based on family hardship or admission to university became much less likely.

reduce accessibility to schooling and thus affect schooling attainment. Similarly, the effects of indirect channels such as displacement are probably immediate, as displaced households face obstacles in sending their children to schools as soon as they arrive at destination municipalities.

Conversely, there are pathways that take time to materialize; in particular, some mechanisms take effect only after the war. These so-called "aftermath" mechanisms may include socio-economic conditions that may have changed as a result of war, such as school reconstruction or ethnic segregation, and are relevant if the affected cohorts resume schooling after the war. In particular, this study looks at schooling attainment six years after the end of the conflict, which implies that the affected cohorts may have had sufficient time to catch up on their schooling.

One caveat of this study is that I am unable to verify directly whether the effects on schooling attainment are immediate (during the war) or aftermath (post-war) because individuals do not report where they attend school. As such, the primary focus of this paper is to examine immediate effects; nonetheless, the issue of separating immediate and aftermath effects is especially relevant from a policy standpoint, supplementary evidence regarding aftermath effects are also presented in Section 5.3.2.

3. Data

The empirical bases of this paper are the data on municipality-level war casualties from the 1991–1995 Bosnian Book of Dead Project, and the individual-level information from the 2001–2004 Bosnian Living Standards Measurement Surveys (LSMS). In addition, I construct municipality-level wartime statistics with the help of other data sources. The rest of this section describes the data that I use in this paper.

3.1 The Bosnian Book of Dead

The 1991–1995 Bosnian Book of Dead Project (also known as the Human Losses in Bosnia and Herzegovina Project) was conducted by the Research and Documentation Center (RDC) in Sarajevo. Being an independent, nongovernmental, nonprofit, and nonpartisan entity, the RDC's primary role is to investigate, document, and publish accurate and unbiased statistics on genocide, war crimes and human rights violations that took place during the Bosnian War.

The project collected a variety of statistics, including the number of war casualties – a collective term used in this paper to refer to individuals who were killed or missing – which are documented based on death records and statements by surviving family members and witnesses. Around 85 percent of the records are relatively complete – containing the victim's vital information at the time of death, including name, age, ethnicity, location of residence and death, military or civilian status, and some even include a picture of the deceased. Years of careful documentation and cross-referencing with a wide variety of other databases ensure that the Bosnian Book of Dead is not only methodologically sound, but also the largest and most complete data on war casualties inflicted in the Bosnian War (Ball, Tabeau, and Verwimp, 2007).

To gain a basic understanding of the data, I construct Table 1 to show the descriptive statistics of war casualties by region. As of August 2008, the Bosnian Book of Dead indicates that 96,749 individuals were killed or missing, with an average of 849 casualties per municipality. Most of the victims (around 60 percent) are soldiers, and Bosniaks constitute the majority of casualties. The eastern and northeastern regions have the highest number of casualties, but the central and western regions also appear to have suffered considerably, when we look at casualty rates (defined as war casualties normalised by municipal population size). A municipal map of pre-war Bosnia by casualty rate succinctly illustrates this point (Appendix Figure 1). For the rest of this paper, I use casualty rates to measure war intensity, because they offer a more accurate reflection of the severity of violent conflict, especially for smaller municipalities.[8] In principle, another possibility is to exploit the variation in the timing of war for different municipalities [see Akresh, Verwimp, and Bundervoet (2011) and Bundervoet, Verwimp, and Akresh (2008), for instance]; however, when the Bosnian War began in eastern Bosnia in early 1992, ethnic violence quickly spread to the rest of the country by the end of the year, so it is difficult to implement a time-varying measure of

[8]The motivation for using casualty rates is best illustrated with the following example. Srebrenica – a Bosniak enclave that suffered one of the worst massacres during the Bosnian War – has the highest number of casualties at 8,862 while Kalinovik – which hosted several concentration camps – has one of the lowest at only 242. When we consider casualty rates instead, both Srebrenica and Kalinovik will be among the top 10 percentile among municipalities.

war.

3.2 The Living Standards Measurement Survey

The 2001–2004 Bosnian LSMS, conducted by the World Bank, is a nationally-representative household survey that covers 25 municipalities (14 from the FBiH, and 11 from the RS).[9] The sampling procedure is as follows. First, each municipality is assigned one of six cells, by entity (FBiH or RS) and type (urban, rural or mixed), using information from the 1991 Yugoslav census. Then, municipalities are independently sampled from each cell, with a probability that is proportional to population size. Among the chosen municipalities, 5,400 households were randomly selected in 2001, approximately half of which were re-interviewed for the panel. The attrition rate across waves is around 5 percent, which is relatively low compared to other national panels.

The key variables that I use from the LSMS are schooling attainment, individual characteristics and migration history, all of which are contained inside the first wave. However, several other variables which are important to this study – ethnicity, subjective health, and physical disabilities, for instance – are only available in subsequent waves from the panel. Therefore, in order to maintain a balanced sample, I will only be using the panel for this paper.[10] Overall, around 5,000 individuals remain in the sample.

The key outcome variable on schooling attainment is derived from the LSMS variable, "the highest level of diploma obtained". I construct dummies for primary and secondary school attainment by checking if an individual reports having at least a primary or secondary school leaving certificate. In my sample, around 85 percent of individuals have completed primary school, of which two-thirds have completed secondary schooling. I also use migration data to match each individual's pre-war municipality of residence to its corresponding casualty rate. It turns out that

[9] Appendix Figure 2 shows the geographical location of these 25 LSMS municipalities.

[10] Furthermore, the design of the first wave resulted in the oversampling of urban households, because municipalities that were larger – and probably more urban – were chosen with higher probabilities. This problem was compensated in the panel design, by retaining all rural and mixed municipalities while sub-sampling only the urban ones. As a result, the first wave, though having the merit of having the largest sample, has a disproportionately urban representation when used on its own.

the individuals in my sample resided in 75 pre-war municipalities, which gives me a fair degree of geographical variation in terms of analyzing war intensity effects.

For the rest of this paper, I define affected cohorts as individuals aged 7–19 in the years 1992–1995 (or aged 13–28 in 2001) as they were attending either primary or secondary school during the war. In particular, those aged 7–15 (or aged 13–24 in 2001) would have been in primary school, and those aged 16–19 (or aged 22–28 in 2001) would have been in secondary school.[11] As students do not normally complete their primary education before the age of 15, however, I discard individuals who are aged 14 and below in 2001; this implies that the sample of affected cohorts is made up of those aged 15–28 in 2001.

Table 2 shows the summary statistics of primary and secondary schooling attainment, by age group and municipality-level casualty rate quantiles. Focusing on the affected cohorts, a quick comparison-in-means between individuals from the high and low intensity municipalities reveals that affected cohorts may have lower completion rates in schooling. For example, primary schooling attainment among affected cohorts is 97.5 percent in low intensity municipalities, compared to 95.3 percent in high intensity municipalities. Similarly, secondary schooling attainment among affected cohorts is 59.5 percent in low intensity municipalities, compared to 52.6 percent in high intensity municipalities. However, by doing the same comparison for unaffected cohorts, we see that these differences in schooling attainment were already in place prior to the war, which implies a pre-existing correlation between war intensity and schooling attainment.

Several health variables are also available from the later waves in the LSMS. For instance, I use responses from self-reported health compared to other people in the same age group (ranked "very poor" to "excellent"), physical disabilities ("yes" or "no") and the frequency of recalling war trauma (from "not at all" to "extremely often") to construct dummies. A novel feature of the Bosnian LSMS is that a symptom inventory – the Hopkins Symptom Checklist – was included and can be used to calculate a depression score (1–4) which corresponds to the likelihood of significant

[11] The fact that the war took place over four years (1992–1995), affected cohorts in primary schooling are matched to 12 birth cohorts in 2001, and affected cohorts in secondary schooling are matched to seven birth cohorts in 2001.

emotional illness. This depression score allows me to construct a binary indicator for depression, based on a well-known cutoff (Derogatis, Lipman, Rickels, Uhlenhuth, and Covi, 1974).[12]

3.3 Other Data

In this paper, I rely on data from the Bosnian Federal Office of Statistics to estimate pre-war and post-war conditions. I use the statistical yearbooks (1988, 1989, 1996, and 1997), which contain primary schooling information such as the number of schools and teachers, to construct measures for the pre-war quality of primary schooling for each municipality. In particular, I divide the number of primary schools (and teachers) by the population aged 0-14 in thousands, to obtain "schools per capita"(and "teachers per capita"). Even though I also have information on the number of students, I choose not to adopt school size or teacher-student ratios because enrollment may be endogenous.

Typically, wartime data is difficult to obtain because the collection and processing of data are paralyzed when organizations are diverted to conflict-related issues. However, with help from the UNHCR, I am able to ascertain the extent of damage to housing units in 1995, as well as repairs completed by the end of 2005, both of which are useful for uncovering mechanisms later on. In addition, the UNHCR maintains a database of internally displaced persons that allows me to construct data on the number of out-migrants for each municipality. As the UNHCR database is based on registered internally displaced persons who return to their original municipality of residence or move to another municipality, it precludes international refugees who remain overseas. Nevertheless, it reflects the displacement pattern during the war, which is useful for testing the impact of teacher displacement.

Notably, as Bosnia has 109 municipalities before the war, and 150 after (due to the division

[12]The Hopkins Symptom Checklist questions in the Bosnian LSMS were developed by the Harvard Program in Refugee Trauma. Out of the original 25 questions, only those on depression were included in the survey, and one was dropped based on the pilot test results. The depression score is simply the average of the score on the remaining 14 questions. Barring clinical evidence from Bosnia, I adopt the common cutoff of 1.75 in determining whether an individual is mentally depressed.

of several municipalities by the IEBL), constructing pre-war per capita measures for the new municipalities is cumbersome. Fortunately, the 1991 Yugoslav census reports data at the settlement (sub-municipality) level, which makes it possible to compute population figures for municipalities that only existed after the war. The pre-war population figures are then used to construct war casualty rates and per capita number of out-migrants for each municipality.

4. Identifying the Effects of War

4.1 Endogeneity

Estimating the effects of war is a particularly challenging task, as unobserved pre-war conditions may determine both post-war outcomes as well as war intensity, causing endogeneity bias in an OLS estimation. For example, if pre-war income is a strong predictor for violent conflict – as argued by Collier, Hoeffler, and Rohner (2009) – which in turn decreases post-war income, then differences in post-war socioeconomic outcomes across high and low war intensity localities may simply reflect differences in pre-war income that might have persisted in the absence of war, and cannot be attributed to war alone. In the case of Bosnia, schooling attainment for the affected cohorts are lower in high intensity municipalities, but the same differences also exist for the unaffected cohorts, suggesting that these differences were already present before the war (Table 2). In fact, polynomial regressions by cohort and war casualty rate also reveal that the schooling attainment of unaffected cohorts is significantly lower in high intensity municipalities, although the gap is closing among younger cohorts (Figure 1).

To get around the issue of endogeneity, one has to isolate the relationship between schooling attainment and war intensity. In this paper, I adopt the difference-in-differences approach by exploiting the variation in war intensity and the birth cohorts of children – which determines whether they were in primary and secondary schools during the war. Estimating war intensity effects off the sample of affected cohorts from high intensity municipalities allows me to control for municipality fixed effects, which overcomes the endogeneity issue. The estimating equation is

as follows:

$$SCHOOL_{ijk} = \beta(WAR_j \times AFFECTED_i) + \lambda X_{ijk} + \alpha_j + \gamma_k + \varepsilon_{ijk} \quad (1)$$

where $SCHOOL_{ijk}$ refers to the measure of schooling attainment for individual i who resides in municipality j (and k) before (and after) the war; WAR_j denotes war intensity in the municipality of residence before war broke out; $AFFECTED_i$ is an indicator for the affected cohorts; X_{ijk} represents a vector of pre-determined individual attributes; α_j and γ_k denote municipality fixed effects, and γ_k is automatically set to zero for non-displaced individuals; ε_{ijk} is the error term.

Notice that α_j and γ_k account for time-invariant differences across municipalities, including heterogeneity in schooling conditions. Since schooling attainment is a stock variable, γ_k captures the indirect costs of war for displaced individuals who resumed schooling in a different municipality. Equation (1) represents the quintessential estimating model in the existing literature.

4.2 Selection

While equation (1) addresses endogeneity, it does not deal with self selection that may exist due to non-random wartime displacement.[13] Self selection introduces an estimation bias when individuals sort themselves into municipalities by war intensity and some unobserved attribute that may also affect schooling attainment. For example, individuals typically move from high to low intensity municipalities, and households that are better able to cope have a lower propensity of displacement; thus, the proportion of high ability individuals may be greater in high intensity municipalities.[14] This brings about a sample correlation between war intensity and the schooling attainment of affected cohorts, which is independent of the effects of war on schooling attainment.[15]

[13] This sort of selection should not be confused with the indirect effects of displacement (as explained in Section 2.2.1). If displacement is driven by war intensity but not by unobserved determinants of schooling attainment, then selection is absent while indirect effects of displacement may still exist.

[14] The opposite could also be true if high ability individuals have better outside opportunities (in employment or schooling) and are thus more likely to migrate (Kondylis, 2008).

[15] Formally, suppose $\varepsilon_{ijk} = \omega_i + v_{ijk}$, where ω_i denotes some unobserved determinant of schooling attainment, and that $Cov(\omega_i, WAR_j) \neq 0$ due to non-random displacement. Assuming that $AFFECTED_i$ is independent of both ω_i and

In fact, any unobserved attribute that induces sorting by war intensity and is correlated with schooling attainment, such as ability or social networks, will bring about a selection bias. As such, self selection can be thought of as an omitted variable problem, which can potentially be overcome by accounting for individual fixed effects using panel data, assuming that the unobserved attribute is time-invariant. Accounting for fixed effects, however, is clearly infeasible in this case as my data is cross-sectional.

Instead, I address this issue by adopting the control function (CF) approach developed by Heckman and Robb (1985). The essence of this approach is to account for the part in the error term – in this case, the unobserved individual attribute – that is correlated with war intensity, by using an instrument. Once this part in the error term is eliminated, the new error term is orthogonal to war intensity; one is then able to obtain the consistent estimate of β. While the CF approach relies on the same sort of identification conditions as standard instrumental variables (Heckman and Navarro-Lozano, 2004), it offers the advantage of a simple procedure for consistent estimation when the key endogenous variable is nonlinear (in this case, $WAR_j \times AFFECTED_i$).

The instrument in this context should be correlated with war intensity but uncorrelated with the unobserved attribute to correct for selection bias. Specifically, I use pre-war municipality-level ethnic polarization indices $POLAR_j$ as instruments for war intensity. The ethnic polarization index is developed by Reynal-Querol (2002) to measure how close the ethnic distribution is to the bi-polar case with two equally sized groups. It takes values between zero and one, where one reflects bi-polarity. This index satisfies the partial correlation condition as it is well-known that ethnic distributions that are closer to bi-polarity are more likely to engage in ethnic conflict (Reynal-Querol, 2002; Montalvo and Reynal-Querol, 2005). In addition, municipality-level ethnic composition should not be correlated with schooling attainment except via war intensity; in this case, ethnic composition should not affect schooling attainment due to unobserved individual attributes such as ability. The fact that my instrument is based on pre-war ethnic composition

WAR_j, we can then deduce that $Cov(\omega_i, WAR_j \times AFFECTED_i) = E(AFFECTED_i) \times Cov(\omega_i, WAR_j) \neq 0$. The OLS estimation of equation (1) would then result in selection bias because $\text{plim}(\hat{\beta} - \beta) = \frac{Cov(\omega_i, WAR_j \times AFFECTED_i)}{Var(WAR_j \times AFFECTED_i)} \neq 0$.

suggests that the exclusion restriction is likely to be satisfied, as pre-war Bosnia was governed by strict principles of socio-economic equality under the Yugoslav regime, so access to schooling was broadly equal across regions, regardless of ethnic composition.

The CF approach begins with the estimation of a first-stage regression in which war intensity is predicted by pre-war ethnic polarization indices. In practice, a polynomial of degree three in ethnic polarization indices is used to flexibly model war intensity. The predicted residuals then enters the second stage as an additional covariate (control function) in equation (1). Under the assumption of selection on observables, this procedure ensures that war intensity, which is endogenous under self selection, becomes exogenous conditional on the control function, and the selection bias is corrected.

5. Empirical Analysis

In this section, I explain the estimation procedure and results. Where specified, individual-level controls include sex, ethnicity, parental secondary schooling completion, and birth cohort fixed effects. Standard errors are clustered at the pre-war municipality level to allow for any unobserved correlation within municipalities. When regressions are adjusted with the control function, second stage standard errors are block-bootstrapped with 1,000 replications, to account for the fact that the additional regressor is a fitted variable.

5.1 Results

I run difference-in-differences regressions by using two measures of schooling attainment – an indicator for completing primary school, and another for completing secondary school – to identify war intensity effects for each level of schooling. For each measure of schooling attainment, I separately run five sets of difference-in-differences regression – first, without controls; second, with individual controls and cohort fixed effects; third, with individual controls, cohort fixed effects and pre-war municipality fixed effects; fourth, with all of the above and post-war municipality fixed effects; finally, I augment the estimating equation with the control function. The main results are shown in Table 3.

Focusing on primary schooling attainment, it is clear that my estimates of β are statistically

indistinguishable from zero [columns (1)-(4) of Table 3]. This does not necessarily mean that the Bosnian War had no impact on primary schooling attainment; it merely confirms that there is no clear difference between affected cohorts across high and low intensity municipalities. Indeed, this conclusion echoes the evidence in Figure 1, where affected cohorts appear to have suffered a slight disadvantage, but the disadvantage is similar among affected cohorts, regardless of war intensity.

We move on to the results on secondary schooling attainment [columns (6)-(9) of Table 3]. Here, the estimates of β are always negative and statistically significant. In particular, the relationship between war intensity and secondary schooling attainment among affected cohorts is substantially negative at -1.242, even without controls [column (6)]. The results in column (7) then show that the inclusion of individual controls and birth cohort fixed effects drives the coefficient down to -1.652, suggesting that these additional covariates are correlated with schooling attainment as well as the affected cohort dummy.

As a testament to the presence of endogeneity, the magnitude of the coefficient becomes even more negative at -1.737 once pre-war municipality fixed effects are also accounted for [column (8)]. This implies that there may be positive endogeneity bias – municipalities with unobserved attributes that positively determine secondary schooling attainment may also be more likely to experience higher war intensity. Finally, with post-war municipality fixed effects accounted for, the coefficient goes back up to -1.659, statistically significant at one percent level [column (9)]. Recall from the discussion in Section 4.1 that these post-war municipality fixed effects capture the indirect costs of war for displaced individuals who resumed schooling in a different municipality. Since β becomes less negative (from -1.737 to -1.659) when post-war municipality fixed effects are accounted for, I confirm the presence of indirect costs. These costs, however, appear to be relatively low when compared to direct costs.

Using the coefficient estimate of -1.659 in column (9), we can deduce that a one standard deviation increase in war casualty rate – the equivalent of around 21 deaths per thousand – reduces an affected individual's likelihood of completing secondary schooling by 4 percentage points. Given

that the average secondary schooling completion probability is around 60 percent, this effect may seem insignificant; however, the impact may be shattering for an individuals in high intensity municipalities, where the war casualty rate can be as high as more than 10 times the standard deviation (in which case completion rate will be reduced by more than 30 percentage points).

Overall, I find no evidence of war intensity effects for primary schooling attainment, while the effects for secondary schooling attainment are considerably negative. This may seem rather puzzling at first, as one would expect war intensity effects – particularly those realized via direct channels such as damaged infrastructure and the displacement of teachers – to affect all levels of schooling. However, a potential explanation is that the impact of war intensity on primary schooling attainment may have been muted by the organization of war schools; in particular, underground educators were probably more successful at providing primary education because it was not as as logistically demanding as the provision of secondary education (Berman, 2001).

5.2 Self Selection

As described in Section 4.2, my approach to address self selection is to augment equation (1) with a control function. With regards to primary schooling attainment, the inclusion of a control function does not produce any non-zero war intensity effect, although it decreases the coefficient slightly [column (5)]. Similarly, results for secondary schooling attainment show that the control function drives the coefficient down to -1.783, statistically significant at one percent level [column(10)]. This implies that the selection bias is positive, although its magnitude appears to be relatively small. One way to interpret this result is to think of selection bias as reflecting the sorting of less able individuals away from high intensity municipalities towards low intensity municipalities.

Again, the coefficient in column (10) can be interpreted as follows: a one standard deviation increase in war casualty rate reduces an affected individual's likelihood of completing secondary schooling by 4 percentage points. This means that quantitative interpretations of the war intensity effects with and without the control function are approximately the same.[16]

[16] As the construction of cohort indicators are based on the average student's schooling age, I also conduct a sensitivity test by changing the definition of affected cohorts (Appendix Table 1). Specifically, I repeat separately add and subtract

5.3 Mechanisms

The preceding section may have given us an idea about quantifying war intensity effects on schooling attainment, but more needs to be done in terms of uncovering the precise mechanisms. For the rest of this section, I consider the sub-sample of secondary schoolers, as this is the group for which we observe evidence of war intensity effects. Against the benchmark case in column (10) of Table 3, I run difference-in-differences regressions, with control functions as additional regressors. Results are shown in Table 4.

5.3.1 Immediate

I first look at immediate channels. One direct mechanism may be reduced demand for schooling by gender. Column (1) of Table 4 shows that the effects are strongly driven by males, whereas column (2) reveals much weaker effects for females. To be precise, the absolute value of β for males is approximately 50 percent greater than that for females. This finding is consistent with either or both of the following: (i) budget-constrained parents tend to substitute away from schooling expenditure on their sons towards the consumption of other goods, and (ii) the military draft could have reduced demand for schooling among males only. I explore this further in Section 5.4.

Another direct channel is the reduction in accessibility to education. To investigate this, I repeat the difference-in-differences regressions by replacing casualty rates with (i) the percentage of damaged housing units and (ii) the number of out-migrants per capita for each municipality. Columns (3) and (4) show that the β coefficients are negative but imprecisely estimated, which suggest that neither of these determinants of accessibility matter.[17] These results suggest that

one cohort we can see that the β coefficients remain statistically significant, and the magnitudes differ only slightly, from the initial -1.783 to between -1.811 [column (1)] and -1.610 [column (2)]. This suggests that the estimation of war intensity effects are rather precise even when we account for the fact that some students may have taken more (or less) time to finish their secondary schooling.

[17] These conclusions are similar to the findings of Merrouche (2006), Shemyakina (2011) and Akresh and de Walque (2008), who find that lower quality of school infrastructure is not an important mechanism through which civil war affects schooling outcomes. That said, in the case of Germany during World War II, Akbulut-Yuksel (2009) concludes that the destruction of schools and the absence of teachers appear to be an important channel.

the supply-side channels may not be so important, provided that damage to housing units is indicative of damage to school buildings, and municipality-level out-migration is a strong proxy for the displacement of teachers.

Apart from direct channels, our results in Section 5.1 have shown that the indirect costs of displacement also exist, although relatively small in magnitude. Using a ballpark calculation based on the comparison between a model with and without post-war municipality fixed effects [columns (8)-(9) of Table 3], indirect costs account for no more than five percent of all war intensity effects. To be more precise, a one standard deviation increase in war casualty rate will only reduce an affected individual's likelihood of completing secondary schooling by 0.2 percentage points, if there were no other effects other than the indirect costs of displacement.[18]

The evidence thus far suggests that direct channels appear to be the primary means through which war intensity affects schooling attainment. That said, could post-war mechanisms potentially explain part of the effects that we find? I now turn to these aftermath channels.

5.3.2 Aftermath

First, I investigate possible adverse effects of post-war ethnic segregation in schools, by repeating the difference-in-differences regressions with an additional control indicator for whether the individual belongs to the ethnic minority. Post-war ethnic segregation is a glaring feature of post-war Bosnia, and ethnic minorities are often disadvantaged in terms of access to schooling (Bozic, 2006; OSCE, 2007; Swee, 2010).[19] However, I find that adding a minority indicator has virtually no impact on my estimates of war intensity effects, and that the ethnic minority indicator is uncorrelated with secondary schooling attainment [column(5) of Table 4]. This suggests that

[18] Using the difference between the two coefficients: $-1.659 - (-1.737) = 0.078$, multiplied by one standard deviation in war casualty rate 0.021, the effect is $0.0016 \approx 0.002$.

[19] Indeed, one glaring consequence of the war on Bosnia's education system is the establishment of ethnically-segregated schools, in which classes are conducted in the language and curriculum of the ethnic majority, discouraging school attendance of the ethnic minority. In fact, many returning refugees from the minority ethnic group are extremely uncomfortable with their local school's ethnocentric curriculum, and some even resort to bussing their children to far-away municipalities where they can attend schools of their ethnicity.

ethnic minorities in the affected cohorts do not resume schooling or that they do not experience a disadvantage (which is unlikely).

Next, I examine the issue of differential post-war reconstruction directly by repeating the difference-in-differences regressions, replacing post-war municipality fixed effects with a control variable that measures each municipality's percentage of repaired housing units. From column (6) of Table 4, we can see that the magnitude of war intensity effects increases slightly while remaining statistically significant and, more importantly, housing repairs do not seem to affect schooling attainment. This implies that repairs have no impact on getting students to attend school or that affected cohorts do not actually resume schooling.

Finally, I examine whether younger individuals in the affected cohorts experience greater negative effects of war intensity. If indeed there were return schoolers, one would expect them to be older rather than younger cohorts, as older cohorts are closer to completion. Indeed, when I decompose the indicator for affected cohorts into individual birth cohorts, I find significant negative war intensity effects for the three youngest cohorts but not older cohorts, which provides some evidence for return schooling (assuming that older cohorts experience lower war intensity effects because they resume schooling). These cohort analysis results can be found in Appendix Table 2, and are also succinctly represented in Figure 2. One notable exception here is that I also find rather large negative effects for the older cohort (aged 20 in 1992) which suggests that the story is perhaps more complex.

Overall, while I cannot discount the possibility that aftermath effects exist, it appears that my estimates are most likely picking up immediate effects. In particular, direct channels that involve the demand for schooling appear to be the main drivers of war intensity effects, while indirect effects of displacement, though significant, are relatively small. Notably, war intensity effects tend to be realized via the male sample, especially among the secondary schooling cohorts, presenting the military draft as a prime candidate for further investigation.

5.4 Health Effects

Given the lack of data on participation in the war as a soldier, there is no direct way of confirming

the whether the military draft is necessarily the key mechanism driving my results. Nevertheless, males aged 18 and above who were drafted during the war may experience shocks to their physical and mental health, so it is perhaps worthwhile to look at war intensity effects on health outcomes depending on whether the individual is likely to be drafted. In particular, I run triple-difference regressions examining whether there are war intensity effects that are specific to older male affected cohorts.

In the following analysis, I restrict the sample to the affected cohorts aged 7–19 in the years 1992–1995 (or aged 13–28 in 2001). The objective here is not to repeat the DID regressions using health outcomes, but to understand whether those earlier findings may be driven by the military draft channel. Hence, unaffected cohorts are excluded here because they may also suffer from adverse health shocks due to the war, and thus do not constitute a natural control group. Instead of having a difference-in-difference involving war intensity and affected cohorts, I look at the triple difference in war intensity, older affected cohorts, and males. Older affected cohorts are defined as secondary schoolers aged 16-19 in 1992–1995; therefore, the interaction between the indicators for older affected cohorts and males should reflect whether an individual is a potential military draftee. Results are presented in Table 5.

In column (1) of Table 5, I use an indicator for subjective health – which equals one if the individual reports her health as being "fair" or better. I find that the coefficient of the interaction between war intensity and older affected cohorts is -0.450 but statistically indistinguishable from zero. This means that older affected cohorts do not, on average, fare worse in self-reported health depending on war intensity. However, when we also condition on older affected cohorts being male (that is, looking at the triple difference variable), the coefficient of is -0.866, statistically insignificant at 10 percent level. This implies that among older affected cohorts, males in high intensity municipalities are reportedly less healthy than females. Precisely, a one standard deviation increase in war casualty rate decreases the older affected male cohorts' likelihood of reporting fair health by 2 percentage points. I take this as evidence for war intensity effects on older affected male cohorts.

The next three columns relate to the effects on war-related health, such as war trauma (an indicator for high frequency of recalling painful war events), physical disability, and war disability [columns (2)-(4)]. The coefficients of the interaction between war intensity and older affected cohorts are imprecisely estimated, so there is no evidence of war intensity effects on war-related health for older affected cohorts. Even when one considers the triple-difference variable, there is still no no trace of war intensity effects. The fact that disability is a very low-probability event (with averages in this sample of around half to one percent) suggests that it may not be so surprising to find no war intensity effect. However, war trauma is reported in more than 40 percent of individuals in this sample, so it is unclear why there are no war intensity effects on older affected cohorts.

Finally, in column (5), I use a depression indicator derived from the Hopkins Symptom Checklist as dependent variable to examine effects on mental health. Depression is a common manifestation of post-war trauma, and previous studies have found that soldiers who are engaged in combat tend to exhibit depression and anxiety symptoms after the war (Blattman and Annan, 2010). Here, the coefficient of the interaction between war intensity and older affected cohorts is -1.430, statistically significant at one percent level. This coefficient implies that older affected cohorts in high intensity municipalities are actually less likely to be depressed; this demonstrates that older affected cohorts are able to cope better than younger affected cohorts, although it is unclear why those residing in high intensity municipalities cope better. Once we also condition on older affected cohorts being male, the coefficient of turns positive at 1.555, statistically insignificant at five percent level. This implies that among older affected cohorts, males in high intensity municipalities are more likely to be depressed than females. Precisely, a one standard deviation increase in war casualty rate increases the older affected male cohorts' likelihood of being depressed by 4 percentage points.

Overall, these results on physical and mental health indicate that older affected male cohorts tend to perform worse in terms of self-reported and emotional health. These results are quite striking, as there is no obvious reason to expect older male cohorts to suffer more than the others, apart

from the fact that older affected male cohorts may have been more involved in the war, for example, though participation in combat.[20] Of course, the war intensity effects found in Table 5 do not necessarily imply that older affected male cohorts are more likely to be drafted in high intensity municipalities; this could well be true, but a more appropriate interpretation is that, conditional on being drafted, an individual is more likely to engage in combat and hence experience larger (negative) impacts on physical and mental health. The evidence presented here therefore points to the military draft as being an important driver of adverse war intensity effects on secondary schooling attainment.

6. Conclusions

In this paper, I explain the detrimental effects of the Bosnian War on affected cohorts that were in the process of completing their primary and secondary schooling during the war. In particular, I estimate war intensity effects by using a unique data set that contains information on war casualties at the intrastate level. The econometric identification of war intensity effects relies on the variation in war intensity and the birth cohorts of children to account for unobserved differences across municipalities. In addition, I use a control function that utilizes pre-determined ethnic polarization indices as an instrument for war intensity to deal with possible selection bias.

My results show that war intensity significantly reduces secondary schooling attainment of affected cohorts, and in particular, a one standard deviation increase in war casualty rate – the equivalent of 21 deaths per thousand – reduces an affected individual's likelihood of completing secondary schooling by 4 percentage points. However, I find no noticeable effects on primary schooling, which could potentially be due to the success of war schools at the primary level. Ancillary evidence suggests that my estimates are picking up immediate rather than aftermath effects. Furthermore, war intensity effects are mostly realized via direct channels, although usual candi-

[20] An alternative explanation to this set of results might be to view health outcomes as a consequence of older affected male cohorts not being able to attend school. For this alternative to be true, however, it would have to be that the older affected male cohorts are more depressed because they are not being able to attend school and, at the same time, incur a higher chance of becoming physically hurt. This scenario appears to be less probable, in my view.

dates such as the destruction of infrastructure and the displacement of teachers do not seem to matter. Instead, there is considerable support for the military draft being a primary driver of the adverse effects on secondary schooling attainment.

While the existing economics and political science literature on examining civil conflicts is vast, until recently, few empirical works have examined the microeconomic impact of civil wars using measures of war intensity. To my knowledge, this study is one of the first to directly estimate war intensity effects of a civil war. Analyzing war intensity effects with casualty data introduces objectivity to the spatial variation in war, and provides precise intrastate estimates that are useful for policy makers who are involved in post-war rebuilding programs. In addition, this paper registers an attempt to infer the mechanisms through which civil wars affect individuals' welfare, and is the one of the first in the empirical literature to dissect war effects into various possible channels.

Given that civil wars lower schooling attainment, which may worsen individuals' longer term welfare and impede the economic growth of their countries, the results of this paper not only provide policy-makers with important insights on the consequences of conflict, but also reaffirms the importance of aid spending on the post-war rebuilding of the education sector. While the results of this study are important and policy-relevant, it is unfortunate that there is no available data on soldiering and attendance in war schools, both of which could be used to pin down the importance of youth soldiering as a key mechanism. Should these data become available in the future, it may be worthwhile to revisit the analysis.

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Table 1 - Descriptive Statistics (War Casualties)

	All regions	Region						
		West	Northwest	North	Northeast	East	Southeast	Central
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
War casualties	849	856	707	835	1462	923	328	752
	(1148)	(812)	(1112)	(539)	(2091)	(773)	(635)	(475)
Casualty rate	0.022	0.017	0.013	0.016	0.031	0.036	0.010	0.019
	(0.030)	(0.012)	(0.011)	(0.007)	(0.055)	(0.029)	(0.012)	(0.011)
Civilians	340	138	413	166	745	358	123	148
	(804)	(82)	(938)	(88)	(1585)	(422)	(212)	(96)
Male	765	815	639	778	1361	783	276	700
	(1063)	(795)	(1017)	(513)	(1976)	(623)	(562)	(453)
Aged 0-14	15	12	8	11	21	26	6	12
	(24)	(11)	(13)	(16)	(28)	(34)	(13)	(12)
Aged 15-64	707	769	529	733	1243	753	253	670
	(969)	(772)	(820)	(463)	(1805)	(612)	(533)	(443)
Aged 65+	44	27	47	31	63	59	31	23
	(76)	(23)	(70)	(18)	(128)	(83)	(46)	(11)
Bosniak	565	592	423	307	1138	656	183	444
	(1009)	(637)	(932)	(295)	(1966)	(608)	(388)	(326)
Serb	213	248	245	387	283	223	73	107
	(219)	(253)	(195)	(334)	(232)	(194)	(131)	(134)
Croat	68	15	35	139	37	40	69	198
	(103)	(33)	(53)	(83)	(78)	(56)	(127)	(146)
Other	3	1	4	3	4	4	2	3
	(6)	(1)	(8)	(2)	(7)	(6)	(8)	(3)
Number of municipalities	109	7	17	9	19	26	19	12

Standard deviations in parentheses. War casualties refer to the number of dead or missing individuals by municipality. Casualty rates are constructed by normalising war casualties by the municipal population in 1991.

Table 2 - Descriptive Statistics (Schooling Attainment)

	Primary schooling attainment				Secondary schooling atainment				Number of individuals
	Affected	Unaffected cohorts			Affected	Unaffected cohorts			
	Aged 15-28	Aged 29-42	Aged 43-56	Aged 57+	Aged 15-28	Aged 29-42	Aged 43-56	Aged 57+	
High war intensity	0.953	0.907	0.680	0.613	0.526	0.619	0.406	0.347	740
	(0.211)	(0.291)	(0.468)	(0.489)	(0.501)	(0.487)	(0.492)	(0.478)	
Medium war intensity	0.969	0.968	0.867	0.739	0.642	0.736	0.606	0.565	1741
	(0.174)	(0.176)	(0.340)	(0.440)	(0.480)	(0.441)	(0.489)	(0.496)	
Low war intensity	0.975	0.958	0.835	0.644	0.595	0.687	0.550	0.364	2514
	(0.155)	(0.201)	(0.372)	(0.479)	(0.491)	(0.464)	(0.498)	(0.482)	
Number of individuals	1383	1324	1282	1006	1383	1324	1282	1006	4995

Standard deviations in parentheses. Schooling attainment is a binary indicator for whether an individual has completed primary or secondary schooling. Municipalities are categorised by casualty rate into three groups - high intensity (casualty rate greater than 2.42 percent), low intensity (casualty rate less than 1.23 percent), and medium intensity (otherwise). Individuals are categorised by cohort into 4 groups, where the youngest group constitutes the affected cohorts who were aged 7-19 in the years 1992-1995 (or aged 15-28 in 2001).

Table 3 - War Intensity and Schooling Attainment

Dependent Variable:	Primary schooling attainment					Secondary schooling attainment				
	DID (1)	DID (2)	DID (3)	DID (4)	DID(5)	DID (6)	DID (7)	DID (8)	DID (9)	DID (10)
Affected cohorts:										
Aged 07-15 in 1992-95	0.117***	1.105***	1.109***	1.108***	1.097***					
	[0.023]	[0.061]	[0.069]	[0.070]	[0.071]					
Aged 16-19 in 1992-95						0.208***	0.084	0.573***	0.573***	0.665***
						[0.018]	[0.067]	[0.055]	[0.056]	[0.051]
War casualty rate × Affected cohorts	0.340	0.387	0.337	0.413	0.410	-1.242**	-1.652***	-1.737***	-1.659***	-1.783***
	[0.374]	[0.310]	[0.251]	[0.252]	[0.259]	[0.570]	[0.538]	[0.478]	[0.442]	[0.473]
Individual controls & cohort fixed effects	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Pre-war municipality fixed effects	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Post-war municipality fixed effects	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Control function	No	No	No	No	Yes	No	No	No	No	Yes
Mean of dependent variable	0.869	0.869	0.869	0.869	0.869	0.598	0.598	0.598	0.598	0.598
Number of observations	4995	4995	4995	4995	4995	4256	4256	4256	4256	4256
R^2	0.02	0.22	0.25	0.26	0.26	0.02	0.37	0.40	0.41	0.42

Clustered standard errors in parentheses, except for columns (5) and (10) where standard errors are block-bootstrapped with 1,000 replications. * significant at 10%; ** significant at 5%; *** significant at 1%. The sample in columns (1)-(5) contains individuals aged 15 and above in 2001. The sample in columns (6)-(10) contains individuals aged 22 and above in 2001. All regressions are standard difference-in-differences, except for columns (5) and (10) in which regressions are difference-in-differences with a control function. Individual controls include sex, ethnicity and parental secondary schooling completion. Schooling attainment is a binary indicator for whether an individual has completed primary or secondary schooling. Schooling data is taken from the 2001 LSMS. War casualty rates refer to the number of dead or missing individuals normalised by municipal population. The mean and standard deviation of the war casualty rate are 0.017 and 0.022 [columns (1)-(5)], and 0.017 and 0.021 [columns (6)-(10)].

Table 4 - Mechanisms

Dependent Variable:	Secondary schooling attainment					
	DID (1)	DID (2)	DID (3)	DID (4)	DID(5)	DID(6)
Affected cohorts:						
Aged 16-19 in 1992-95	0.501***	0.969***	0.437***	0.937***	0.665***	0.301***
	[0.056]	[0.094]	[0.070]	[0.099]	[0.051]	[0.052]
War casualty rate × Affected cohorts	-1.833***	-1.209**			-1.782***	-1.950***
	[0.690]	[0.542]			[0.473]	[0.492]
Percentage of damaged housing × Affected cohorts			-0.058			
			[0.037]			
Out-migrants per capita × Affected cohorts				-0.429		
				[0.730]		
Ethnic minority					0.004	
					[0.027]	
Percentage of repaired housing						0.074
						[0.054]
Individual controls & cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Pre-war municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Post-war municipality fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Control function	Yes	Yes	Yes	Yes	Yes	Yes
Mean of dependent variable	0.702	0.495	0.598	0.598	0.598	0.598
Number of observations	2129	2127	4256	4256	4256	4188
R^2	0.67	0.34	0.42	0.42	0.42	0.41

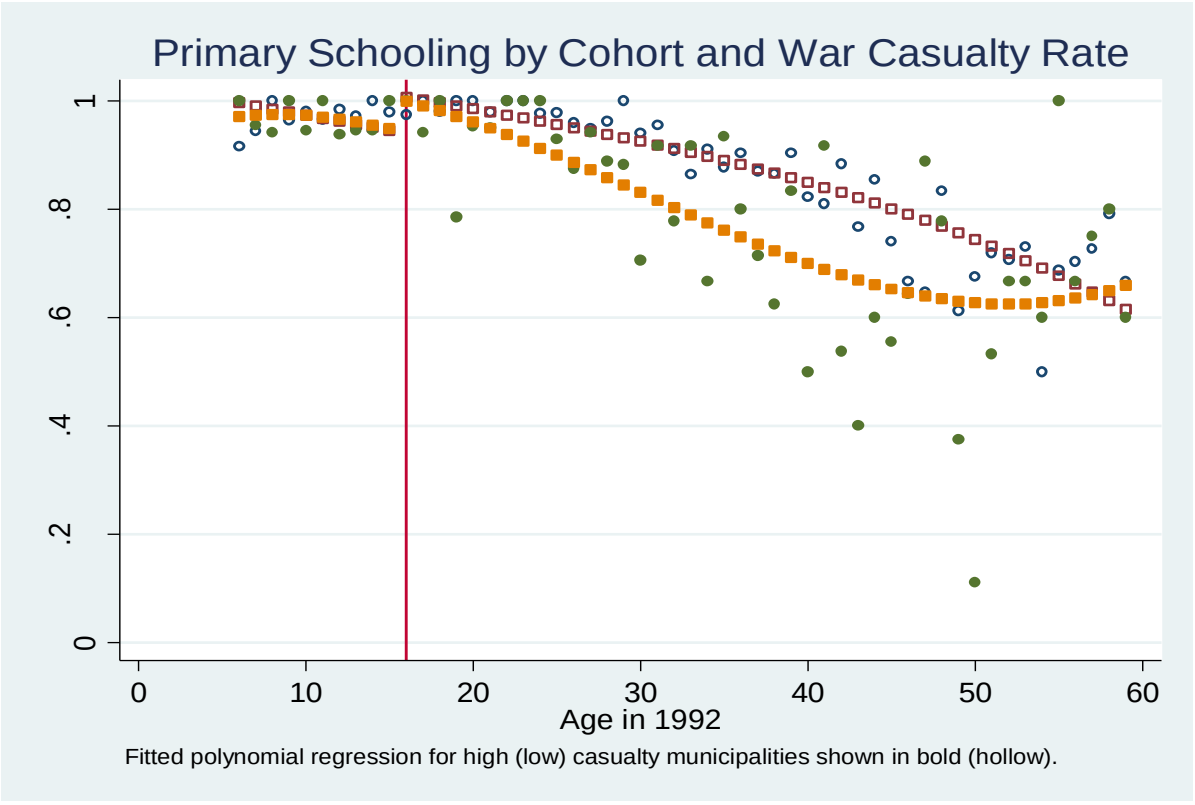
Clustered standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. This sample contains individuals aged 22 and above in 2001. Columns (1) and (2) use the male and female sample respectively. We lose 68 observations in column (6) due to missing data on repaired housing units. All regressions are difference-in-differences with a control function. Individual controls include sex, ethnicity and parental secondary schooling completion. Schooling attainment is a binary indicator for whether an individual has completed primary or secondary schooling. Schooling data is taken from the 2001 LSMS. War casualty rates refer to the number of dead or missing individuals normalised by municipal population. Data on damaged and repaired housing units, and the number of out-migrants are taken from the UNHCR. The mean and standard deviation of the war casualty rate are 0.016 and 0.017 [columns (1)], 0.018 and 0.023 [column (2)], and 0.017 and 0.021 [columns (5)-(6)].

Table 5 - War Intensity and Health

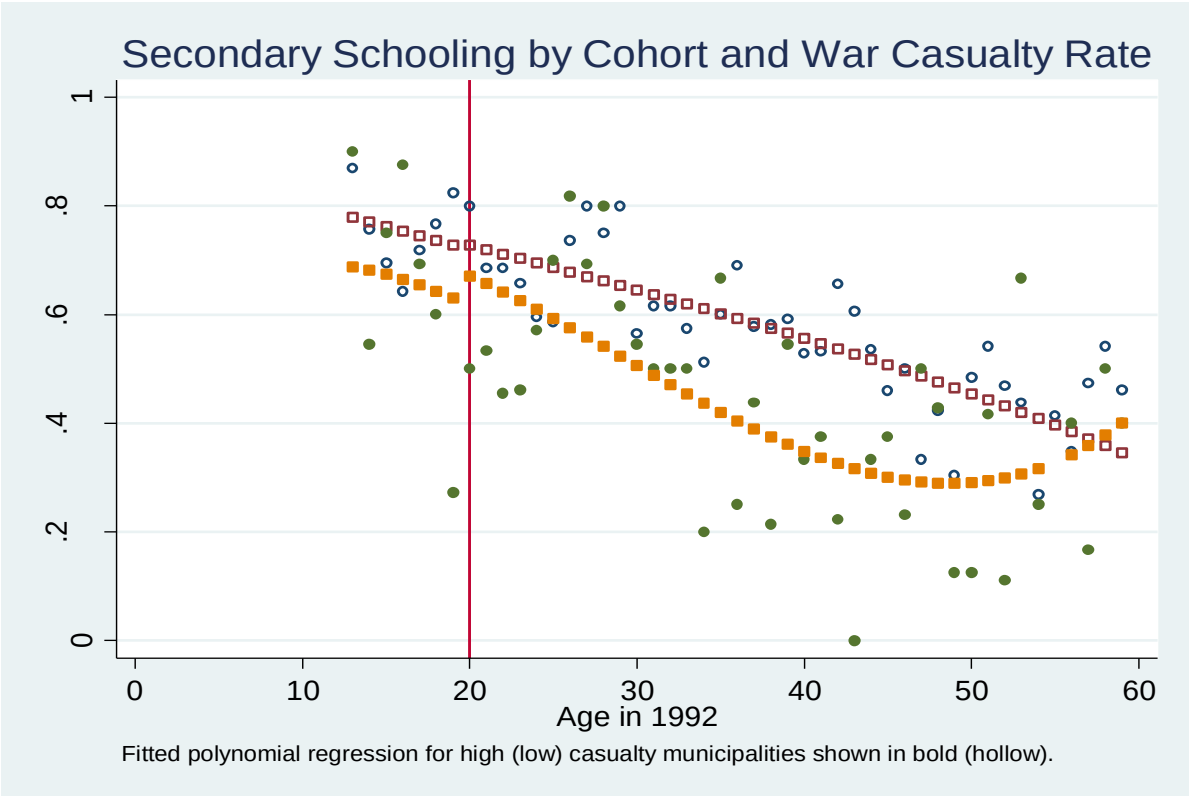
Dependent Variable:	Subjective health	War trauma	Physical disability	War disability	Depression
	DID (1)	DID (2)	DID (3)	DID (4)	DID(5)
Older affected cohorts:					
Aged 16-19 in 1992-95	-0.045	0.021	0.012	0.007	-0.025
	[0.039]	[0.111]	[0.028]	[0.013]	[0.037]
War casualty rate × Older affected cohorts	-0.450	0.133	-0.050	0.101	-1.430***
	[0.359]	[1.053]	[0.236]	[0.174]	[0.309]
War casualty rate × Older affected cohorts × Male	-0.866*	-0.301	0.100	-0.037	1.555**
	[0.466]	[1.038]	[0.327]	[0.189]	[0.683]
Individual controls & cohort fixed effects	Yes	Yes	Yes	Yes	Yes
Pre-war municipality fixed effects	Yes	Yes	Yes	Yes	Yes
Post-war municipality fixed effects	Yes	Yes	Yes	Yes	Yes
Control function	Yes	Yes	Yes	Yes	Yes
Mean of dependent variable	0.952	0.437	0.012	0.005	0.061
Number of observations	1383	1365	1379	1379	1084
R^2	0.09	0.23	0.09	0.05	0.20

Clustered standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. This sample contains individuals aged 28 and below in 2001. All regressions are difference-in-differences with a control function. Individual controls include ethnicity and parental secondary schooling completion. War casualty rates refer to the number of dead or missing individuals normalised by municipal population. Subjective health is a dummy = 1 if reported health is no less than "fair", based on health in the last 12 months, relative to people of the same age; the actual responses in the LSMS are: (1) very poor, (2) poor, (3) fair, (4) good, (5) excellent. War trauma is an indicator that denotes the recall of war trauma in the previous week. Depression is a dummy that takes the value 1 when an individual is Hopkins Symptom Checklist (HSCL) positive, with a depression score of 1.75 or higher (out of a possible 4), where a higher score corresponds to a greater likelihood of significant emotional illness; the HSCL is a symptom inventory which measures symptoms of depression. Physical disability (due to war or not) is a dummy that equals one when the individual reports disability. Some observations are lost due to unreported health measures. The mean and standard deviation of the war casualty rate in columns (1)-(5) are 0.018 and 0.027 respectively.

Figure 1 - Schooling Attainment by Cohort and War Casualty Rate

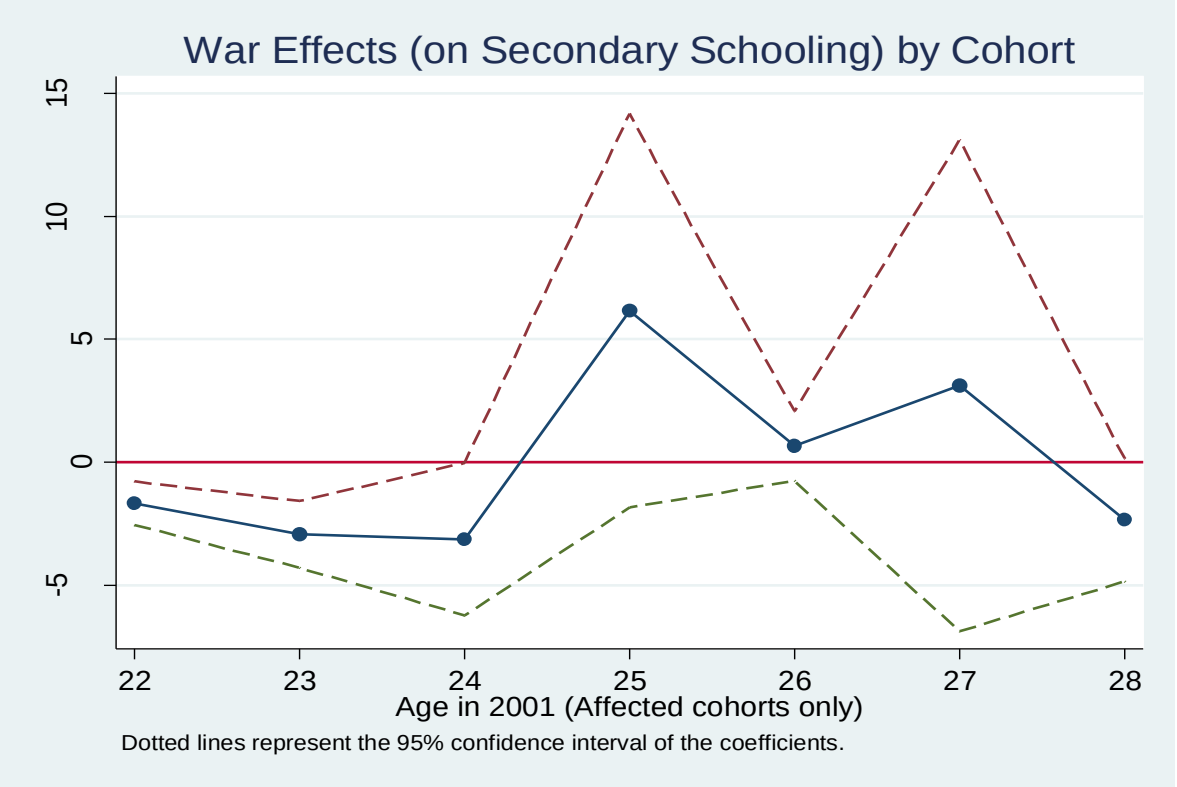


Fitted polynomial regression for high (low) casualty municipalities shown in bold (hollow).



Fitted polynomial regression for high (low) casualty municipalities shown in bold (hollow).

Figure 2 - War Effects by Cohort



Appendix Table 1 - Sensitivity Analysis

Dependent Variable:	Secondary schooling attainment	
	DID (1)	DID (2)
Affected cohorts:		
Aged 16-19 in 1992-95	0.052	1.118***
	[0.056]	[0.056]
War casualty rate × Affected cohorts	-1.811***	-1.610***
	[0.449]	[0.391]
Individual controls & cohort fixed effects	Yes	Yes
Pre-war municipality fixed effects	Yes	Yes
Post-war municipality fixed effects	Yes	Yes
Control function	Yes	Yes
Mean of dependent variable	0.605	0.489
Number of observations	4365	4172
R^2	0.42	0.42

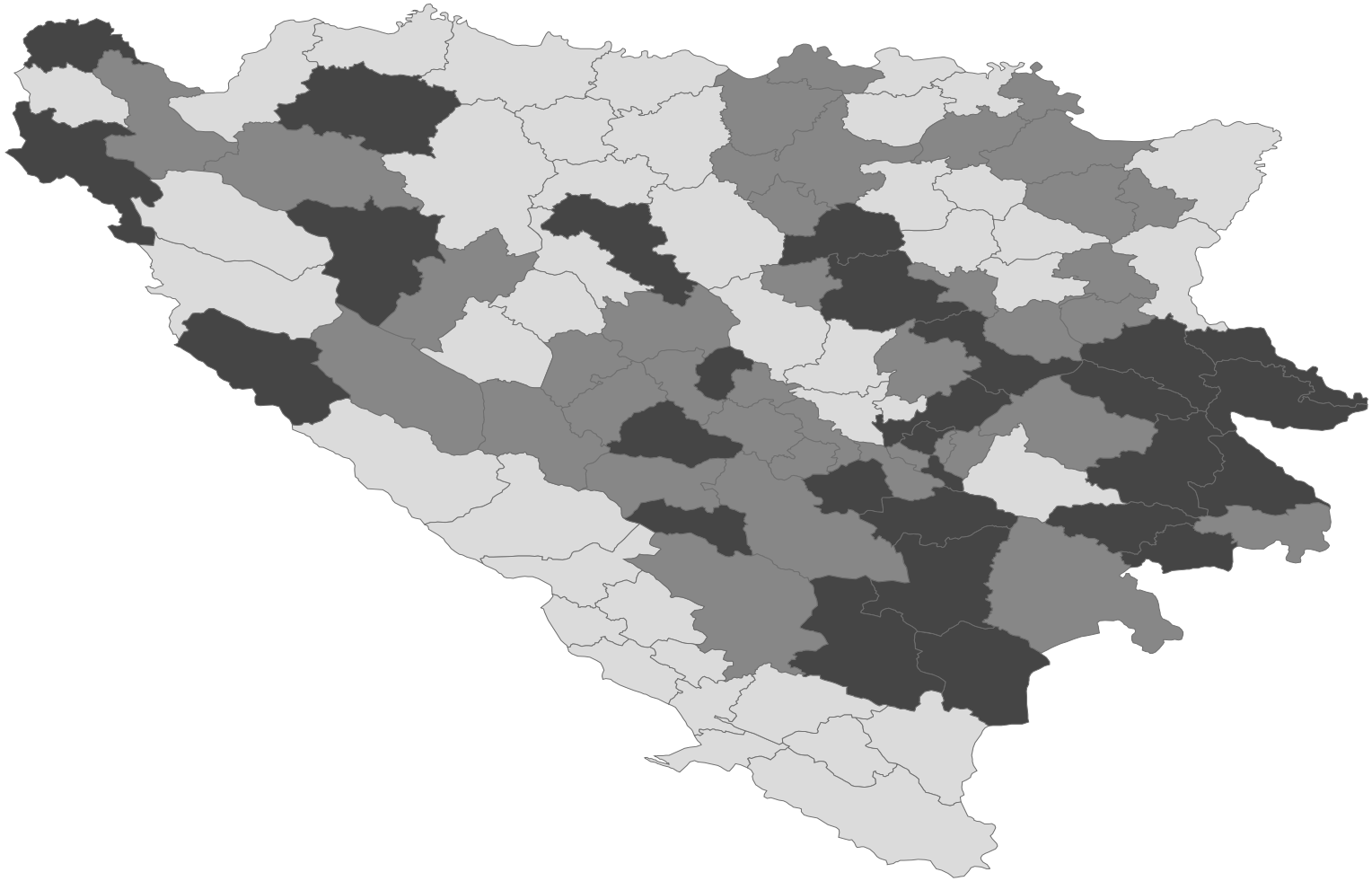
Clustered standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The sample in column (1) contains individuals aged 21 and above in 2001, and that in column (2) contains individuals aged 23 and above in 2001. Individual controls include sex, ethnicity and parental secondary schooling completion. Schooling attainment is a binary indicator for whether an individual has completed primary or secondary schooling. Schooling data is taken from the 2001 LSMS. War casualty rates refer to the number of dead or missing individuals normalised by municipal population. The mean and standard deviation of the war casualty rate are 0.017 and 0.021.

Appendix Table 2 - Cohort Analysis

Dependent Variable:	Primary schooling attainment DID (1)	Secondary schooling attainment DID (2)
War casualty rate × Aged 07 in 1992	0.970	
	[2.003]	
War casualty rate × Aged 08 in 1992	0.696*	
	[0.379]	
War casualty rate × Aged 09 in 1992	-1.228***	
	[0.352]	
War casualty rate × Aged 10 in 1992	1.287***	
	[0.336]	
War casualty rate × Aged 11 in 1992	0.638	
	[0.535]	
War casualty rate × Aged 12 in 1992	1.230***	
	[0.417]	
War casualty rate × Aged 13 in 1992	0.108	
	[0.397]	
War casualty rate × Aged 14 in 1992	0.098	-1.991***
	[0.301]	[0.420]
War casualty rate × Aged 15 in 1992	0.181	-2.923***
	[0.784]	[0.743]
War casualty rate × Aged 16 in 1992	0.525	-3.382**
	[0.482]	[1.490]
War casualty rate × Aged 17 in 1992	2.760	6.527
	[2.295]	[4.449]
War casualty rate × Aged 18 in 1992	0.263	0.299
	[0.569]	[0.649]
War casualty rate × Aged 19 in 1992	2.845	2.686
	[2.797]	[5.036]
War casualty rate × Aged 20 in 1992	0.227	-2.694**
	[0.606]	[1.127]
Individual controls & cohort fixed effects	Yes	Yes
Pre-war & post-war municipality fixed effects	Yes	Yes
Control function	Yes	Yes
Mean of dependent variable	0.869	0.598
Number of observations	4995	4256
R^2	0.26	0.42

Clustered standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The sample in column (1) contains individuals aged 15 and above in 2001, and that in column (2) contains individuals aged 22 and above in 2001. Individual controls include sex, ethnicity and parental secondary schooling completion. Schooling attainment is a binary indicator for whether an individual has completed primary or secondary schooling. Schooling data is taken from the 2001 LSMS. War casualty rates refer to the number of dead or missing individuals normalised by municipal population. The mean and standard deviation of the war casualty rate are 0.017 and 0.022 [columns (1)], and 0.017 and 0.021 [columns (2)].

Appendix Figure 1 - Municipal Map of Pre-War Bosnia by War Casualty Rate



Municipalities are grouped by casualty rate into three equal quantiles - high (casualty rate greater than 2.42 percent), low (casualty rate less than 1.23 percent), and medium (otherwise). Darker shades depict higher casualty rates.

Appendix Figure 2 - Municipal Map of Pre-War Bosnia (LSMS Sample)

The sample of 25 LSMS municipalities are shaded.