Intergenerational effects of war on education: Evidence from World War II in Europe*

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Abstract

The negative effects of war on the education and health of the civilian population are well documented. However, there is little evidence on whether these effects extend to subsequent generations. To fill-in this gap we analyze the intergenerational effects of World War II on educational attainments focusing on parent-child dyads in which parents were born in 1926–1949. We show two things. First, parents who suffered the war, that is, were exposed to major war events or personally experienced war-related hardship, ended up with less schooling than parents with similar characteristics who did not. Second, the children of parents who suffered the war have lower educational attainments than the children of parents with similar characteristics who did not suffer the war. Our reduced form results also suggest estimates of the coefficient of intergeneration transmission of education based on war-related hardships as instruments. These estimates show that mother's education matters more for daughters, whereas father's education matters more for sons.

Key words: Education; intergenerational effects; war; conflict; hunger; hardship; World War II; Europe; SHARE.

JEL codes: I0, J24, J3

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1 Introduction

The short-term negative effects of war on human and physical capital are well documented, and so are its long-term negative effects on human capital, as measured by the educational attainments or the physical and mental health of the survivors. However, relatively little is known about the persistence of the effects on human capital across generations. Our paper tries to fill-in this gap by documenting the intergenerational effects of World War II (WW2) on educational attainments.

WW2 was the deadliest conflict in history, with around 70 million casualties (Beevor 2012). It directly affected most European countries, though at different times and with different intensity. Unlike most previous wars, civilians were heavily exposed to combat, bombing, stress, and hunger. In particular, the war affected the childhood of various cohorts of Europeans, exposing them to a variety of shocks. Many of them are still alive today and able to recall the experience of war-related hardship.

Recent surveys that interview people who lived through WW2 have stimulated a growing literature that focuses on the long-term effects of the war on life-cycle outcomes, such as education, income, and physical and mental health. The empirical results provide evidence of large negative effects. This literature also explores specific channels that may be responsible for the observed effects, such as the disruption of the educational process through physical destruction, loss of educators, school closure or conscription of students (Ichino and Winter-Ebmer, 2004; Akbulut-Yuksel, 2014), or the exposure to hunger or famine (Havari and Peracchi, 2011, 2017; Jürges, 2013; Kesternich et al., 2014; van den Berg et al., 2016). However, to date there is little evidence on whether these negative effects persist across generations and what mechanisms are responsible for the intergenerational persistence.

Our paper provides novel evidence on the intergenerational effects of WW2 on educational attainments by combining micro-level data on linked generations from the Survey of Health Ageing and Retirement in Europe (SHARE) with detailed historical information on military operations during WW2. We contribute to the recent literature on the long-term effects of conflicts, as well as to the more established literature on the intergenerational transmission of education, by focusing on parents-child dyads in which the parents were born between 1926 and 1949, and therefore spent part of their childhood or adolescence during the WW2 period, defined here as the period from the beginning of the Spanish Civil War in 1936 to the end of its immediate aftermath in 1948. The available data allow us to address the following questions: How large is the negative educational shock for parents who were exposed to war-related hardship during the WW2 period? How much of this negative effect persists across generations? Is the effect different by gender or age of exposure to war-related hardship? Does socio-economic status (SES) play a mitigating role? What other

mechanisms may be at work?

By answering these questions, our study contributes to the literature in three ways. To begin with, this is the first study that analyzes the effects of WW2 on multiple generations, and is among the few that look at the intergenerational effects of violent conflicts. The literature on this topic is limited to some evidence from the German Famine of 1916–1918 during World War I (van den Berg and Pinger, 2016), the 1967–1970 Nigerian Civil War (Akresh et al., 2017), and the 1861–1865 U.S. Civil War (Costa et al., 2019). To some extent, this reflects the lack of data, as it is hard to find nationally representative surveys that provide detailed information on linked generations (parents and children) and also contain information on parents' exposure to war-related hardships. Second, unlike the studies just mentioned, our paper is not confined to a single country and deals with the deadliest war in history, especially for civilians. Third, unlike studies of more recent conflicts, which focus on short-run children outcomes such as school dropout rates, test scores, or health, the children in our study are mature adults who have largely completed their educational process, so we can measure much more accurately their investment in formal schooling.

We exploit the availability in SHARE of data on linked generations, coupled with the rich retrospective information on early-life circumstances collected in the third wave of the survey (SHARELIFE) from nationally representative samples of people born before 1957 in thirteen countries of continental Europe, namely Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Italy, the Netherlands, Poland, Spain, Sweden, and Switzerland. A number of features of SHARE are especially important for our purposes. First, although SHARELIFE does not contain any question about direct experience of war, it contains detailed information on the residential history of each respondent, typically unavailable in similar household surveys. By matching this information with the geographical information on major war events during the WW2 period, we are able to construct for every individual an indicator of potential war exposure in each year. Second, SHARELIFE also contains information on the experience of severe hardship episodes, such as hunger, financial hardship, etc., including their timing and duration. Third, SHARE respondents with children (henceforth, "parents") are asked to provide information on their offsprings, whether cohabiting or not, in particular their education and occupational status. This is an important advantage of our data, as most available studies only look at cohabiting children (Oreopoulos et al., 2006). Fourth, since SHARE parents are aged 50 years or older, most of their children have already completed their formal education. This is another important advantage, as many available studies lack information on completed education and can only consider outcomes such as school dropout or grade repetition (Oreopoulos et al., 2006; Black and Devereux, 2011).

Our main indicators of parental exposure to war during childhood or adolescence (ages 0–16)

are the number of years they lived in war-affected regions and the length of their hunger experience. The coefficients from our estimated reduced form relations show that the children of parents who experienced hunger or were exposed to war tend to have less schooling on average than the children of parents who did not suffer hardships, all else being equal. Estimates from the pooled sample show that one year of war exposure by the mother is associated with an average reduction by 0.11 years in children schooling, and one year of hunger exposure is associated with an average reduction by 0.049 years in children schooling. Surprisingly, the effects of hunger experience by the father is essentially zero, while the effect of war exposure is associated to a decrease of 0.086 years in children schooling. As for the differences by the gender of the child, we find that the effect of war exposure is negative and statistically significant for the dyads mother-daughter, mother-son, and father-son.

Our results are broadly in line with the findings in the literature, including the few studies that look at differences by gender. The paper closest in spirit to ours is Akresh et al. (2017), which uses data for the Nigerian cohorts exposed to the Biafran war of 1967–1970 to estimate a reduced form relationship linking the education of children to an indicator of war exposure of the parents. This paper finds no evidence of differential effects for mothers and fathers, nor significant differences by gender of the child. On the contrary, we find evidence of differential effects depending on the gender of the parent and the child, which provides insights into the possible mechanisms at work.

Our reduced form results also allow us to derive instrumental variables (IV) estimates of the coefficient of intergeneration transmission of education for the "war parents" by treating the indicators of war-related hardship as potential instruments. The results from the first stage equation show that these candidate instruments are indeed relevant and we provide evidence supporting the "exclusion restriction" that parental war exposure has an impact on children's education only through parental education. According to our estimated IV regressions, a one-year increase in maternal education increases children's education by 0.25 years on average, while a one-year increase in paternal education has no significant effects. These results are consistent with the main findings from the literature on intergenerational transmission of human capital, namely that the effects of education are stronger for mothers compared to fathers. After splitting the sample by gender and considering the different parent-child dyads, we find that mothers' education is more important for daughters compared to sons, everything else being equal. A one-year increase in maternal schooling on average increases the schooling of daughters by 0.35 years and that of sons by 0.16 years. Interestingly, these results are in line with most other IV studies. Amin et al. (2015) show that maternal education is more important than paternal education, even when using twin data. They provide new evidence on this "puzzle" using register-based Swedish data on the largest sample of

twins used so far in the literature. The magnitude of their estimated effect is close to what has been found in most IV studies. They also show that only maternal education matters when allowing the effects to differ between sons and daughters. Such conclusions have strong policy implications. Since parental education accounts for a large part of the variation in intergenerational mobility, they seem to suggest that is more efficient to invest in maternal schooling in order to increase intergenerational mobility (Behrman and Rosenzweig, 2002).

This paper continues as follows. Section 2 describes the data sources and the variables used in the analysis. Section 3 presents our empirical evidence. Section 3.5 discusses a number of potential mechanisms leading to our results. Section 4 presents some extensions and sensitivity checks. Section **??** discusses how the results in the previous section may be used to estimate the intergenerational transmission of education. Finally, Section 5 concludes.

2 Data

This section describes the data we use, namely the micro-level data from SHARE and SHARELIFE, and the geographical and temporal information on major war events during the WW2 period. We also provide some descriptive evidence on the distribution of war-related hardships across European regions.

2.1 SHARE and SHARELIFE

SHARE is a multidisciplinary cross-country household panel survey that collects detailed information on individuals aged 50 or more (and their spouses irrespective of age), who speak the official language of the country in which they reside, and do not live abroad or in an institution. The survey is designed to be representative at the national level and the country coverage offers a full representation of the different areas of continental Europe. The first three waves of SHARE cover all parts of continental Europe: Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France, Germany, the Netherlands, Switzerland), Eastern Europe (Czech Republic and Poland) and the Mediterranean countries (Greece, Italy, Spain). Five waves of SHARE are currently available, with new countries (Estonia, Hungary, Ireland, Israel, Luxembourg, Portugal, and Slovenia) joining the project in the last two waves.

The survey collects detailed information, at both the household and the individual level, covering different domains, such as education, health, social security, income, financial investments, etc. One advantage of SHARE is its cross-country comparability due to the common questionnaire and the standardization of fieldwork procedures. Moreover, wave 3 (2008–2009) of SHARE, known as SHARELIFE, is a retrospective survey containing a variety of questions on the respondents' early

life circumstances, ranging from residential mobility to health conditions, experience of hardships, and so on.

Two other aspects of SHARE make the survey particularly appealing for our purposes. First, we have detailed information on all the living children of people interviewed in wave 2 (2006–2007).[1] This information includes gender, birth year, education, employment status, marital status, residence, and whether the child is a natural child or not. Since the target population of SHARE are people aged 50+ and their spouses, most of these children have already completed their educational process. As remarked in the Introduction, both these features are important for the study of intergenerational transmission of education.

Second, for people interviewed in SHARELIFE, we also have detailed retrospective information on residential mobility, experience of hardship episodes, early-life circumstances and family background.[2] Specifically, SHARELIFE collects information on the primary residence of the respondents at the time of their birth, as well as information on each subsequent residence where they lived for six months or more, including the start and end year, the type of residence, and the country, region and area (urban or rural) in which the residence was located.[3] We use this information to construct a retrospective longitudinal data set with people's location in each year, which we then match with data on major war events across European regions to obtain indicators of potential exposure to war events.

SHARELIFE also asks whether there was a distinct period during which the respondent experienced a specific hardship, namely stress, poor health, financial hardship, and hunger, and records the years when this period started and ended. For example, the sequence of SHARELIFE questions on the experience of hunger starts by asking: "Looking back on your life, was there a period during which you suffered from hunger?". It the answer is affirmative, it continues by asking: "When the hunger period started?", and concludes by asking: "When the hunger period stopped?".[4] Although we have no information on how serious each hardship episode was, we can compute the number of

[1] More precisely, SHARE collects information on up to four living children. We do not know the number of children who died. When there are more than four living children, the information is collected only for the first four sorted in ascending order by age group, geographical proximity to the parents, and birth year. If two or more children share the values of all sorting variables, then one of them is randomly selected. Only 6 percent of the SHARE respondents with children report having more than four, so this aspect of the survey is unlikely to affect the results of our analysis.

[2] The SHARELIFE interview was designed to maximize the accuracy of recall. To this purpose, it adopted a multidimensional life grid (a computerized version of the life-calendar interview) that allowed respondents to view important events on a computer screen and, at the same time, allowed the interviewer to link questions to parallel events. Havari and Mazzonna (2015) provide evidence that the childhood information reported in SHARELIFE is relatively immune from recall bias.

[3] SHARELIFE adopts the Nomenclature of Units for Territorial Statistics (NUTS) developed by the European Union, but the level of regional disaggregation varies considerably and ranges from the finer NUTS3 level for the Czech Republic to the coarser NUTS1 level for Belgium, Denmark, France, and the Netherlands.

[4] Respondents are asked to report only one episode for each type of hardship. Since SHARE uses terms such as "distinct period" and "compared to the rest of your life", this is plausibly the most salient.

years it lasted by taking the difference between the year it stopped and the year it started.

In addition to the information on residential location and hardship episodes, SHARELIFE collects detailed information on the SES of the respondents when they were 10 years old. Most relevant for our purposes is the information on the occupation of the main breadwinner in the family, on the number of books at home, on the household size and composition, and on the absence of the mother or the father.

As for the variable of our primary interest, the survey measures the education of both the parents and the children by the highest degree obtained, following a protocol that is harmonized across the participating countries. More precisely, the questionnaire asks: "What is the highest school leaving certificate or school degree that you have obtained?". Each country team relies on local experts to map the answer to the SHARE education question into two measures: the ISCED-97 educational level corresponding to each degree and the number of years of education needed to complete each level. The release guide of SHARE provides a conversion table from ISCED levels to years of education.[5] In addition, SHARE also provides information on the years of completed schooling of the parents. More precisely, the SHARE questionnaire includes the question: "How many years have you been in full time education?". This is the standard measure used in the literature on the intergenerational transmission of education, so using this measure is important for comparability.

As for our sample selection criteria, we confine attention to people born between 1926 and 1949, present in waves 2 and 3 of the survey, whose biological children (about 96 percent of the total sample of children) were born between 1951 and 1981, and therefore had at least 25 years of age at the time of their parents' interview in wave 2. Because of this age limit, most of our children have completed their full-time education. After dropping cases with missing values, our working sample consists of 15,443 mothers, 11,306 fathers and 18,464 children. The number of mothers and fathers is different because we have families with either one or two parents.

Table 1 presents the mean and standard deviation of all the variables we use in our analysis. For simplicity, we pool the data without distinguishing by country or birth cohort. The table shows that fathers are on average more educated than mothers (they have on average one more year of schooling), while children are on average more educated than parents (they have on average 2.7 more years of schooling than fathers and 3.7 more years of schooling than mothers). Because fathers were on average born in late 1937, and are almost one and a half year older than mothers, they are more likely to have been exposed to war (40 percent of fathers and 34 percent of mothers) and to have experienced hunger (9.6 percent of fathers and 6.1 percent of mothers) or financial

[5] More information is available at http://www.share-project.org/fileadmin/pdf.

hardship (3.5 percent of fathers and 2.9 percent of mothers). However, there are no significant differences between parents in terms of experience of stress (1.4 percent of fathers and 1.5 percent of mothers) and SES in childhood, as measured by the fraction living in rural areas, or having few books at home, or being from a family with a low-skilled breadwinner, or having grown up in a family where either the mother or the father were absent.

2.2 Major war events in Europe, 1936–1945

SHARE does not ask direct questions about war experience, but the information it collects on the residential history of each respondent allows us to construct measures of potential war exposure in each year by exploiting the available information on major war events (both combat operations and aerial bombings) during the period from the beginning of the Spanish Civil War in 1936 to the end of WW2 in 1945.

For the Spanish Civil War, our main sources of information are Thomas (2003) and Preston (2006), while for WW2 we exploit a variety of sources, including Ellis (1994) and Davies (2006). We refer to the European regions affected by major war events as "war regions". Our classification into war and non-war regions updates that used in Havari and Peracchi (2017). The remainder of this section provides some detail for the regions covered by SHARE.

The Spanish Civil War began in July 1936 and initially affected all of Spain, except the Canary Island and Ceuta and Melilla. In 1937 it mostly affected Andalusia, Extremadura, Castile-La Mancha, Madrid, Aragon, the Basque Country, Cantabria, and Asturias. In 1938 it mostly affected Andalusia, Extremadura, Castile-La Mancha, Madrid, and Aragon, while in 1939 it mostly affected Andalusia, Extremadura, Castile-La Mancha, Madrid, the Valencian Community, and Catalonia. The Spanish Civil War conventionally ended on April 1, 1939.

Exactly five months later, on September 1, 1939, WW2 began with the German invasion of Poland, coordinated with the Soviet invasion from the east on September 17. Thus, for 1939, our war regions include the whole of Poland and some regions of Spain. The regions along the French-German border are not included because only affected by small-scale war operations (the so-called "phony war"). In 1940, our war regions include the whole of Belgium and the Netherlands, the northern and eastern regions of France, and the north-western part of Greece. In 1941, they include the whole of Greece, as well as the German regions of Bremen and Hamburg, subject to heavy aerial bombing. In 1942, no region considered in SHARE was affected by major combat operations, except some heavily bombed German regions. In 1943, combat was limited to the southern Italian regions, but aerial bombing of Germany extended and intensified. In 1944, combat spread to the eastern regions of Poland, the central regions of Italy, most of Greece, and parts of Belgium, France and

the Netherlands, while large part of Germany was under heavy aerial bombing. In 1945, our war regions include all of Germany, the western, central and northern regions of Poland, the eastern and central regions of the Czech Republic, the northern regions of Italy, the eastern regions of Austria, and parts of Belgium, France and the Netherlands. WW2 ended in Europe on May 8, 1945, with the unconditional surrender of all German forces.

2.3 War-related hardship

We use various indicators of war-related hardship. One is having lived in a war region between 1939 and 1945 (between 1936 and 1939 for Spain), while the others are indicators for reporting the experience of a variety of hardships (hunger, stress, and financial hardship) . Of these hardships, hunger is most closely associated with WW2 (Havari and Peracchi, 2017). For some countries, financial hardship and stress are also related to war, but the link is much weaker than for hunger, especially with reference to our age-interval (0–16).

As for war exposure, Figure 1 shows for how many years each European region was subject to major war events between 1936 and 1945. The regional disaggregation reflects the level of geographical detail available in the public-use files of SHARELIFE. The shading in the map darkens with the number of years. The darkest color, corresponding to three years or more, is for some regions of Belgium, Eastern France, and the Netherlands (visited by war a first time in 1940 and a second time in 1944–1945), the Berlin, Bremen and Hamburg regions in Germany (subject to heavy aerial bombing from 1942 to 1945 and to combat in 1945), the regions around Warsaw in Poland (ravaged by war first in 1939 and then again in 1944–1945), and Andalusia, Aragon, Castile-La Mancha, Extremadura and the Madrid regions in Spain (subject to fighting for at least three years during the Spanish Civil War). The lightest color is for the regions that did not experience any major war event. These include the neutral countries (Sweden and Switzerland), as well as Denmark (under German occupation from April 1940 to the end of WW2), the south-western part of France, two Alpine regions of Italy, the central and western regions of Austria, the western and southern part of the Czech Republic, and the Spanish regions of Ceuta and Melilla and Murcia.

As for the other types of hardship – hunger, financial hardship, and stress – Figure 2 shows the average percentage of parents who report suffering them in each region during the period 1936–1948, which includes the aftermath of WW2 with the Allied occupation of Austria and Germany, the Greek Civil War, and population displacement in several Eastern European countries. Panel (a) is for hunger, panel (b) for financial hardship, and panel (c) for stress. As it can be seen from the figure, hunger and financial hardship are more common than stress. When we look at the distribution of the year in which these hardship episodes started and ended (see Havari and Peracchi, 2017), stress

and financial hardship mostly appear after 1945. We will discuss again the role of these episodes in Section 3.5.

3 Empirical results

The existing literature is mainly concerned either with the long-term effects of violent conflicts on the cohorts directly exposed or with the effects on the next generation shortly after the end of a conflict. Our data offer the unique opportunity of assessing the long-term effects of WW2 on both the education of the parents' generation and the spillover effects on the education of the next generation.

WW2 could have impacted the parents' generation through many channels: human capital formation, family resources, health outcomes (physical and mental), behavioral aspects (risk-aversion), etc. On the other hand, spillover effects of WW2 on the next generation are possible, as the literature that studies the intergenerational transmission of schooling identifies parental education as one of the key inputs of the so-called nurture channel (Holmlund et al., 2011).

3.1 Descriptive evidence

Figures 3 and 4 provide some descriptive evidence on the association between the experience of war-related hardship by the parents and the educational attainments of both the parents and their children.

Panel (a) in each figure shows the distribution of mothers' and fathers' years of schooling by, respectively, war exposure and hunger experience. Parents who were exposed to war or hunger have less schooling compared to those who were not. The difference is large for both mothers and fathers, and is larger in the case of hunger experience (right panels) than in the case of war exposure (left panels). For example, the probability of low education (having 5 years of education or less) is 10 percent for mothers not exposed to war (dashed grey line) but doubles (20 percent) for those exposed (solid black line). The difference is even larger in the case of hunger, as the probability of low education is 10 percent for mothers who did not experience hunger but more than 30 percent for those who did. For fathers, the difference in the probability of low education is smaller: only 5 percentage points in the case of war exposure and 12 percentage points in the case of hunger experience.

Panel (b) in each figure instead shows the distribution of children's years of education separately by parental exposure to war and experience of hunger. Children whose parents were exposed to war or hunger have on average less schooling compared to children whose parents were not. This difference is larger for children at the lower part of the distribution of educational attainments,

especially when looking at the mother-child dyad. In this case, the probability of having at most 10 years of education is 10 percent if the mother was not exposed to war but 20 percent if the mother was exposed, and this difference is actually slightly bigger when considering hunger.

These figures provide evidence of intergenerational spillovers of war-related hardship, but do not control for observed differences among parents or among children. In the next sessions we analyze the data in more detail by adding various sets of controls, such as family background characteristics and cohort and country fixed effects.

3.2 Parental education and experience of war-related hardship

Our baseline model for the relationship between the education of parents and their experience of war-related hardship is

$$Y_{ij}^{p} = \gamma_0 + \boldsymbol{\gamma}_1^{\top} \boldsymbol{H}_i + \boldsymbol{\gamma}_2^{\top} \boldsymbol{X}_i + \boldsymbol{\gamma}_3^{\top} \boldsymbol{Z}_{ij} + V_{ij}, \tag{1}$$

where Y_{ij}^{p} denotes the years of schooling of the ith parent (the mother or the father) of the jth child,[6] $\boldsymbol{H}_i$ is a vector containing the number of years of parental exposure to war ("war duration") and the length of her/his hunger experience ("hunger duration"), $\boldsymbol{X}_i$ is a vector containing family background characteristics at the time the parent was about 10 year old, $\boldsymbol{Z}_{ij}$ is a vector of controls for the birth year and the country of residence of the parent (the reference country is Switzerland, a neutral country) and for the gender and birth year of the child, γ_0, $\boldsymbol{\gamma}_1$, $\boldsymbol{\gamma}_2$ and $\boldsymbol{\gamma}_3$ are unknown parameters, and V_{ij} is a regression error uncorrelated with $\boldsymbol{H}_i$, $\boldsymbol{X}_i$ and $\boldsymbol{Z}_{ij}$. Specifically, $\boldsymbol{X}_i$ contains indicators for having only few books at home, for living in a rural area, for the breadwinner in the family (usually a grandparent of the child) being low-skilled, for the father of the parent (i.e., the grandfather of the child) being absent, and for the mother of the parent (i.e., the grandmother of the child) being absent, while the vector $\boldsymbol{Z}_{ij}$ includes an indicator for the child being a female, a cubic polynomial in the birth year of the child, and a set of indicators for the birth year of the parent and her/his country of residence at the time of the SHARE interview. The controls for birth year and country of residence help capture time-invariant unobserved characteristics of WW2 and subsequent cohorts (risk aversion, rate of time preference, etc.). We estimate model (1) by ordinary least squares (OLS) using the subsample of SHARE respondents who were born in 1926–1949, participated in both waves 2 and 3, and whose biological children were born in 1951–1981. Standard errors are clustered by country and birth year of the parent.

Table 2 presents our estimates of model (1). In columns 1 and 4 we pool all children but include an indicator for the child being a female, while in columns 2 and 5 we consider the dyads

[6] Our notation reflects the fact that we may observe more than one child for a given parent, and more than one parent for a given child.

mother-daughter and father-daughter, and in columns 3 and 6 we consider the dyads mother-son and father-son. Our results show that experiencing hunger in childhood or early adolescence has a strong negative effect on parental education, an effect that is separate from the negative effect of having a low socioeconomic status in childhood, as measured by the number of books at home or the skills of the breadwinner in the family when the parent was 10 year old. One year of war exposure, measured by the number of years living in a war region, is associated with an average reduction of 0.110 years in maternal schooling (column 1) and 0.086 years in paternal schooling (column 4). One year of hunger experience is instead associated with an average reduction of 0.054 years in maternal schooling and 0.004 years in paternal schooling. The estimated coefficients on war exposure are strongly statistically significant for both mothers and fathers, whereas those related to hunger exposure are statistically significant only for the mothers. Interestingly, the background characteristics of the parent's family when she/he was about 10 year old (i.e., before completing formal education) seem to have a stronger negative effects for mothers than for fathers. Having has a low-skilled breadwinner when aged 10 is associated with a reduction of mothers' education by 0.445 years, and fathers by 0.333 years. Consistent with the results in Kalil et al. (2016), we also find that the absence of parents when aged 10 matters for educational attainments, especially in the case of mothers.

3.3 Education of children and parental experience of war-related hardship

Our baseline model for the relationship between the education of children and parental experience of war-related hardship is

$$Y_{ij}^{c} = \pi_0 + \boldsymbol{\pi}_1^{\top} \boldsymbol{H}_i + \boldsymbol{\pi}_2^{\top} \boldsymbol{X}_i + \boldsymbol{\pi}_3^{\top} \boldsymbol{Z}_{ij} + \epsilon_{ij}, \tag{2}$$

where Y_{ij}^{c} denotes the number of years of schooling of child j born to parent i, π_0, $\boldsymbol{\pi}_1$, $\boldsymbol{\pi}_2$ and $\boldsymbol{\pi}_3$ are unknown parameters, and ϵ_{ij} is a regression error uncorrelated with $\boldsymbol{H}_i$, $\boldsymbol{X}_i$ and $\boldsymbol{Z}_{ij}$.

Table 3 presents our OLS estimates of model (2), separately for mothers (columns 1–3) and fathers (columns 4–6). Our estimates show that the effects of the war extend to the children of parents that were directly exposed to war. All else equal, these children have on average less schooling than the children of parents who were not exposed to war. Surprisingly, these effects are strong and statistically significant for the dyads mother-daughter and mother-son, but not for the dyads father-daughter and father-son. More precisely, the pooled estimates show that one year of hunger experience by the mother is associated with an average reduction of 0.054 years in the child's schooling, and one year of war exposure with an average reduction of 0.004 years. The first effect is strongly statistically significant at the 1 percent level, whereas the second is not statistically significant at the conventional levels.

As for (1), we also include in (2) background characteristics of the parent's family when she/he was about 10 year old. This establishes a link between three generations: the parents of either the mother or the father of the child (the grandparents, or first generation), the mother or father of the child (the parents, or second generation), and the child (the third generation). This link represents an important improvement over the few studies that look at the long-term effects of violent conflict or famine, as we can account for a large number of characteristics of the three generations to isolate the effect of war-related hardship on educational attainments. Some characteristics of the grandparents' generation appear to have a strong effect on the schooling of the third generation, pointing towards an independent effect of grandparents' characteristics on the schooling of their grandchildren.[7] In particular, we find that belonging to a family that had few books at home when the parent was aged 10 reduces the schooling of their offspring by 1.22 years from the matrilineal side and 1.17 from the patrilineal side. Also, the absence of the grandparents (especially the grandmother) from the mothers' side when the mother was 10 year old is associated with a negative effect on the grandchildren's schooling. Hence, we again find that the mother's absence has a stronger effect on the educational attainments of both children and grandchildren.

As for gender differences, we find that the effects of both hunger experience and war exposure are not very different after we consider separately the two dyads, mother-daughter and mother-son. Looking at the dyads father-daughter and father-son we instead find that war exposure is the one that matters most, with a strong negative effect on the educational attainment of sons.

Overall, our findings are consistent with the those in Akresh et al. (2017), which uses data for the Nigerian cohorts exposed to the Biafran war of 1967–1970 to estimate a reduced form relationship similar to (2) linking the education of children to war exposure of the parents. That paper finds no differential effects for mothers or fathers, nor significant differences by gender of the child. It is important to notice, however, that we consider a long-run effect, namely the intergenerational transmission of completed education, whereas Akresh et al. (2017) estimates the short-term effect of war exposure on the health of children at young ages (mortality under the age of 5 and heigh-for-age z-score) in the context of a developing country.

3.4 Exposure to war-related hardship at school age

Our results show that exposure to war-related hardship in childhood and adolescence has a negative effect on parental schooling attainment. One may wonder what channels drive these results and whether the timing of exposure matters. Our data enable us to investigate whether the experience of war-related hardship when a parent was of school age (6–16 old) between 1936 and 1945 has

[7] Recent studies that look at intergenerational mobility across multiple generations show that there exists an independent grandparental effect. See Solon (2018) for a review.

an impact on the education of a child. Results are reported in Table 4, top panel. As before, results are shown separately for mothers and fathers. The estimated coefficients from the reduced form equation are strong and statistically significant, and are now larger in magnitude compared to the estimated coefficients of our baseline specification (Table 3). The estimated coefficients on the mother-daughter dyad is still significant, though at 5 percent level.

A natural "placebo test" is to check whether these results are confirmed for children of parents who experienced war-related hardship at later ages. Results are reported in the bottom panel of Table 4. We now see that the effects of war-related hardship on the first and second generation are much weaker. In particular, the estimated coefficients for hunger are no longer statistically significant. As for fathers, the estimated coefficients on hunger and war duration confirm the baseline results in Table 3. We are aware that these are different cohorts and that the effects of war for these groups could be different. For this reason we now report some evidence on the relationship between cohorts exposure to war and compulsory schooling laws in Europe.

The SHARE data allow us to follow individuals over time and check whether those exposed to war or hunger were affected by the compulsory schooling laws implemented in Europe during the post-war period. Table **??** reports, for each country or region, the year in which the law was implemented, the birth year of the first cohort affected by the reform (pivotal cohort), and the change in mandatory schooling years (whether it was raised from 8 years to 9 years, etc.).[8] There is substantial variation across countries in the year in which the reform was adopted (from 1948 to 1972), whereas the change in mandatory schooling years is the same for most of the countries (from 8 to 9 years). The second column shows the first cohort that was exposed, and there is variation across countries and regions.

Figure **??** shows the distribution of compulsory years of schooling taken by our cohorts of parents (separately for mother and father), depending on whether they experienced war or hunger. We see that those exposed to war when aged 6–16 in 1936–1945 get less mandatory schooling after the 7th year of schooling, whereas those exposed to hunger at the same age and in the same period are affected along the distribution.

3.5 Other potential mechanisms

3.6 The socio-economic status of the family of origin

WW2 could have affected the availability of resources of the family of origin (in this case, the grandparents when parents were very young), for example hitting harder those in the lower part of the income distribution.

[8] This information is from Brunello et al. (2009) and Brunello et al. (2017).

We can account for this channel controlling in our regressions for characteristics related to the family of origin when the parents were 10 years old. Interacting all these family background variables with war and hunger duration would lead to serious problems of overfitting. To avoid this we construct a single index of SES of the parent around age 10 and interact it with our hardship indicators namely the duration of war exposure and hunger experience. Following Havari and Peracchi (2017), we construct the index via principal component analysis from the set of indicators of parental family background in childhood, namely the number of books at home, the occupation level of the breadwinner, and the number of rooms per capita. The results, presented in Table A2, show that SES plays a protective role by reducing the negative effect of war and hunger on parental education.

3.6.1 Parental health

WW2 could have also impacted the health status of the parents. The available literature shows only correlates of exposure to hardships during childhood (ages 0–16) with health outcomes measured later in life (after age 50). For example, Havari and Peracchi (2011, 2017), van den Berg et al. (2016), and Kesternich et al. (2014) show by using the SHARE data that exposure to famine, hunger or war events is negatively correlated with physical and mental health outcomes after age 50. In order to test this channel we need to use data on health conditions of the parents when they were young enough. SHARELIFE collects retrospective information on respondents' health when they were children (defined as age 0 to 15 included). We consider the following health variables: an indicator of self-reported health taking value 1 for health being "excellent", 2 for "very good", 3 for "good", 4 for "fair" and 5 for "poor", a binary indicator for health being either "fair" or "poor", a variable which counts the number of diseases of type 1 the individual had during childhood (infectious diseases, polio, asthma, allergies, speech impairment, etc.), a variable which counts the number of diseases of type 2 (severe headaches, emotional problems, diabetes, heart troubles, etc.), an indicator for having been hospitalized for 1 month or longer, and an indicator for having missed school for 1 month or longer. We then regress these health outcomes on the indicators of war and hunger exposure, separately for each parent.[9] As before, we also account for family background characteristics and try to separate the two channels: the health channel, and the economic status channel. Results are reported in Table 5. They show that there is association between experiencing hardship (hunger) in childhood (age 0–16) and reporting poor health conditions in the same age interval for parents. However, the magnitude of the coefficients is not particularly relevant. Results seem to be stronger for females rather than males when

[9] In this case we consider the parent sample to avoid having repeated observations.

consider measures of health such as indicators of SRH and number of diseases (type 1). For males experiencing hunger is associated with a higher probability of missing school for heath problems. Finally, we do not find any statistically significant effect for our measure of war duration neither for mother nor for fathers.

3.6.2 Labor market history

We also investigate whether the parental exposure to WWII related hardship may affect children's education via the parent's labor market outcomes later in life. Thanks to the SHARE job episode panel,[10] we can test this hypothesis and see if differential exposure to war events can explain: i) participation in the labor market (number of years worked between age 20-50), ii) number of years working part time at the same age, iii) whether the parent worked as self-employed (which should be seen as an indicator of risk aversion). Results are reported in Table 6 and show that exposure to hunger or war is not associated with labour market participation later in life. The only interesting result is that exposure to hunger reduces the probability of working as self-employed for the father but not the mother.

3.6.3 Migration

In our baseline analysis we only consider the sample of parents who did not migrate. Figure 5 shows the fraction of people who changed country or region within a country in the period of our interest. In most countries migration is not very important, the big exceptions being Germany and Poland in 1945 and immediately after.

4 Robustness checks

We now discuss a number of sensitivity checks. First we consider an alternative specification using binary indicators for hunger experience and and war exposure, instead of duration in terms of years. Results are reported in Table A5. Second, in our previous specifications we treated children education as a continuous variable measured by the number of years of completed education. We now estimate a different model that takes into account the categorical nature of the original information in SHARE[11] by considering three education levels: "Less than high school" (Less than HS), "Only high school" (Only HS), and "College or more" (College). Treating years of parental education as a continuous variable, and controlling for exogenous characteristics of the parent and the child, gives

[10] SHARE provides a database of the job history of all respondents from their first job until 2008.

[11] SHARE only collects information on the education level of the respondents, namely "No school", "Elementary", "Lower secondary", "High school", "Vocational", "College", and "Post-graduate diploma", with the education levels defined according to ISCED-97.

the following model for the probability that child i in family j has education level y_s:

$$\mathbb{P}\left[Y_{ij}^c = y_s \mid Y_{ij}^p = y, \boldsymbol{X}_i = \boldsymbol{x}, \boldsymbol{Z}_{ij} = \boldsymbol{z}\right] = G\left(\beta_{0s} + \beta_{1s} y + \boldsymbol{\beta}_{2s}^\top \boldsymbol{x} + \boldsymbol{\beta}_{3s}^\top \boldsymbol{z}\right), \quad s = 1, 2, 3, \tag{3}$$

where $G(\cdot)$ is some link function. Notice that one of these relationships is redundant because probabilities add up to one.

For simplicity, we take the function $G(\cdot)$ to be the identity link, so the resulting linear probability model can again be estimated via 2SLS. The first stage equation is the same as (1), but now the reduced form consists of a set of linear probability models:

$$\mathbb{P}\left[Y_{ij}^c = y_s \mid \boldsymbol{H}_i = \boldsymbol{h}, \boldsymbol{X}_j = \boldsymbol{x}, \boldsymbol{Z}_{ij} = \boldsymbol{z}\right] = \pi_{0s} + \boldsymbol{\pi}_{1s}^\top \boldsymbol{h} + \boldsymbol{\pi}_{2s}^\top \boldsymbol{x} + \boldsymbol{\pi}_{3s}^\top \boldsymbol{z}, \quad s = 1, 2, 3, \tag{4}$$

one for each possible education level of the child. Table 7 shows the reduced form results and the 2SLS estimates. For simplicity, we only report the estimated coefficients for the first two education levels, namely having less than a high school degree (top panel) and having only a high school degree (bottom panel). As before, we contrast the results for the dyads mother-all children, mother-daughter, mother-son, father-all children, father-daughter, and father-son. All specifications include indicators for the birth year and the country of residence of the parent at the time of the SHARE interview and a cubic polynomial in the birth year of the child. The reduced form results show that children whose mothers were exposed to hunger or war have a higher probability to receive less than a high school degree. Results are not too different by gender and the magnitude of the estimated effect is larger for war compared to hunger. As in the case of fathers, we find weaker effects only for hunger.

5 Conclusions

In this paper we investigate the intergenerational effects of World War II on education using rich and unique data on linked generations from the Survey of Health, Ageing and Retirement in Europe (SHARE) and detailed historical data on military operations for the period 1936–1945. This paper is the first to analyzes the intergenerational transmission of educational shocks triggered by war and severe hardship. We contribute to the existing literature, which documents how hardship can leave scars on those directly exposed, by showing that some of these effects can extend to subsequent generations. Our reduced form results show that children whose mothers were exposed to WW2 hardship receive less education (from 0.07 to 0.49 less years), while we find no statistical significant effect from the father's side. The richness of our data also allow us to estimate the coefficient of intergenerational transmission of education by using an IV strategy that relies on war exposure and hunger experience as instruments. Interestingly, the sign and magnitude of our 2SLS estimates

are roughly in line with those found in the intergenerational mobility literature that mostly relies on legislated increases in minimum school-leaving age. The similarity of the results is actually remarkable, as we use a very different reference population in terms of country and birth cohort and a completely different set of instruments. Our IV estimates also confirm the existence of large differences between mothers and fathers, and between boys and girls. As for the mechanisms at place, our placebo regressions show that being at school age on the onset of hardships can explain most of the detrimental effect for parents' education and for the education of the offspring. In fact, we do not find statistically significant estimates when considering parents who experienced these hardships after the age of 18. We provide a series of extensions and robustness checks that confirm our main results.

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Table 1: Mean and standard deviation of all variables used in the analysis.

	Mean	Std. dev.
Mothers ($N = 15,443$)		
Years of education	9.2	4.2
Year of birth	1940.5	5.7
Age in 2006–2007	65.7	5.7
War	0.288	0.453
Hunger	0.061	0.239
Financial hardship	0.029	0.168
Stress	0.015	0.121
Rural area	0.701	0.458
Few books	0.505	0.500
Low skilled breadw	0.235	0.424
Grandpa absent	0.091	0.288
Grandma absent	0.039	0.193
Fathers ($N = 11,306$)		
Years of education	10.0	4.7
Year of birth	1937.7	5.9
Age in 2006–2007	68.5	6.0
War	0.414	0.493
Hunger	0.096	0.294
Financial hardship	0.035	0.183
Stress	0.014	0.118
Rural area	0.698	0.459
Few books	0.539	0.499
Low skilled breadw	0.224	0.417
Grandpa absent	0.089	0.285
Grandma absent	0.038	0.192
Children ($N = 18,464$)		
Years of education	12.9	3.3
Year of birth	1967.7	6.5
Age in 2006–2007	39.1	6.5
Female child	0.483	0.500

Note: The sample consists of mothers and fathers born in 1926–1949 and children aged 25 or more in the second wave of SHARE (2006–2007).

Table 2: Estimates of the effects of war-related hardships on parental schooling.

	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
Hunger duration	-0.119***	-0.122***	-0.116***	-0.108***	-0.117***	-0.101***
	(0.016)	(0.021)	(0.021)	(0.015)	(0.025)	(0.019)
War duration	-0.157***	-0.171**	-0.146**	-0.306***	-0.246***	-0.361***
	(0.050)	(0.067)	(0.063)	(0.053)	(0.073)	(0.069)
Rural area	-1.064***	-1.058***	-1.065***	-1.002***	-1.129***	-0.886***
	(0.067)	(0.094)	(0.090)	(0.083)	(0.118)	(0.110)
Few books	-1.826***	-1.813***	-1.837***	-2.335***	-2.168***	-2.474***
	(0.086)	(0.102)	(0.108)	(0.108)	(0.142)	(0.134)
Low-skilled breadw	-0.783***	-0.831***	-0.732***	-0.458***	-0.478***	-0.434***
	(0.068)	(0.104)	(0.090)	(0.082)	(0.118)	(0.112)
Grandpa absent	0.159*	0.168	0.150	0.216*	0.131	0.297
	(0.092)	(0.139)	(0.127)	(0.125)	(0.177)	(0.181)
Grandma absent	-0.591***	-0.333	-0.853***	0.010	-0.203	0.226
	(0.142)	(0.203)	(0.206)	(0.209)	(0.291)	(0.293)
Female child	0.032			-0.002		
	(0.052)			(0.070)		
Cons	11.675***	11.596***	11.760***	12.835***	13.034***	12.636***
	(0.205)	(0.245)	(0.314)	(0.280)	(0.357)	(0.399)
N	14754	7183	7571	10753	5260	5493

Notes: All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Standard errors are clustered by country and birth year of the child. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Table 3: Estimates of the effects of war-related hardships of the parent on child schooling.

	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
Hunger duration	-0.054 ***	-0.062 ***	-0.046 **	-0.004	0.009	-0.014
	(0.014)	(0.020)	(0.021)	(0.013)	(0.021)	(0.016)
War duration	-0.110 ***	-0.103 *	-0.121 **	-0.086 **	-0.050	-0.118 **
	(0.042)	(0.058)	(0.051)	(0.042)	(0.055)	(0.059)
Rural area	-0.370 ***	-0.282 ***	-0.457 ***	-0.187 ***	-0.196 **	-0.183 *
	(0.067)	(0.085)	(0.095)	(0.067)	(0.086)	(0.094)
Few books	-1.220 ***	-1.233 ***	-1.199 ***	-1.169 ***	-1.026 ***	-1.294 ***
	(0.068)	(0.092)	(0.094)	(0.071)	(0.094)	(0.099)
Low-skilled breadw	-0.443 ***	-0.362 ***	-0.523 ***	-0.333 ***	-0.441 ***	-0.262 **
	(0.066)	(0.090)	(0.090)	(0.073)	(0.100)	(0.109)
Grandpa absent	-0.089	-0.084	-0.107	0.009	0.053	-0.024
	(0.091)	(0.129)	(0.129)	(0.099)	(0.144)	(0.134)
Grandma absent	-0.443 ***	-0.256	-0.604 ***	-0.139	-0.236	-0.117
	(0.130)	(0.182)	(0.199)	(0.158)	(0.205)	(0.255)
Female child	0.097 *			0.078		
	(0.054)			(0.064)		
Cons	15.157 ***	14.992 ***	15.426 ***	15.149 ***	15.226 ***	15.145 ***
	(0.189)	(0.246)	(0.275)	(0.201)	(0.257)	(0.270)
N	14754	7183	7571	10753	5260	5493

Notes: All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Standard errors are clustered by country level birth year of the child. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Table 4: Results for experiencing hardships at different ages during 1936–1948.

	Aged 6–16					
	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
	Parents					
Hunger dur	-0.191 ***	-0.209 ***	-0.174 ***	-0.187 ***	-0.204 ***	-0.172 ***
	(0.034)	(0.048)	(0.046)	(0.028)	(0.044)	(0.037)
War dur	0.037	0.067	0.003	-0.118 **	-0.055	-0.171 **
	(0.057)	(0.083)	(0.070)	(0.055)	(0.077)	(0.077)
	Children					
Hunger dur	-0.110 ***	-0.076 *	-0.149 ***	-0.005	0.040	-0.043
	(0.030)	(0.042)	(0.045)	(0.027)	(0.037)	(0.036)
War dur	0.019	-0.006	0.047	-0.090 **	-0.062	-0.108 *
	(0.049)	(0.067)	(0.066)	(0.044)	(0.064)	(0.062)
	Aged 18–30					
	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
	Parents					
Hunger dur	-0.125	-0.341	-0.025	0.475 *	0.334	0.639 *
	(0.445)	(0.696)	(0.579)	(0.281)	(0.454)	(0.375)
War dur	0.300	0.493 *	0.175	0.270	0.089	0.406
	(0.218)	(0.293)	(0.322)	(0.293)	(0.437)	(0.402)
	Children					
Hunger dur	0.179	0.294	0.006	0.638 *	0.349	0.823 **
	(0.298)	(0.517)	(0.448)	(0.336)	(0.621)	(0.376)
War dur	-0.183	-0.357	0.180	0.271	0.466	0.059
	(0.278)	(0.374)	(0.410)	(0.295)	(0.437)	(0.387)

Notes: We define hardship as having lived in a war region or having experienced hunger when aged 6–16 or 18–30. These two indicators take value 1 if the hardship spells are observed during 1936–1948 and 0 otherwise. All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Standard errors are clustered by country and birth year of the child. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Table 5: Effects of war-related hardships on parents' health conditions during childhood.

	SRH	Bad health	Diseases1	Diseases2	Hospitalized	Missed school
			Mother			
Hunger duration	0.037***	0.011***	0.009*	0.004	0.002	0.003
	(0.008)	(0.003)	(0.005)	(0.003)	(0.002)	(0.002)
War duration	-0.002	-0.009	0.007	0.015*	-0.003	0.005
	(0.018)	(0.006)	(0.010)	(0.009)	(0.004)	(0.006)
Rural area	-0.049**	-0.011	-0.033**	-0.023*	-0.007	-0.014
	(0.025)	(0.007)	(0.015)	(0.014)	(0.006)	(0.008)
Few books	0.073**	0.015*	-0.047***	-0.035**	-0.002	-0.012
	(0.029)	(0.008)	(0.016)	(0.014)	(0.006)	(0.008)
Low-skilled breadw	-0.014	-0.013	-0.033**	0.004	0.002	0.003
	(0.030)	(0.010)	(0.015)	(0.016)	(0.007)	(0.010)
Grandpa absent	0.149***	0.050***	0.039	0.030	0.020*	0.006
	(0.049)	(0.015)	(0.024)	(0.025)	(0.012)	(0.015)
Grandma absent	0.006	0.009	-0.024	0.043	0.018	0.003
	(0.079)	(0.023)	(0.039)	(0.033)	(0.019)	(0.022)
Cons	2.422***	0.144***	1.040***	0.215***	0.090***	0.123***
	(0.090)	(0.028)	(0.043)	(0.036)	(0.017)	(0.024)
N	6317	6321	6299	6333	6346	6346
			Father			
Hunger duration	-0.003	0.007***	0.012***	0.005	0.001	0.005**
	(0.007)	(0.003)	(0.004)	(0.003)	(0.001)	(0.002)
War duration	-0.038	-0.004	0.005	0.000	-0.003	-0.002
	(0.023)	(0.005)	(0.010)	(0.008)	(0.005)	(0.006)
Rural area	-0.076*	-0.019**	-0.031*	-0.053***	-0.010	-0.014
	(0.039)	(0.009)	(0.018)	(0.015)	(0.007)	(0.010)
Few books	0.055	0.010	-0.054***	-0.029*	0.010	-0.011
	(0.039)	(0.008)	(0.019)	(0.015)	(0.007)	(0.009)
Low-skilled breadw	-0.003	-0.003	-0.022	-0.014	0.004	0.009
	(0.041)	(0.009)	(0.019)	(0.016)	(0.007)	(0.011)
Grandpa absent	0.023	0.002	-0.017	0.003	0.009	0.012
	(0.065)	(0.013)	(0.030)	(0.027)	(0.012)	(0.016)
Grandma absent	0.192*	-0.012	-0.008	-0.000	-0.011	-0.007
	(0.102)	(0.022)	(0.041)	(0.040)	(0.017)	(0.025)
Cons	2.469***	0.081***	0.988***	0.274***	0.075***	0.132***
	(0.119)	(0.023)	(0.048)	(0.036)	(0.022)	(0.027)
N	3487	4747	4706	4755	4768	4768

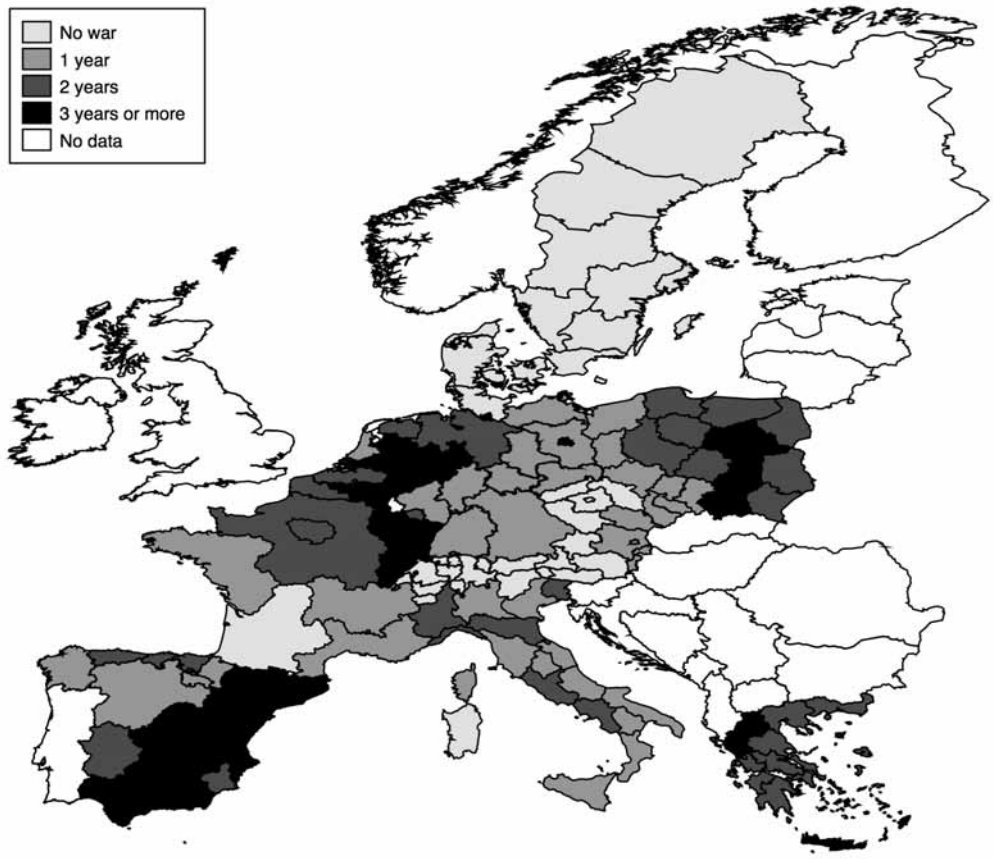
Notes: Each column is a separate regression for the following outcomes: (1) "SRH" is self-reported health during childhood (age 0–15), where 1 is excellent health and 5 very poor health; (2) "Bad health" is a binary indicator for being in poor health and very poor health using the last two categories of SRH; (3) "Diseases1" counts the number of diseases of type 1 (infectious diseases, polio, asthma, allergies, speech impairment, etc); (4) "Diseases2" counts the number of diseases of type 2 (severe headache, emotional problems, diabetes, heart troubles, etc); (5) "Hospitalized" is an indicator for having been hospitalized for 1 month or longer when aged 0–15; (6) "Missed school" is an indicator for having missed school for 1 month or longer due to health problems. All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland). Standard errors are clustered by country and birth year of the parent. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Table 6: Effects of war-related hardships on parents' labour market participation.

	Mother			Father		
	Work	Work part time	Self-employed	Work	Work part time	Self-employed
Hunger dur	0.045	0.110 **	-0.003	-0.009	-0.011 *	-0.006 **
	(0.081)	(0.053)	(0.002)	(0.050)	(0.006)	(0.002)
War dur	0.291	0.102	0.005	-0.010	0.017	0.006
	(0.207)	(0.098)	(0.005)	(0.091)	(0.022)	(0.007)

Notes: Each column is a separate regression for either the mother or the father and for the following outcomes: (1) "Work" indicates the number of years that the mother or the father has worked between age 20-50; (2) "Work part time" indicates the number of years that the mother or the father has worked part time between age 20-50 ; (3) "Self-employed" is an indicator that the mother or the father has worked as self-employed; All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland). Standard errors are clustered by country and birth year of the parent. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

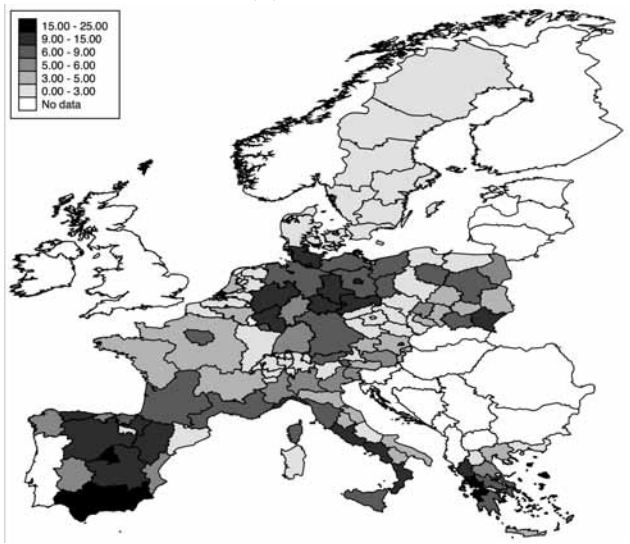
Figure 1: Regional exposure to major war events in Europe, 1936–1945.



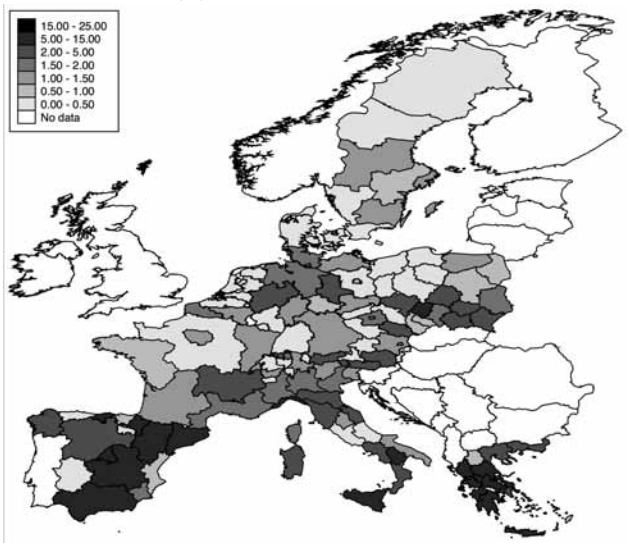
Notes: The figure shows for how many years each European region was exposed to major war events over the period 1936–1945. The shading in the map becomes darker as the number of years increases (the darkest color corresponds to 3 years or more).

Figure 2: Geography of hardship in Europe, 1936–1948.

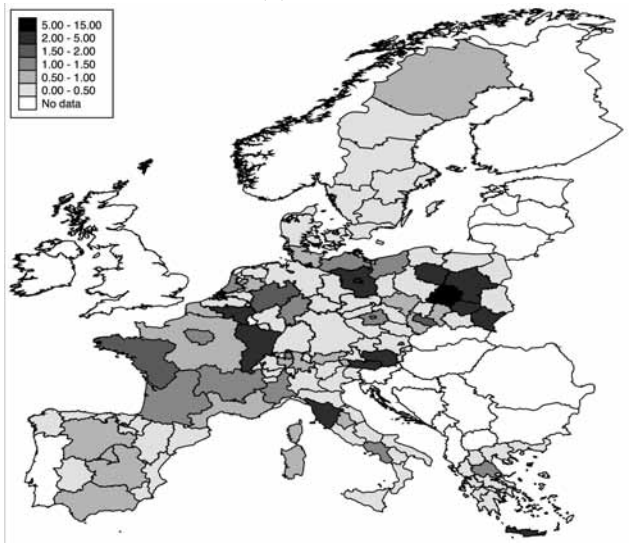
(a) Hunger



(b) Financial hardship



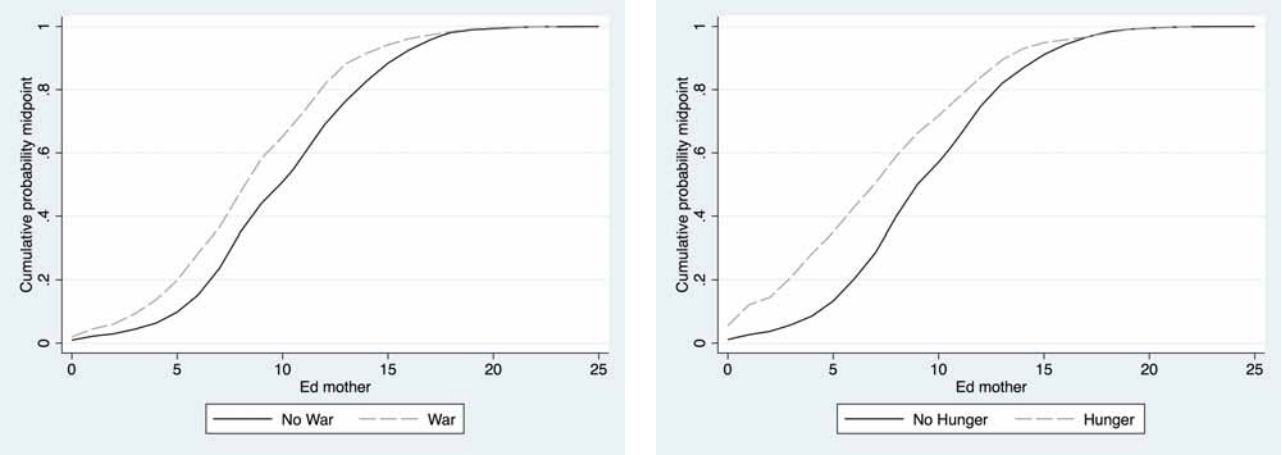
(c) Stress



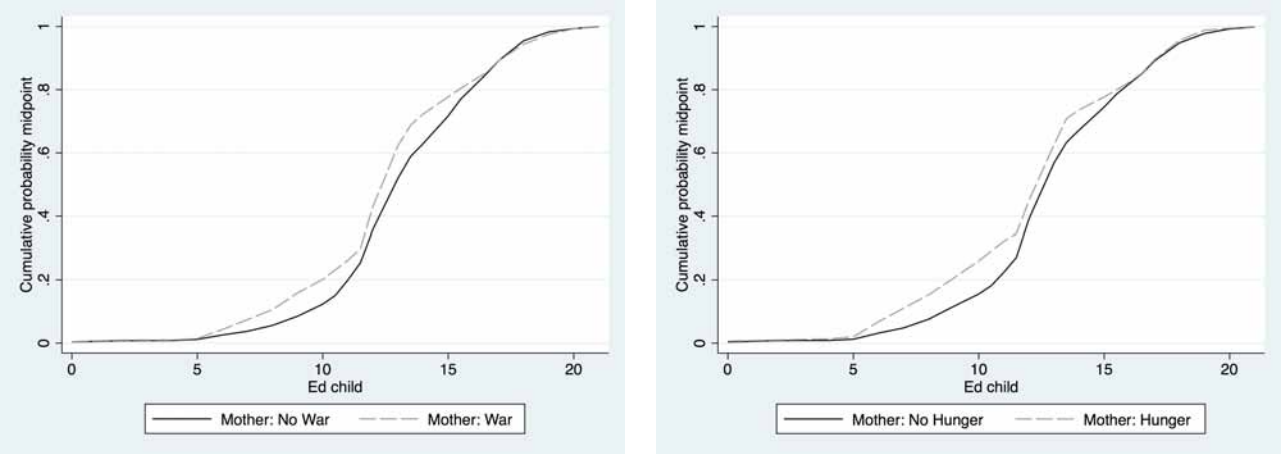
Notes: The figure shows the percentage of parents who report suffering hardship in each region averaged over the period 1936–1948. The shading in the map becomes darker as the percentage of parents who report having suffered a given hardship increases.

Figure 3: Distribution of years of schooling of the mother and the child by maternal war exposure and hunger experience.

(a) Mother



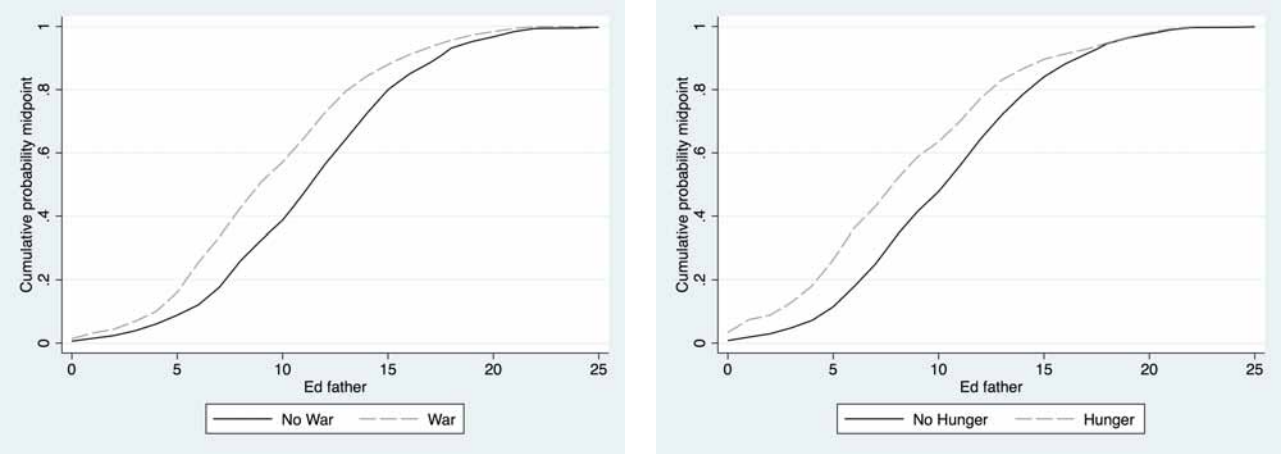
(b) Child



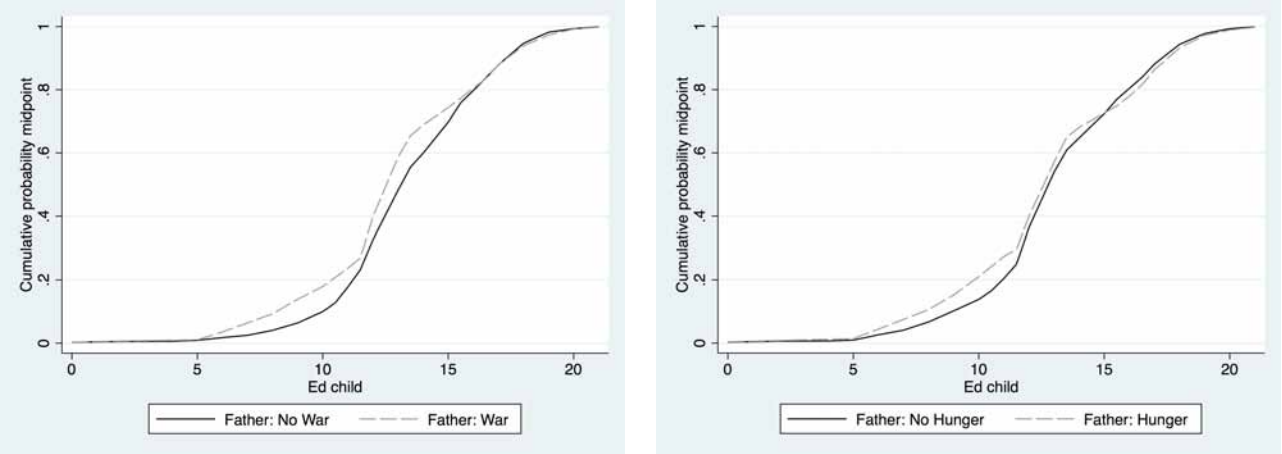
Note: We consider the cohorts of mothers born in 1926–1949 and the cohorts of children born in 1951–1981.

Figure 4: Distribution of years of schooling of the father and the child by paternal war exposure and hunger experience.

(a) Father

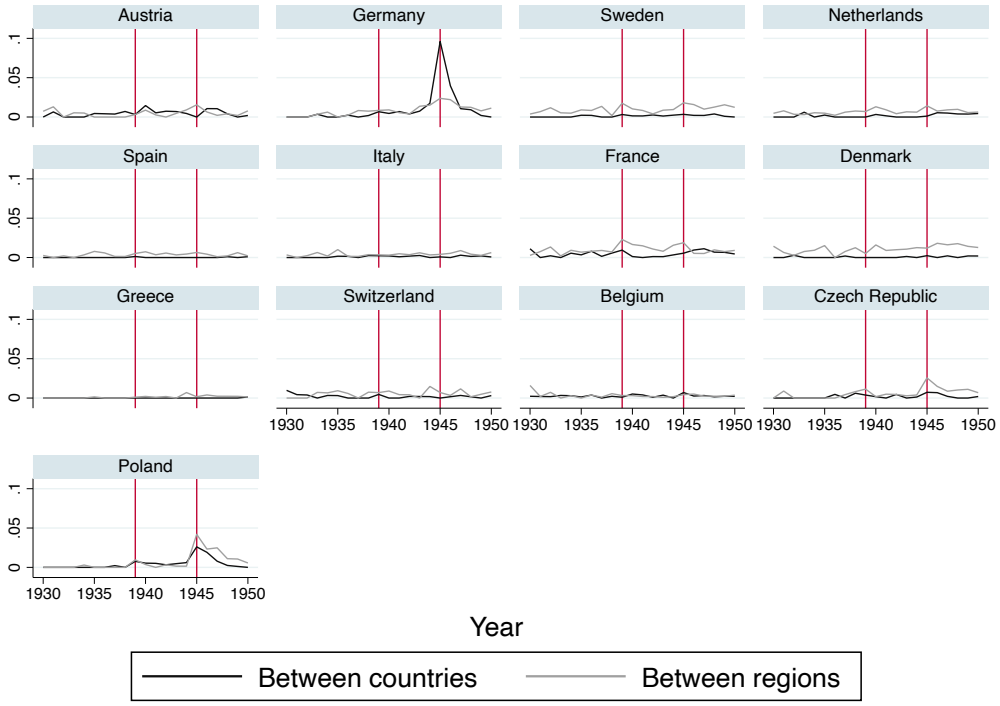


(b) Child



Note: We consider the cohorts of fathers born in 1926–1949 and the cohort of children born in 1951–1981.

Figure 5: Migration patterns of parents in childhood (between countries and between regions of a country).



Note: The figure shows the percentage of parents who report having migrated when aged 0–16.

Table 7: Parental hardship and child education. Linear probability model.

	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
Child education: Less than high school						
Reduced form						
Hunger duration	0.008 ***	0.006 **	0.009 ***	0.002	0.004	0.001
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
War duration	0.016 ***	0.020 ***	0.014 **	0.011 **	0.012 *	0.010
	(0.004)	(0.006)	(0.006)	(0.005)	(0.007)	(0.006)
Constant	-0.009	-0.026	-0.027	0.026	-0.003	0.037
	(0.019)	(0.026)	(0.026)	(0.019)	(0.026)	(0.027)
2SLS						
Educ parent	-0.048 ***	-0.046 ***	-0.051 ***	-0.022 ***	-0.029 **	-0.015
	(0.008)	(0.012)	(0.012)	(0.008)	(0.012)	(0.011)
Constant	0.573 ***	0.531 ***	0.585 ***	0.295 ***	0.353 **	0.222 *
	(0.100)	(0.139)	(0.139)	(0.097)	(0.146)	(0.130)
F-stat	104.0	55.2	56.6	88.7	39.2	48.8
J-test	0.9	0.1	2.0	0.2	0.0	0.4
p-value	0.338	0.806	0.162	0.646	0.949	0.537
Child education: Only high school						
Reduced form						
Hunger duration	-0.003	0.002	-0.007 ***	0.002	-0.004	0.004
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
War duration	-0.008	-0.000	-0.015 **	0.011 **	0.008	-0.000
	(0.005)	(0.007)	(0.007)	(0.005)	(0.008)	(0.008)
Constant	0.563 ***	0.555 ***	0.572 ***	0.026	0.530 ***	0.469 ***
	(0.025)	(0.035)	(0.035)	(0.019)	(0.039)	(0.038)
2SLS						
Parent educ	0.020 **	-0.004	0.046 ***	-0.022 ***	0.000	-0.011
	(0.009)	(0.013)	(0.014)	(0.008)	(0.014)	(0.013)
Constant	0.316 ***	0.605 ***	0.016	0.295 ***	0.526 ***	0.605 ***
	(0.114)	(0.157)	(0.163)	(0.097)	(0.178)	(0.159)
N	14815	7181	7572	10792	5282	5510
F-stat	104.0	55.2	56.6	88.7	39.2	48.8
J-test	0.0	0.2	0.2	0.2	2.5	1.4
p-value	0.971	0.647	0.623	0.646	0.111	0.231

Notes: All specifications include indicators for the birth year and the country of residence of the mother (the reference country is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Standard errors are clustered by country and birth year of the child. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Appendix A: Intergenerational transmission of education

In our baseline analysis we have shown that parental exposure to war-related hardship is associated with lower educational attainments not only for parents but also for their children. It is interesting to go beyond the reduced form relationships (1) and (2), and ask whether we can use the data to identify the causal effect of parents' education on children's education. We are aware that strong assumptions are needed to identify this causal effect in our setting, but we nonetheless think that

this is a useful exercise since it provides more insight into the intergenerational effects of violent conflicts. In this section we discuss these assumptions, provide some evidence for the validity of the proposed instruments, and presents the empirical results that they produce.

Instrumental variables estimation

We write the structural relationship linking the education of a child to the education of the mother or the father as:

$$Y_{ij}^{c} = \beta_0 + \beta_1 Y_{ij}^{p} + \boldsymbol{\beta}_2^{\top} \boldsymbol{X}_i + \boldsymbol{\beta}_3^{\top} \boldsymbol{Z}_{ij} + U_{ij}, \tag{5}$$

where β_0, β_1, $\boldsymbol{\beta}_2$ and $\boldsymbol{\beta}_3$ are unknown parameters. Of these parameters, β_1 is of primary interest because it summarizes the process of intergenerational transmission of education by measuring the change in the number of years of schooling of the child caused by a one-year increase in parental schooling, everything else being equal. The problem with (5) is that, although uncorrelated with $\boldsymbol{X}_i$ and $\boldsymbol{Z}_{ij}$, the error term U_{ij} is potentially correlated with Y_{ij}^{p}, as it may contain unobserved characteristics of the parent-child dyad that directly affect years of schooling of the child. If this is the case, estimating model (5) by OLS gives biased and inconsistent estimates of β_1. For this reason, the recent literature on the intergenerational transmission of education is very careful in distinguishing between correlations and causal effects (see, e.g., Holmlund et al., 2011). A common way of accounting for endogeneity of parental education is to use as instruments legislated increases in the minimum school-leaving age, also known as "compulsory schooling laws". The argument is that these increases force members of the affected cohorts to stay in school longer than they would otherwise and therefore represent an exogenous positive shock to formal education.[12]

The regression results from Section 3 suggest exploiting, as an alternative source of identifying information, the geographic and temporal variation in the timing and intensity of exposure to WW2-related events. In particular, the estimates of (1) show that individuals of school-age during WW2 would have taken more schooling in the absence of the war. This strategy is similar to that proposed by Ichino and Winter-Ebmer (2004), who find that Austrians and Germans who were 10 years old during or immediately after WW2 went to school for a shorter period compared to otherwise similar individuals in other cohorts, and this had an impact on their earnings in the long-term. The main difference is that we include both parents and children, include a richer set of background variables, and extend the analysis to 13 European countries.

Notice that substituting the relationship (1) into (5) and rearranging gives the relationship (2), with $\boldsymbol{\pi}_1 = \beta_1 \boldsymbol{\gamma}_1$. The fact that our OLS estimates of $\boldsymbol{\pi}_1$ and $\boldsymbol{\gamma}_1$ are both negative and statistically

[12] Angrist and Krueger (1991) and Acemoglu and Angrist (2000) are the first papers that use this type of instruments to identify the effect of schooling on earnings, whereas Oreopoulos et al. (2006) is the first paper that uses compulsory schooling laws to identify the intergenerational effects of education using U.S. data.

different from zero is encouraging. In this perspective, (1) is the "first stage", while (2) is the "reduced form". If the effect of parental education on children education is not constant in the population, then our instruments only allow estimating a local average treatment effect, that is, the average effect of parental education among the children of the "compliers", that is, the parents who took less schooling because of war exposure or hunger experience. In the absence of war-related hardship, these parents would have taken more schooling.

Table A1 presents our two-stage least squares (2SLS) estimates of model (5), obtained using as instruments the duration (number of years of exposure) of war and hunger episodes.[13] To facilitate comparisons with existing results, we employ the same educational measure for both the parent and the child, namely the number of years of schooling completed. Our estimates confirm the existence of large differences between mothers and fathers, and between boys and girls. In line with the results in Black et al. (2005), we find a stronger effect for mothers' education compared to father's education. In particular, the pooled estimates in column 4 of Table A1 show that a one-year increase in maternal education on average increases the schooling of a female child by 0.527 years, and the schooling of a male child by 0.478 years. The difference between girls and boys becomes substantial when we look at the dyads father-daughter and father-son, as for the first we do not find a statistically significant effect while for the second the coefficient is about 0.25 years. Overall, our 2SLS estimates lie in the interval of values found in the intergenerational mobility literature, where the estimated IV coefficients for parental schooling vary between 0.2 and 0.5 years. Unlike Black et al. (2005), however, our estimates are always strongly statistically.[14] As pointed out by these Authors, the main reason for the lack of precision of their 2SLS estimates is the weak first stage relationship between parental education and their instrument, namely educational reforms. This is not our case, as the conventional criteria are fulfilled (the F-statistic for the significance of two instrument is always well above its conventional threshold of 10 and the estimated coefficients are strong and statistically significant).

Although we cannot formally test the exogeneity of the proposed instruments, we provide some evidence supporting their use. First we present the results of the Hansen-Sargan J-test of the over-identifying restriction implied by our instruments. The coefficients on hunger and war duration are small, significant at the 10 % level only for mothers, and always not statistically significant for fathers. As a comparison, in Table A3 we reproduce the results of estimating model (1) by OLS. A one-year increase in maternal education is associated with 0.257 more years of school for a female

[13] The results of an alternative specification that uses as instruments the binary indicators of war exposure and hunger experience are discussed in Section 4.

[14] The IV estimates in their paper are statistically different from zero only for the subsample of parents with less than 10 years of schooling.

child and 0.254 more years for a male child (there is hardly any difference by gender). Since a typical school year corresponds to about 10 months, this corresponds to about 2.5 more months of school for a child. The results for the sample of fathers are only slightly lower as a one-year increase in paternal education is associated with 0.222 more years of school for a female child and 0.232 more years of school for a male child. Interestingly, our results are very much in line with the findings in Black et al. (2005) who use population register data from Norway to estimate the causal effect of parental schooling on children's schooling.

Comparing the estimates of the effect of parental education in Table A3 and A1, we observe that they have the same sign but the 2SLS coefficients are larger for mothers, especially for the mother-daughter dyad, and smaller (and not statistically significant) for the father-daughter dyad. A conclusion from this analysis is that one of the channels to be explored is whether women are more vulnerable to dramatic events such as wars and hunger, especially if they are of school-age. Papers analyzing more recent wars indeed find that during a war girls are more likely to be affected in terms of schooling attainment because they react by not going to school at all (Shemyakina, 2011). This could be a working hypothesis which we explore in the next session.

Table A1: 2SLS estimates of the effect of parental schooling on child schooling.

	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
Parent educ	0.507 ***	0.527 ***	0.478 ***	0.153 *	0.025	0.249 **
	(0.098)	(0.141)	(0.153)	(0.091)	(0.137)	(0.114)
Rural area	0.170	0.275	0.052	-0.034	-0.169	0.037
	(0.126)	(0.180)	(0.179)	(0.113)	(0.186)	(0.136)
Few books	-0.292	-0.278	-0.319	-0.812 ***	-0.973 ***	-0.678 **
	(0.197)	(0.280)	(0.300)	(0.223)	(0.311)	(0.297)
Low-skilled breadw	-0.046	0.075	-0.173	-0.261 ***	-0.427 ***	-0.152
	(0.099)	(0.146)	(0.147)	(0.086)	(0.124)	(0.119)
Grandpa absent	-0.166 *	-0.171	-0.172	-0.019	0.051	-0.092
	(0.091)	(0.131)	(0.126)	(0.100)	(0.144)	(0.131)
Grandma absent	-0.145	-0.081	-0.200	-0.134	-0.218	-0.173
	(0.154)	(0.202)	(0.253)	(0.152)	(0.202)	(0.242)
Female child	0.081			0.077		
	(0.055)			(0.062)		
Cons	9.220 ***	8.879 ***	9.780 ***	13.181 ***	14.903 ***	11.994 ***
	(1.135)	(1.608)	(1.781)	(1.170)	(1.795)	(1.430)
N	14754	7183	7571	10753	5260	5493
F-stat	30.4	19.0	18.6	40.4	17.0	31.5
J-test	0.6	0.1	1.2	2.0	1.0	0.7
p-value	0.426	0.799	0.271	0.158	0.321	0.388

Notes: All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Standard errors are clustered by country and birth year of the child. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Table A2: Interacting hardship indicators with SES.

	Mother-All		Mother-Daughter		Mother-Son	
	RF	2SLS	RF	2SLS	RF	2SLS
Educ mother		0.283 ***		0.373 ***		0.206 **
		(0.064)		(0.094)		(0.086)
Female child	0.084 *	0.079	0.000		0.000	
	(0.050)	(0.048)	(.)		(.)	
Hunger duration	-0.071 ***		-0.074 ***		-0.072 ***	
	(0.018)		(0.025)		(0.026)	
War duration	-0.007		-0.094 *		0.083 *	
	(0.035)		(0.050)		(0.048)	
Hunger dur*SES	-0.053 *		-0.053		-0.060	
	(0.028)		(0.040)		(0.039)	
War dur*SES	0.224 ***		0.122		0.336 ***	
	(0.052)		(0.075)		(0.073)	
SES	1.174 ***	0.520 ***	1.292 ***	0.314	1.058 ***	0.708 ***
	(0.071)	(0.196)	(0.101)	(0.284)	(0.100)	(0.269)
Constant	13.624 ***	10.634 ***	13.708 ***	9.749 ***	13.633 ***	11.471 ***
	(0.147)	(0.668)	(0.218)	(0.975)	(0.194)	(0.902)
N	15373	15373	7506	7506	7867	7867
F-stat		50.1		23.5		27.4
J-test		21.6		4.2		23.9
p-value		0.000		0.243		0.000
	Father-All		Father-Daughter		Father-Son	
	RF	2SLS	RF	2SLS	RF	2SLS
Educ father		0.144 ***		0.155 **		0.125 *
		(0.050)		(0.072)		(0.067)
Female child	0.084	0.077	0.000		0.000	
	(0.057)	(0.055)	(.)		(.)	
Hunger duration	-0.038 *		-0.013		-0.064 **	
	(0.022)		(0.034)		(0.028)	
War duration	0.053		0.034		0.078	
	(0.046)		(0.065)		(0.066)	
Hunger dur*SES	-0.070 **		-0.039		-0.103 **	
	(0.033)		(0.051)		(0.041)	
War dur*SES	0.303 ***		0.294 ***		0.316 ***	
	(0.074)		(0.109)		(0.102)	
SES	1.288 ***	1.028 ***	1.394 ***	1.102 ***	1.186 ***	0.991 ***
	(0.113)	(0.201)	(0.161)	(0.294)	(0.158)	(0.270)
Constant	14.029 ***	12.403 ***	14.311 ***	12.555 ***	13.850 ***	12.452 ***
	(0.150)	(0.587)	(0.206)	(0.862)	(0.209)	(0.791)
N	11276	11276	5507	5507	5769	5769
F-stat		59.4		28.9		31.7
J-test		18.6		7.0		13.4
p-value		0.000		0.071		0.004

Notes: In all specifications we include indicators for the birth year and the country of residence of the mother (the reference is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Robust estimated standard errors in parenthesis. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Table A3: OLS estimates for child education as a function of parental education.

	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
Parent educ	0.256 ***	0.257 ***	0.254 ***	0.226 ***	0.222 ***	0.232 ***
	(0.009)	(0.012)	(0.012)	(0.009)	(0.012)	(0.012)
Rural area	-0.093	-0.003	-0.185 **	0.039	0.053	0.023
	(0.064)	(0.083)	(0.090)	(0.068)	(0.086)	(0.097)
Few books	-0.759 ***	-0.774 ***	-0.738 ***	-0.639 ***	-0.541 ***	-0.719 ***
	(0.062)	(0.090)	(0.086)	(0.068)	(0.090)	(0.097)
Low-skilled breadw	-0.249 ***	-0.156 *	-0.343 ***	-0.225 ***	-0.327 ***	-0.160
	(0.063)	(0.086)	(0.086)	(0.069)	(0.096)	(0.102)
Grandpa absent	-0.136	-0.139	-0.145	-0.032	0.029	-0.088
	(0.087)	(0.124)	(0.124)	(0.098)	(0.138)	(0.131)
Grandma absent	-0.294 **	-0.171	-0.392 **	-0.134	-0.170	-0.169
	(0.129)	(0.182)	(0.196)	(0.152)	(0.200)	(0.239)
Female child	0.089 *			0.077		
	(0.053)			(0.063)		
Cons	12.116 ***	11.957 ***	12.383 ***	12.247 ***	12.344 ***	12.197 ***
	(0.216)	(0.282)	(0.290)	(0.238)	(0.313)	(0.301)
N	14754	7183	7571	10753	5260	5493

Notes: All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Standard errors are clustered by country and birth year of the child. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Table A4: Robustness check: Using one instrument at a time.

	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
Instrument: only Hunger duration						
			FS			
Hunger duration	-0.121 ***	-0.123 ***	-0.119 ***	-0.113 ***	-0.122 ***	-0.105 ***
	(0.016)	(0.021)	(0.021)	(0.016)	(0.025)	(0.019)
			RF			
Hunger duration	-0.056 ***	-0.062 ***	-0.048 **	-0.005	0.008	-0.015
	(0.014)	(0.020)	(0.021)	(0.013)	(0.021)	(0.016)
			IV			
Parent educ	0.462 ***	0.506 ***	0.406 **	0.045	-0.066	0.148
	(0.116)	(0.163)	(0.174)	(0.118)	(0.173)	(0.150)
Instrument: only War duration						
			FS			
War duration	-0.168 ***	-0.177 ***	-0.161 **	-0.320 ***	-0.264 ***	-0.371 ***
	(0.051)	(0.068)	(0.063)	(0.054)	(0.073)	(0.069)
			RF			
War duration	-0.115 ***	-0.106 *	-0.127 **	-0.086 **	-0.049	-0.120 **
	(0.043)	(0.059)	(0.051)	(0.042)	(0.055)	(0.060)
			IV			
Parent educ	0.683 ***	0.599 *	0.786 **	0.269 **	0.185	0.323 **
	(0.254)	(0.324)	(0.344)	(0.122)	(0.195)	(0.154)

Notes: All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Standard errors are clustered by country and birth year of the child. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.

Table A5: Robustness check: Using binary instruments

	Mother			Father		
	All	Daughter	Son	All	Daughter	Son
			FS			
Hunger	-0.798 ***	-0.803 ***	-0.800 ***	-0.585 ***	-0.612 ***	-0.552 ***
	(0.134)	(0.183)	(0.164)	(0.128)	(0.184)	(0.157)
War	-0.030	-0.027	-0.032	-0.534 ***	-0.335 **	-0.715 ***
	(0.104)	(0.135)	(0.136)	(0.117)	(0.162)	(0.159)
			RF			
Hunger	-0.336 ***	-0.395 ***	-0.285 *	0.052	0.079	0.037
	(0.104)	(0.142)	(0.166)	(0.105)	(0.149)	(0.137)
War	-0.158 *	-0.233 *	-0.093	-0.191 **	-0.079	-0.309 **
	(0.094)	(0.126)	(0.127)	(0.097)	(0.120)	(0.139)
			IV			
Educ mother	0.432 ***	0.506 ***	0.364 *	0.137	-0.030	0.269 *
	(0.129)	(0.187)	(0.200)	(0.127)	(0.206)	(0.155)
N	14754	7183	7571	10753	5260	5493
F-stat	17.8	9.6	11.9	18.8	7.1	15.3
J-test	2.8	3.4	0.5	3.4	0.7	3.0
p-val	0.092	0.065	0.492	0.066	0.397	0.084

Notes: All specifications include indicators for the birth year and the country of residence of the parent (the reference country is Switzerland) and a cubic polynomial in the birth year of the child (in deviations from 1970). Standard errors are clustered by country and birth year of the child. Significance: *** $p \leq .01$, ** $.01 < p \leq .05$, * $.05 < p \leq .10$.