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Abstract

This paper studies the effects of episodes of stress, poor health, financial hardship and hunger earlier in life on education and health in later life. As a source of identification, we exploit the huge temporal and regional variation of war-related events in Europe during the period from the beginning of the Spanish Civil War in 1936 to the end of World War II in 1945. We focus on the cohorts born between 1930 and 1954 in 13 European countries, and combine the available historical information with micro-level data from the Survey of Health Ageing and Retirement in Europe (SHARE), which provides detailed retrospective information on life histories from childhood to adulthood for people born before 1955. Using these data we find that hunger episodes are more closely associated with war than any other hardship episode. Our instrumental variable estimates suggest that hunger in childhood or early adolescence has important negative effects on educational attainments and various measures of physical and mental health past age 50. They also suggest that suffering hunger for longer periods has stronger negative effects.

Key words: Socio-economic status; Health; Financial hardship; World War II; Europe; SHARE survey

JEL codes: I0, J13, J14, N34.

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1 Introduction

World War II (WW2) was perhaps the deadliest conflict in history, with around 70 million casualties (Beevor 2012). It directly affected most European countries, but at different times and with different intensity. Though WW2 in Europe conventionally lasted from September 1, 1939, to May 8, 1945, the period of "Europe at war" may actually be broadened to cover the period from the beginning of the Spanish Civil War in 1936 to the descent of the Iron Courtain in 1949. In addition to the Spanish Civil War (1936–39), this period includes the German occupation of Austria and Czechoslovakia (1938), the aftermath of WW2 in the Axis countries and Eastern Europe (1945–48), and the Greek Civil War (1946–1949).

Unlike World War I, WW2 was a war of movement rather than trenches, and a much greater fraction of the civilian population was exposed to combat, bombing, stress and hunger. Children and older people are likely to have suffered most. In particular, the war affected the childhood of different cohorts of Europeans subjecting them to a variety of shocks. Many of those children are still alive today and are able to recall these hardship episodes.

Our paper contributes to the recent literature on the long-run effects of wars and civil conflicts, and the channels through which these effects operate (Ichino and Winter-Ebmer 2004, Bundervoet, Verwimp and Akresh 2009, Akbulut-Juksel 2009, Jürges 2011, Kesternich et al. 2011, Akresh et al. 2012, van den Berg, Pinger and Schoch 2012). Some of this literature focuses on the effects of WW2 on the human capital and health of the survivors. In particular, Ichino and Winter-Ebmer (2004) and Akbulut-Yuksel (2009) study the effects of disruption of the educational process, while Jürges (2011), Kesternich et al. (2011) and van den Berg, Pinger and Schoch (2012) study the effects of civilians being persecuted, dispossessed, exposed to hunger, food rationing or even famine. Although they use different empirical strategies, most of these studies find negative effects of experiencing war-related events (e.g. having lived in a heavily bombed city) on education, health and earnings of the survivors.

Our paper is also related to the extensive literature on the long-run impact of childhood shocks (Case, Fertig and Paxson 2005, Case and Paxson 2010, Currie 2009, 2011, Almond and Currie 2011) and the role of critical periods for investments in children (Cunha and Heckman 2007). A general result from this literature is that childhood circumstances may affect outcomes at older ages both directly and indirectly, through their effects on health and socio-economic status (SES) at younger ages. Different channels may be at work. Case, Lubotsky and Paxson. (2002) show that poor children in the U.S. tend to be in worse health at adult ages than wealthy children (SES

channel). On the other hand childhood health may affect adult SES directly through the health channel or indirectly through it's effect on human capital. Case and Paxson (2005, 2010) provide a useful framework for thinking at the relationship between health and SES at different stages of life. They distinguish between three periods–childhood, young adulthood and older adulthood–and allow for both direct and indirect links between them. Estimating this kind of model puts stringent requirements on the data, as critical information on health and SES at intermediate ages must be available. In the absence of prospective studies, subjective data have been widely used (Elo 1998, Haas 2007, Smith 2009). For comprehensive reviews see Lumey, Stein and Susser (2010) and Almond and Currie (2011).

Because identifying and estimating causal relationships is far from trivial, economists often rely on the variation induced by extreme and sharp events, such as famines. Examples include the Leningrad Siege (Sparén et al. 2004), the Greek hunger (Neelson and Stratmann 2011), the Dutch "hunger winter" 1944–45 (Lumey, Stein and Susser 2010, Rooseboom, de Rooij and Painteret 2006, Ravelli, van der Meulen and Barker 1998), and China's "great famine" (Gorgens, Meng and Vaithianathan 2008, Meng and Qian 2009). Most of this literature is motivated by Barker's fetal origins hypothesis and focuses on nutritional shortages around birth, although attention has recently also been devoted to hardship conditions after birth (Gluckman et al. 2005). Unlike undernourishment or hunger, which can affect a person's life for long time, famines have the feature of being sharp events and finish in a relatively short time. However, famine is somewhat of a black box, for it is not really clear what happens when it occurs and what mechanisms matter (lack of food, disease, etc.). The main findings from this literature are that exposure to famine around birth or in early childhood negatively influences educational attainments, health status, height, and well-being. However, in this literature there are concerns in finding both appropriate control groups for individuals affected by famine (especially while in utero) and accurate data on famine intensity. Comparing the outcomes of exposed cohorts with those not exposed is not sufficient to net out the effects of famine from other relevant changes over time. Further, when analyzing famines one should be careful with selection issues arising from the high mortality rates that typically characterize famines.

We explore the causal link between hardship episodes in childhood/early adolescence and adult outcomes, exploiting the variation induced by major war operations on the individual probability of suffering hardship episodes in childhood (ages 6–10) or early adolescence (ages 11–15). We choose age 6 as our starting age to minimize issues of recall bias and because this an important "temporal

landmark", as it represents the school-entry age in most countries considered. We initially consider four types of hardship: stress, poor health, financial hardship and hunger. It turns out that, of these hardships, hunger is by far the most relevant.

Unlike other papers that only exploit macro-level variation (e.g. Brakman, Garretsen and Schramm 2004, Davis and Weinstein 2004, and Acemoglu, Hassan and Robinson 2010), we use rich micro-level data from the Survey of Health, Ageing and Retirement in Europe (SHARE), a multi-purpose and cross-national survey that provides detailed retrospective information on people aged 50+ in 13 European countries. In particular, we take advantage of the life history data from childhood to adulthood collected in the survey's third wave, named SHARELIFE. Using SHARELIFE offers several advantages. First, we can distinguish between cohorts born before, during, and after WW2 in 13 different European countries. Second, the different cohorts were exposed to war events at different ages, and the timing and intensity of the exposure was different both between and within countries. SHARELIFE allows us to take into account the timing of these events, as respondents are asked to recall the year in which specific hardship episodes occurred. Third, recall of hardship episodes can be combined with retrospective information on individual residence history, thus allowing for substantial variation both between and within countries.

Since other researchers are recently investigating similar issues (Jürges 2011, Kesternich et al. 2011, van den Berg, Pinger and Schoch 2012), it is important to clarify the main differences between our work and theirs. First, while Jürges (2011) focuses on Germany using data from the German Socio-Economic Panel and van den Berg, Pinger and Schoch (2012) on Germany, Greece and the Netherlands using SHARELIFE data, our paper has in common with Kesternich et al. (2011) the focus on the full set of European countries in SHARELIFE. Second, unlike the other papers, we jointly analyze episodes of stress, financial hardship, poor health and hunger. Third, our source of quasi-experimental variation differs from van den Berg, Pinger and Schoch (2012), who use the timing and duration of famine in the three countries that they consider. We use instead the spatial and temporal information on major war operations. This allows us to cover both more countries and more cohorts. Further, from the historical viewpoint, the periods of famine that some countries experienced during WW2 (Greece, the Netherlands) were induced by war events.

The remainder of the paper is organized as follows. Section 2 describes our data. Section 3 presents some descriptive statistics. Section 4 presents the results of our regression analysis. Finally, Section 5 concludes.

2 Data

We use data from two sources. The first is micro-level information from the second and third wave of the Survey of Health, Ageing and Retirement in Europe (SHARE), a cross-national longitudinal household survey whose main aim is to help understand patterns of ageing and how they affect the welfare of individuals in the diverse cultural settings of Europe. In particular, we take advantage of the life histories from childhood to adulthood collected in the survey's third wave, called SHARELIFE, which provides retrospective information on region of residence, various aspects of the childhood environment, and the experience of hardship episodes.

The second is macro-level information on major war operations by region and year during the period 1936–1945. We merged this information with the longitudinal information from SHARELIFE on the region of residence, thus obtaining a panel data set with indicators of potential exposure to war operations and experience of hardship episodes in each single year of age starting from birth.

2.1 SHARE and SHARELIFE

SHARE provides micro-data on health, socioeconomic status, family characteristics, etc., from nationally representative samples of individuals born before 1955, speaking the official language of the country and not living abroad or in an institution, plus their partners irrespective of age. The survey is designed to be cross-nationally comparable and is harmonized with the English Longitudinal Study of Ageing (ELSA) and the U.S. Health and Retirement Study (HRS). Three waves of SHARE are currently available. The first two (2004–05 and 2006–07) mostly gather current information on the respondents. The third, named SHARELIFE and conducted between fall 2008 and summer 2009, collects information on important areas of respondents' life, namely events related to partners and children, childhood health and family background characteristics, complete employment transitions from the first job to retirement, information on past residences, health and health care information from childhood to adulthood, income, and assessments of well-being and happiness.

SHARELIFE was carried out in 13 European countries (Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Italy, the Netherlands, Poland, Spain, Sweden and Switzerland) and interviewed all people aged 50+ who participated in wave 2, plus their partners independently of age. Our working sample consists of 20,473 individuals born between 1930 and 1954 who participated in waves 2 and 3 of SHARE, which represents 76.2% of the total SHARE sample. Sample sizes by country range between a minimum of 637 individuals in Austria and 957 in Switzerland,

to a maximum of 2,133 individuals in Belgium and 2,249 in Greece. Men represent 46.5% of our working sample and women 53.5%.

2.1.1 Childhood environment and region of residence

In its Childhood SES (CS) section, SHARELIFE collects retrospective information on childhood environment around age 10. This information includes household characteristics such as the occupation of the main breadwinner (white collar, blue collar, farmer, etc.), features of the accommodation (presence of fixed bath, running water, inside toilet, or central heating), and the number of books at home.

The Accommodation (AC) section of SHARELIFE also collects retrospective information on each residence a person lived in for six months or more, starting from birth. This information includes the year the person started and stopped living at that residence, whether its was private or non-private and its type, and the country (at current boundaries), region and area of residence (big city, suburbs or outskirts of a big city, large town, small town, rural area or village). This allows us to construct a longitudinal data set with annual observations for each individual. The level of regional disaggregation varies by country: it is at the coarser NUTS1 level for Belgium, Denmark, France and the Netherlands, at the finer NUTS3 level for the Czech Republic, and at the intermediate but not very detailed NUTS2 level for the other countries.

2.1.2 Hardship episodes

To the longitudinal information on the residence a person lived in, we add information from the General Life (GL) section of SHARELIFE on the experience of hardship episodes.

This section first asks the following question: "Looking back on your life, was there a distinct period during which you were under more stress compared to the rest of your life?". If the answer is yes, the following two questions are asked: "When did this period start?", and "When did this period stop?". It then asks similar questions for poor health ("Looking back on your life, was there a distinct period during which your health was poor compared to the rest of your life?"), financial hardship ("Looking back on your life, was there a distinct period of financial hardship?"), and hunger ("Looking back on your life, was there a distinct period during which you suffered from hunger?"). The ordering of the questions is fixed: first stress, then poor health, financial hardship, and finally hunger. Notice that respondents are asked to report only one episode for each type of hardship, presumably the most salient. Further, the available information is rather coarse, as we

only have binary indicators for suffering hardship in a given year and we lack information on the intensity of the various episodes.

Figure 1 shows the fraction of people reporting the various types of hardship in each single year between 1930 and 1954, separately for six country groups: the German Reich (Germany and Austria), Italy, the German occupied countries in Eastern Europe (Czech Republic and Poland) and in Western Europe (Belgium, Denmark, France, Greece, and the Netherlands), Spain, and the neutral countries (Sweden and Switzerland). During the period considered, financial hardship and hunger are much more important than stress and poor health. Further, they are important only for Spain and the countries involved in WW2, not for the neutral countries. While financial hardship shows less of a time pattern, hunger is concentrated during the war and postwar periods, where it appears to be much more important than financial hardship. In particular, for the German Reich and Italy hunger is concentrated at the end of WW2 and in the postwar period, while for the occupied countries in the East and the West it is important throughout the war. For Spain, financial hardship and hunger rise steadily from 1931 to 1941, and decline afterwards but remain at very high levels compared to most other countries. In fact, Spain is quite different from all other countries, both because financial hardship and hunger were a problem even before the start of the civil war and because they remain a problem also in the early 1950s.

Figure 2 looks at the relationship between hunger and financial hardship. It shows, for each year and country group, the fraction of people reporting only hunger (top-left panel), only financial hardship (top-right panel), and both hunger and financial hardship (bottom-left panel). It appears that, for all country groups, hunger is most strongly associated with war.

To better understand the link between hunger and war, Figure 3 looks at people who report suffering hunger in childhood and shows, for each country, the distribution of the year when hunger started. Most hunger episodes start between 1939 and 1945. For Austria and Germany, they mostly start in 1944 or 1945. For the Czech Republic, France and Poland, the distribution is roughly bimodal, with peaks both at the beginning of the war in 1939 or 1940, and towards its end in 1944 or 1945. Some evidence of bimodality is also found for Belgium, Greece and Italy, though the first peak, in 1940, is much more pronounced than the second one, towards the end of the war. while for the Netherlands, we observe a sharp peak in 1944, corresponding to the "Hunger Winter". For Spain, the majority of reported hunger episodes does not begin during the civil war but rather after its end, with a peak in 1940. Finally, for the neutral countries, the few reported hunger episodes start mostly during WW2. Overall, this evidence corresponds to the available historical

records.

The fact that, for many WW2 countries, hunger appears to start either with the war or with the beginning of the German occupation raises the issue of what people really mean by a period during which they suffered hunger. Specifically, people may not remember hunger episodes that they actually suffered and may instead associate hunger with either the war in general or with the country's narrative based on collective memories rather than personal experience.

To address the first concern, Figure 4 looks at the distribution of hunger duration, computed as the difference between the year when hunger is reported to end and the year when is reported to start. A duration equal to zero means that hunger started and ended during the same year, while a duration of 15 years also includes cases where hunger is reported to last more than 15 years (about 5% of the total). For the Netherlands hunger duration is typically short (zero or one year), while for Austria and Germany the modal duration is three years. Thus, the evidence from these three countries does not support the hypothesis that people just identify hunger with WW2. For Belgium, France, Greece and Italy, the modal duration of hunger is five years, while for Poland it is between five and six years. For four of these five countries (Italy being the exception), the association between hunger and war may be stronger and more difficult to separate as they experienced combat both at the beginning and towards the end of the war. Long durations (15 years or more) are also not uncommon, especially for Greece, Poland and Spain, which are also the countries with the lowest levels of per capita income.

To address the second concern, Figures 5–7 show the fraction of people who report suffering hunger, separately by age, birth year and country group: Figure 5 is for the German Reich and Italy, Figure 6 is for the countries occupied by Germany in the East and the West, Figure 7 is for Spain and the neutral countries. The downward sloping lines mark the combinations of age and birth year corresponding to the calendar years 1939, 1945 and 1949. The figures show little evidence that people respond on the basis of collective rather than personal memories, as the fraction reporting suffering hunger below age 4 is always very small.

2.1.3 Data problems

We now briefly discuss the main problems we face when using the SHARE and SHARELIFE data.

The first problem is item nonresponse. In our data, this is an important problem for variables such as income and wealth, but not for the hardship questions and the questions on childhood environment (for example, nonresponse to the question on hunger episodes is less than 0.15%). A

potentially more serious problem is missing data on the region of residence during childhood and early adolescence. In Section 4, we address this problem by adding an indicator that takes value one if the region of residence is missing and value zero otherwise.

The second problem is survivorship bias due to selective mortality, as we focus on people who survived until the SHARELIFE interview in 2008–09. A related problem is selective fertility, as children born immediately before or during WW2 may be different in many unobservable dimensions from those born after the war. To address these two problems, in Section 4 we distinguish between different cohorts and include interactions between cohort and country fixed effects.

The third issue is the fact that information on the regions of residence during childhood is rather coarse for some countries (most notably France). Thus, unlike Jürges (2011), we can only establish a coarse link between the information in SHARELIFE and known war-related events.

The fourth problem is migration, as suffering combat, stress, hunger and financial hardship may have triggered the decision to migrate, either between urban and rural areas within the same region, or between regions within the same country, or between countries. We control for the first type of migration using the information on the area of residence (rural vs. non-rural). The second and third types of migration were especially important at the end of WW2 for people living in the former German Reich (Germany and Austria), Poland and the Czech Republic (Fassmann and Münz 1994). In Section 4.5 we check whether including or excluding these migrants changes our results.

The last problem is the quality of recall data, as individuals may not remember events that happened earlier in life, or may misreport them. An important advantage of SHARELIFE over other surveys (HRS, PSID) is that it applies the life-history calendar method, which is based on "temporal landmarks" (events that are striking or easier to remember) and should lead to better accuracy (see the appendix). However, even if an event is a temporal landmark, one cannot rule out coloring, namely the fact that individuals may answer questions about the distant past based on their current status or on macro-events that are part of a country's narrative. To reduce this type of concern, we confine attention to events which occurred after 5 years of age.

2.2 Information on war operations

We use information from external sources to identify whether the region a person was living in was subject to major war operations (combat operations or aerial bombings) during the period between the beginning of the Spanish Civil War in 1936 and the end of WW2 in 1945. We refer

to these regions as "war regions". It is worth stressing that we do not know whether a person in SHARELIFE was directly exposed to war operations. Knowing that the person was living in a war region only provides a measure of potential exposure. For the Spanish Civil War, the data on war operation have been obtained from Thomas (2003), Preston (2006) and Wikipedia, while for WW2 they have been obtained from Ellis (1994) and Wikipedia.

Figure 8 shows our war regions. The Spanish Civil War began on July 17, 1936. In 1936 it affected all of Spain, except Ceuta and Melilla and the Canary Islands. In 1937 it mostly affected the Central, South-Eastern, Eastern and Northern regions of Spain. In 1938 and 1939 it mostly affected the Central, South-Eastern and Eastern regions. 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. Thus, in 1939, our war regions also include the whole of Poland and the border regions between France and Germany. In 1940, they include Belgium, the Netherlands, and the Northern and Eastern regions of France. In 1941, they include the whole of Greece, plus Bremen and Hamburg in Germany that were subject to heavy aerial bombing. In 1942, no region considered was affected by major combat operations, and our only war regions are some heavily bombed parts of Germany. In 1943, combat was limited to the Southern Italian regions but aerial bombing of Germany extended and intensified. In 1944, combat affected Central Italy, parts of Belgium, France and the Netherlands, Eastern Poland and most of Greece, while large parts of Germany were under heavy aerial bombing. In 1945, our war regions include most of Germany, Eastern Austria, Northern Italy, parts of Belgium, Eastern France and the Netherlands, Western Poland, and the Eastern and Central regions of the Czech Republic.

The shading in the map provides a measure of the length of potential exposure to war, and becomes darker as the number of years with war operations increases. The darkest color, corresponding to three or more years, is for some regions of Belgium, the Netherlands and Eastern France, the Berlin, Bremen, Hamburg and Ruhr regions in Germany, the region around Warsaw in Poland, and Andalusia, Aragon, Castile La Mancha, Catalonia, Extremadura, and the Madrid and Valencia regions in Spain. The Danish regions are never included among the war regions because, although Denmark was occupied by German forces in April 1940, no major war operation took place in this country.

3 Descriptive statistics

In this section we first ask whether living in a war region during childhood or early adolescence helps predict adult outcomes (Section 3.1). We then ask whether it also helps predict the experience of episodes of stress, poor health, financial hardship, or hunger (Section 3.2). Finally, in Section 3.3, we try to identify the causal effect of hardship episodes on adult outcomes by exploiting the variation induced by different potential exposure to war operations, both between and within countries.

3.1 War and adult outcomes

Most of the available micro-level literature on wars and civil conflicts is concerned with their long-run effects on the education, health and well-being of individuals. This literature mainly focuses on experiencing war and civil conflicts in childhood, both because this is a critical period in life and because of its public policy implications. Different measures of intensity of war exposure have been employed. Akbulut-Yuksel (2009) uses both an indicator for having lived during childhood in a region affected by WW2 events and a variable measuring the amount of war destruction (tons of bombs dropped by the Allies on a German city by the end of WW2). She finds that children who grew up in these circumstances tend to be less educated and have worse health status and lower earnings than children who lived in areas not exposed to war. Akresh et al. (2012) analyze the effects of the Nigerian Civil War employing a difference-in-differences strategy and using a measure of intensity of exposure given by the number of months an individual was living in an area interested by war events. They find that several generations of Nigerian women carry the scars of war exposure in terms of shorter adult stature, a latent stock measure of health. As for the channels through which war affects adult outcomes, the paper stresses nutritional deficiency in late childhood.

We find similar evidence in the SHARELIFE data. Table 1 presents, separately by country, the mean value of various adult outcomes for people born in 1930–54 who lived in war regions in childhood or early adolescence ($\tilde{Y}_1$) and people who did not ($\tilde{Y}_0$). For the WW2 countries it was people born in 1930–39 who were exposed to war at ages 6–15, while for Spain it was people born in 1924–33. Thus, for Spain, our sample selection criteria ignore the small fraction of people born before 1930 who experienced the Spanish Civil War at ages 10–15 and survived until 2008. The table also reports the value of the difference $\Delta\tilde{Y} = \tilde{Y}_1 - \tilde{Y}_0$, along with the observed significance level (p-value). For Denmark, Sweden and Switzerland, only $\tilde{Y}_0$ is reported because no major war operation took place in these countries.

The adult outcomes that we consider include measures of education, physical health and mental health. As a measure of education we consider the age at which a person left schooling (`AgeLeftEd`). As measures of physical health we consider self-rated health on the 1–5 scale (`SRH`), with 1 for excellent health and 5 for poor health, the number of reported chronic conditions (`Chronic`), ranging from 0 to 10, stature in centimeters (`Height`), and the body-mass index (`BMI`), namely the ratio of weight in kilograms to squared height in meters. As a measure of mental health we consider an overall index of depression on the 0–12 scale (`Depression`), with 0 for no depression and 12 for very depressed.

The table shows that, for almost all countries affected by the war, people who lived in war regions on average left education earlier, have more chronic conditions and worse self-rated health, are more depressed, and have shorter stature. These differences are usually strongly statistically significant and appear to be particularly strong for Greece. On the other hand, we observe no statistically significant association between war exposure and BMI.

In Section 4, we extend this analysis by controlling for individual differences in SES, as children of different SES may be affected differently by war.

3.2 War and hardship episodes

The channels through which exposure to war may influence adult outcomes are multiple. Some of these channels may affect individuals indirectly, through destruction of physical capital and infrastructures such as school or hospitals. Others, like physical injuries, nutritional deficiencies or psychological stress, may affect them directly. SHARELIFE allows us to investigate the role of four types of hardship episodes that directly affect individuals, namely stress, poor health, financial hardship and hunger, and the time and duration of these individual experiences. In this section we ask whether living in regions affected by major war operations makes individuals more likely to experience this type of hardship.

Table 2 presents, separately by country, the fraction suffering hunger and financial hardship among people born in 1930–54 who lived in war regions at ages 6–15 ($\tilde{H}_1$) and people who did not ($\tilde{H}_0$). We ignore stress and poor health because they turn out to be low frequency events, at least for the range of ages that we consider. They also turn out to be only weakly associated with war exposure. The table also reports the value of the difference $\Delta\tilde{H} = \tilde{H}_1 - \tilde{H}_0$ and the F statistic for testing the hypothesis that the probability of experiencing hardship is the same for those who lived in war regions and those who never did. For Denmark, Sweden and Switzerland, only $\tilde{H}_0$ is

reported because no major war operation took place in these countries.

The table shows that, for all countries, experiencing hunger is much more frequent than experiencing financial hardship. Further, while the association of war exposure with hunger is strongly significant ($F > 10$) for all countries except Austria and the Czech Republic, its association with financial hardship is weak, except for Greece, Italy and Poland. Thus, war exposure appears to be a strong predictor only of hunger.

3.3 Wald estimates

The estimates in Sections 3.1 and 3.2 are the key ingredients when constructing Wald-type estimates of the causal effect of hardship episodes on adult outcomes.

Consider for concreteness the population of individuals born in the same country between 1930 and 1954. Let Y be an adult outcome, for example a measure of educational attainments or health status. Also let H be an indicator for suffering a hardship episode (e.g. hunger or financial hardship) between 6 and 15 years of age. Our parameter of interest is $\beta = \mathrm{E}(Y \mid H = 1) - \mathrm{E}(Y \mid H = 0)$, the causal effect of suffering hardship at ages 6–15 on the adult outcome.

Given a sample of individuals randomly drawn from the population, the OLS estimator of β is $\hat{\beta} = \bar{Y}_1 - \bar{Y}_0$, where $\bar{Y}_1$ and $\bar{Y}_0$ respectively denote the sample average of Y for those who suffered hardship at ages 6–15 and those who did not. This estimator is biased for β if the determinants of Y also include unobservable variables that are correlated with H, such as the reaction of parents to hardship episodes experienced by their children. Now suppose that, in addition to Y and H, one has available a binary instrument W, that is, a binary variable that is correlated with H but has no direct effect on Y. Then a Wald estimator of β is $\tilde{\beta} = \Delta\tilde{Y}/\Delta\tilde{H}$, where $\Delta\tilde{Y} = \tilde{Y}_1 - \tilde{Y}_0$ is the mean difference in Y for people with $W = 1$ and $W = 0$, and $\Delta\tilde{H} = \tilde{H}_1 - \tilde{H}_0$ is the difference between the sample fractions of people with $W = 1$ and $W = 0$. If the unobservable determinants of Y are mean independent of W, then $\operatorname{plim} \Delta\tilde{Y} = \beta \operatorname{plim} \Delta\tilde{H}$, so $\tilde{\beta}$ is consistent for β provided that H is relevant, that is, correlated with W, which implies that $\operatorname{plim} \Delta\tilde{H} \neq 0$.

In our case, a natural candidate instrument is the indicator for living in a war region between 6 and 15 years of age. A simple comparison of Figure 8 with Figures 9 and 10 suggests that, at least for hunger, this variable is relevant because $\mathrm{E}(H \mid W = 1) \neq \mathrm{E}(H \mid W = 0)$, that is, the probability of suffering hunger is different for two randomly chosen individuals born in the same country between 1930 and 1954, one ever living and one never living in a war region. The key issue is whether this variable can also be regarded as exogenous, that is, uncorrelated with the

unobserved determinants of the adult outcome considered. Here, exogeneity means that living in a war region during childhood has no direct effect on the adult outcome and its effect is only indirect, through a higher probability of experiencing hardship. It means, in particular, that the postwar experience of people of the same country and cohort is on average the same irrespective of whether or not they lived in a region that witnessed major war operations.

Using this approach, we can only consider countries for which we have both regions affected and regions not affected by major war operations. Thus, we cannot consider Denmark and neutral countries (Sweden and Switzerland). Further, we can only include Axis and other WW2 countries for the period 1939–1945, and Spain for the period 1936–39.

If the effect of hardship is heterogeneous in the relevant population, then the Wald estimator is consistent for the local average treatment effect (LATE) of hardship among the "compliers" (Imbens and Angrist 1994). In our case, the "compliers" are the members of the population who suffered hardship because their region of residence was exposed to war operations. Notice that, since our instrument is different from that used by van den Berg, Pinger and Schoch (2012), our LATE parameter is also different from what they identify, namely the LATE for those who suffered hunger because of exposure to a period of famine.

Table 3 reports, separately by country, the Wald estimates of the causal effect of hunger on our adult outcomes. We ignore financial hardship because war exposure appears to be a weak instrument for this variable. The numerator $\Delta\tilde{Y}$ of the Wald estimates is obtained directly from Table 1, whereas the denominator $\Delta\tilde{H}$ is slightly different from the mean differences in Table 2 because we now exclude observations with missing values on the outcome of interest. Because the denominator $\Delta\tilde{H}$ is always positive, that is, living in a war region is associated with a higher probability of suffering hunger, the Wald estimates of β always have the same sign as the mean differences in Table 1. In particular, the sign is negative for `AgeLeftEd` and `Height`, and positive for `Chronic`, `SRH`, `Depression` and `BMI`. However, even when strongly statistically different from zero, the denominator $\Delta\tilde{H}$ is sometimes much smaller in absolute value than the numerator $\Delta\tilde{Y}$, so the Wald estimates are sometimes "too large". This mainly occurs for three countries: the Czech Republic, where exposure to war does not help predict hunger France, where the sample sizes are small, and Greece, where the association between adult outcomes and war exposure is very strong.

4 Regression analysis

A limitation of the estimates in Section 3 is that they only control for country of birth. Accounting for the large number of personal characteristics available in SHARELIFE is important in order to reduce potential biases due to omitted variables. This leads naturally to instrumental variable (IV) regression. In this section we present the results of two alternative empirical strategies that try to estimate the causal effect of hunger using as instruments a set of indicators for living in a war region at various ages. We ignore financial hardship because, as argued in Section 3.3, war exposure appears to be a weak instrument for this variable.

4.1 Empirical strategies

Let Y_i be the value of an adult outcome for the ith sample unit, let H_{ia} be an indicator for suffering hunger at age a, let W_{ia} be a binary indicator for living in a war region at age a, and let X_i be a vector of observable time invariant characteristics of the person, such as gender, cohort and country of birth, and indicators of the childhood environment.

The Wald estimates in Table 3 coincide with the estimated slope coefficients in separate country-specific IV regressions of Y_i on a constant and H_{ia} using W_{ia} as an instrument. So, a simple extension of the approach in Section 3.3 is a set of age- and cell-specific IV regressions of the form

$$Y_i = \alpha_a + \beta_a H_{ia} + \gamma_a X_i + U_{ia}, \tag{1}$$

where the slope coefficient β_a represents the causal effect of suffering hunger at age a on the adult outcome and the error term U_{ia} may contain variables that are correlated with the hunger indicator H_{ia} but, hopefully, not with the instrument W_{ia} and the variables in X_i. The model is fitted separately by country group (German Reich, Italy, occupied Eastern countries, occupied Western countries, and Spain) and age group (childhood and early adolescence). This allows us to look for the existence of critical periods, namely periods in which the effect of exposure to hunger is particularly severe.

In addition to country-group fixed effects, cohort fixed effects and their interactions, the vector X_i includes an indicator for being a female (`Female`) and controls for household circumstances and SES in childhood, namely indicators for ever living in a rural area or a small town (`Rural`), having at least one shelf of books at home (`Books`), the main breadwinner being a white collar (`Wcollar`) or a farmer (`Farmer`), parents drinking heavily (`Pdrink`), not living with the biological mother (`Nomother`), and living in a bad accommodation (`Badaccomm`), that is, one without fixed

bath, running water, inside toilet, and central heating. Including them as additional regressors in model (1) allows us to investigate whether suffering hunger in childhood or early adolescence has an effect on adult outcomes separate from the SES channel. Table 4 shows the means of these indicators, separately by country group and type of region (war vs. non-war).

Our second strategy imposes stronger parametric assumptions by estimating the "overall" model

$$Y_i = \alpha + \sum_a \beta_a H^*_{ia} + \gamma X_i + U_i, \tag{2}$$

where the H^*_{ia} are mutually exclusive hunger-by-age indicators and the set of β_a parameters measure the causal effect of suffering hunger at different ages on adult outcomes after controlling for the variables in X_i, which now also include a fully interacted set of country-group and cohort fixed effects. These fixed effects are important because they capture a variety of factors that differentially affect the various countries and cohorts, including differential survival and the different aggregate effects of war on the various cohorts, the consequences of educational and health reforms in the post-WW2 period, the different political developments in the Western and Eastern countries during the post-war period, etc. Unlike model (1), which is fitted separately be cell, model (2) is fitted to the full sample. It is much more parsimonious than model (1), but at the cost of forcing the β_a coefficients to be the same for all countries and cohorts.

Our set of hunger-by-age indicators includes dummies for experiencing hunger only during childhood (6–10 (`Hunger 6--10`), only during early adolescence (`Hunger 11--15`), and during both childhood and early adolescence (`Hunger 6--15`). This specification also allows us to take into account the duration of hunger episodes. Our instruments consist instead of a set of mutually exclusive indicators W^*_{ia} for living in a war region only during childhood (`War 6--10`), only during early adolescence (`War 11--15`), and during both childhood and early adolescence (`War 6--15`), plus an indicator for missing information on the region of residence (`Regmis`). Unlike model (1), we now have one more instrument than parameters to be estimated, so we can test the overidentifying restriction implied by the assumption of instrument validity.

We estimate two different specifications of model (2). The first includes in X_i only a female dummy, country-group and cohort fixed effects, and the interactions of country-group and cohort fixed effects. The second adds our set of variables describing the childhood environment.

4.2 Reduced-form regressions

Panel A of Table 5 presents the reduced-form estimates of the effect of W_{ia} in model (1), namely the estimated coefficients on the instrument W_{ia} in the regression of each adult outcome on a constant,

W_{ia} and the variables in X_i, separately by country group and age group.

Table 6 instead presents the results from the set of reduced-form regressions for model (2), namely the regressions of each adult outcome on a constant, the set of instruments W_{ia}^{*} and the variables in X_i. Specification (a) omits the variables describing childhood conditions, while specification (b) includes them. Both specifications include country-group fixed effects, cohort fixed effects and their interactions. Standard errors are robust to heteroskedasticity of unknown form. We only report the coefficients on the indicators for experiencing war at different ages and on the variables describing the childhood environment. We also report the sample size (N), the number of regressors including the constant term (k), the adjusted R^2, and the robust F test statistic for the significance of the regression.

In general, the reduced-form regressions tend to have the expected sign and to be strongly statistically significant. In particular, having lived in a war region tends to have a negative effect on age when left schooling, self-rated health, and mean height, and a positive effect on the number of chronic conditions, the depression index, and BMI. Interestingly, with the exception of the depression index, living in a war region during early adolescence has a stronger effect on adult outcomes than living in a war region during childhood, a result in line with the findings of Akresh et al. (2012). These effects are somewhat weaker in specification (b), where we add the gender indicator and variables describing the childhood environment.

On average, women have lower education, worse physical and mental health, shorter stature and lower BMI. As for the variables describing the childhood environment, people living in rural areas or in households where the main breadwinner is a farmer tend to have lower education, shorter stature but less chronic conditions. People with higher SES status (more books at home or father white collar) tend to have higher education, better physical and mental health, taller stature and lower BMI, while people with lower SES status (parents drinking, no mother, bad accommodation) tend to have lower education, worse physical and mental health, shorter stature and higher BMI.

4.3 First-stage regressions

Panel B of Table 5 presents the first-stage estimates of the effect of W_{ia} in model (1), namely the estimated coefficients on the instrument W_{ia} in the regression of the hunger-by-age indicators H_{ia} on a constant, W_{ia} and the variables in X_i, separately by country group and age group. The first-stage estimates vary by outcome because the presence of missing values in the outcome considered implies small differences in the sample used for IV estimation. The number in parentheses are the

robust F test statistics for the significance of W_{ia}.

Table 7 instead presents the results from the set of first-stage regressions for model (2), namely the regressions of each hunger-by-age indicator H^*_{ia} on a constant, the set of instruments W^*_{ia} and the variables in X_i. Specification (a) omits the variables describing childhood conditions, while specification (b) includes them. As before, we only report the coefficients on the indicators for experiencing war at different ages and on the variables describing the childhood environment.

In general, these first-stage regressions tend to be strongly statistically significant and have the expected positive sign, that is, people exposed to war operations at a given age tend to have higher probability of suffering hunger at that age or at later ages relative to similar people who were not exposed.

4.4 IV regressions

Panel C of Table 5 presents the IV estimates of β_a in model (1), separately by country group and age group. Like for the Wald estimates in Section 3.3, these IV estimates are ratios between the reduced-form coefficients in panel A and the first-stage coefficients in panel B. Because the first-stage coefficients are always positive, the IV estimates always have the same sign as the reduced-form coefficients, namely negative for `AgeLeftEd` and `Height`, and positive for `Chronic`, `SRH`, `Depression` and `BMI`. However, even when they are statistically different from zero, the first-stage coefficients are sometimes much smaller in absolute value than the reduced-from coefficients so, again like the Wald estimates in Section 3.3, our IV estimates are sometimes "too large". This mainly occurs for the Occupied East (which includes the Czech Republic) and the Occupied West (which includes France and Greece).

Table 8 instead reports the IV estimates for two different specifications of model (2). Specification (a) omits the variables describing childhood conditions, while specification (b) includes them. As before, we only report the coefficients on the indicators for experiencing war at different ages and on the variables describing the childhood environment. The table also reports the Hansen-Sargan test statistic of the overidentifying restriction (J) implied by the model, along with its asymptotic p-value. Based on this test, the overidentifying restrictions are not rejected for chronic diseases, self-reported health, depression and height, but are rejected for the educational outcome and BMI.

The results confirm our findings in Section 4.2 that hunger has a negative effect on education, self-rated health, depression and stature, and that suffering hunger during both childhood and early adolescence has stronger negative effects. On the other hand, we find no statistically significant

effect on the number of chronic conditions and BMI.

Women tend to have lower education, worse physical and mental health, shorter stature and lower BMI. People living in rural areas or in households where the breadwinner is a farmer tend to have lower education, less chronic conditions and shorter stature. People with higher SES status (books at home, breadwinner white collar) tend to have higher education, better physical and mental health, taller stature and lower BMI, while people with lower SES status (parents drank, not living with the mother, living in a bad accommodation) tend to have lower education, worse physical and mental health, shorter stature and higher BMI.

4.5 Robustness checks

Table 9 summarizes a number of checks that we carried out to assess the robustness of our results to a number of modeling decisions. We report the IV estimates only.

Panel A excludes from our sample people who migrated between countries or between regions of the same country during the period 1936–49. War and post-war developments, especially in Germany and the occupied Eastern countries, led many people to leave their native country or region (Figure 11). SHARELIFE allows us to identify these movers. Excluding them does not change the results compared to Table 8.

Panel B excludes the countries considered by van den Berg, Pinger and Schoch (2012), namely those that experienced episodes of famine during or immediately after WW2 (Germany, Greece and the Netherlands). These episodes affected millions of people and were triggered by a reduction in food supply caused by war operations, blockades or mismanagement by either the Axis or the Allies. Country groups are redefined accordingly. The sample size is now lower but point estimates do not change much, except for a higher and statistically more significant negative effect of hunger on depression and height.

Panel C interacts hunger with a single measure of household SES constructed by applying principal component analysis (PCA) to a set of four variables: the number of rooms per capita after excluding common areas and indicators for having none or very few books at home, living in a bad accommodation, and the main breadwinner being a blue collar. Our SES measure (`SES`) is the first PCA component and explains 42% of the total variance. A higher value of this measure means a lower level of household SES. To allow for nonlinearities, we interact our SES measure with the hunger-by-age dummies. We find that higher SES has a "protective" role on adult outcomes and the interaction terms have the expected negative sign but are not statistically significant.

Finally, following Poterba, Venti and Wise (2010), Panel D shows the results obtained using as additional adult outcome a general health index constructed via PCA. The first two waves of SHARE offer a large amount of information on health conditions. We apply PCA to 18 indicators which refer to physical limitations (difficulties in walking, climbing stairs, etc.), difficulties with daily life activities, the number of doctor visits or hospital stays, etc. Our health index is the first PCA component and a higher value of this index means worse health. Again, results do not change compared to Table 8.

5 Conclusions

WW2 affected the civilian population of Europe on an unprecedented scale. There was enough variation–across regions, over time and between individuals–in the experience of war-related events to hope to be able to identify the long-run effects of the war and some of the channels through which they were produced.

To pursue our goal, we use retrospective micro-data from the third wave of SHARE (SHARELIFE) to construct a longitudinal data set with detailed information on residential location and the occurrence of important episodes of stress, poor health, financial hardship and hunger in each year of an individual's life. Using these data we find that hunger episodes are more closely associated with war than any other hardship episode.

To obtain estimates of the causal effect of hunger on adult outcomes, we exploit the temporal and regional variation in potential exposure to major war operations. Our reduced-form estimates show that exposure to war in childhood or early adolescence has strong negative effects on schooling and various indicators of physical and mental health past age 50. Further, these negative effects do not disappear after we control for other characteristics of the childhood environment, such as the household SES.

Our first-stage regressions suggest that our instruments are relevant. They also show that exposure to war at a given age increases the probability of suffering hunger at that age or at later ages, and that living in a rural area or in a household with a higher SES has a protective effect.

Finally, our IV estimates are in line with the reduced-form estimates and show that hunger has important negative effects on educational attainments and various measures of physical and mental health. They also suggest that suffering hunger for longer periods has stronger negative effects.

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Table 1: Means of adult outcomes for people born in 1930–54 who lived in war regions at ages 6–15 ($\tilde{Y}_1$) and people who did not ($\tilde{Y}_0$).

	AgeLeftEd			Chronic			SRH		
Country	$\tilde{Y}_1$	$\tilde{Y}_0$	$\Delta\tilde{Y}$	$\tilde{Y}_1$	$\tilde{Y}_0$	$\Delta\tilde{Y}$	$\tilde{Y}_1$	$\tilde{Y}_0$	$\Delta\tilde{Y}$
Austria	15.71	16.06	-.36	1.62	1.49	.13	3.35	3.19	.17
Belgium	17.02	18.08	-1.06***	1.92	1.34	.59***	3.23	2.96	.27***
Czech Republic	17.67	18.05	-.38**	2.17	1.66	.51***	3.72	3.38	.34***
Denmark		19.31			1.59			2.81	
France	16.42	18.04	-1.62***	1.94	1.33	.61***	3.59	3.16	.43***
Germany	18.45	18.92	-.47*	1.77	1.32	.45***	3.50	3.27	.23***
Greece	14.34	16.69	-2.35***	2.03	1.11	.91***	3.43	2.76	.67***
Italy	12.85	14.58	-1.73***	2.49	1.60	.89***	3.61	3.26	.35***
Netherlands	16.04	17.45	-1.41***	1.48	1.15	.33***	3.11	3.01	.10
Poland	15.43	16.87	-1.44***	2.65	1.99	.66***	4.23	3.81	.42***
Spain	13.60	14.60	-1.00***	2.19	1.71	.48***	3.85	3.54	.32***
Sweden		20.36			1.46			2.87	
Switzerland		19.17			1.07			2.76	

	Depression			Height			BMI		
Country	$\tilde{Y}_1$	$\tilde{Y}_0$	$\Delta\tilde{Y}$	$\tilde{Y}_1$	$\tilde{Y}_0$	$\Delta\tilde{Y}_1$	$\tilde{Y}_1$	$\tilde{Y}_0$	$\Delta\tilde{Y}_1$
Austria	2.10	1.85	.24	167.77	168.51	-.74	27.55	27.55	-.00
Belgium	2.22	2.28	-.06	166.93	168.57	-1.64***	26.84	26.54	.30
Czech Republic	2.24	1.80	.44***	167.92	169.28	-1.37**	27.85	27.77	.09
Denmark		1.71	.00		171.38			26.00	
France	2.52	2.58	-.06	165.09	166.74	-1.66***	26.33	26.26	.07
Germany	1.79	1.88	-.09	169.73	170.34	-.61	27.03	26.85	.18
Greece	1.84	1.48	.36***	165.49	168.03	-2.55***	27.43	27.18	.25
Italy	3.01	2.42	.59***	165.49	165.41	.08	26.75	26.93	-.18
Netherlands	1.76	1.83	-.07	171.23	172.20	-.97*	26.20	26.30	-.10
Poland	4.19	3.46	.72***	165.43	166.36	-.93*	27.57	27.72	-.14
Spain	3.17	2.64	.53*	161.73	163.53	-1.80**	27.82	28.05	-.24
Sweden		1.67			171.08			26.22	
Switzerland		1.73			168.95			25.34	

Notes: Standard errors are robust to heteroskedasticity of unknown form.
p-values: * $< .10$, ** $< .05$, *** $< .01$.

Table 2: Fraction suffering hardship episodes among people born in 1930–54 who lived in war regions at ages 6–15 ($\tilde{H}_1$) and people who did not ($\tilde{H}_0$).

	Hunger				Financial hardship			
Country	$\tilde{H}_1$	$\tilde{H}_0$	$\Delta\tilde{H}$	F	$\tilde{H}_1$	$\tilde{H}_0$	$\Delta\tilde{H}$	F
Austria	.162	.051	.111	5.9	.044	.028	.016	.4
Belgium	.091	.012	.079	44.0	.005	.007	-.002	.5
Czech Rep	.023	.008	.015	3.3	.015	.006	.008	1.5
Denmark		.005				.005		
France	.143	.038	.105	29.9	.036	.012	.025	5.8
Germany	.278	.098	.180	53.6	.029	.022	.006	.4
Greece	.140	.024	.116	65.0	.111	.025	.086	43.5
Italy	.194	.046	.147	67.6	.082	.019	.063	25.6
Netherlands	.129	.026	.103	34.3	.000	.006	-.006	.0
Poland	.156	.033	.123	39.6	.043	.006	.037	11.5
Spain	.266	.094	.171	22.5	.082	.035	.048	4.5
Sweden		.014				.012		
Switzerland		.025				.018		

Notes: The F test statistic is robust to heteroskedasticity of unknown form.

Table 3: Wald estimates of the causal effect of suffering hunger at ages 6–15 on adult outcomes for people born in 1930–54.

Country	AgeLeftEd	Chronic	SRH	Depression	Height	BMI
Austria	-3.22	1.04	1.49	1.98	-6.16	-.02
Belgium	-13.45 ***	7.42 ***	3.40 ***	-.78	-20.81 ***	3.79
Czech Republic	-23.94	31.85 *	21.98 *	27.41	-84.65	5.28
France	-15.99 ***	5.90 ***	4.09 ***	-.63	-15.84 ***	.68
Germany	-2.58 *	2.51 ***	1.27 ***	-.48	-3.43	1.03
Greece	-26.31 ***	7.97 ***	5.79 ***	3.25 ***	-21.34 ***	2.17
Italy	-11.95 ***	6.07 ***	2.38 ***	3.96 ***	.56	-1.25
Netherlands	-13.59 ***	3.26 ***	.94	-.65	-9.53 *	-1.00
Poland	-12.26 ***	5.39 ***	3.40 ***	5.75 ***	-7.54 *	-1.16
Spain	-6.74 **	3.22 ***	1.85 ***	3.46 *	-11.33 **	-1.44

Notes: Standard errors are robust to heteroskedasticity of unknown form.
p-values: * < .10, ** < .05, *** < .01.

Table 4: Means of the indicators describing household circumstances and SES status in childhood.

Country	War region	Rural	Books	Wcollar	Farmer	Pdrink	Nomother	Badaccom
German Reich	0	.687	.667	.325	.158	.094	.041	.206
	1	.677	.583	.307	.168	.056	.048	.241
Italy	0	.648	.528	.238	.318	.098	.031	.241
	1	.743	.196	.181	.319	.125	.040	.549
Occup. East	0	.553	.575	.282	.242	.080	.029	.197
	1	.611	.394	.206	.353	.070	.034	.354
Occup. West	0	.687	.658	.218	.293	.074	.029	.426
	1	.797	.477	.121	.423	.052	.027	.592
Spain	0	.618	.377	.185	.289	.081	.045	.413
	1	.722	.272	.178	.268	.096	.051	.589
Neutral	0	.585	.776	.350	.221	.090	.054	.091

Table 5: Estimates of model (1).

Country group	Age group	AgeLeftEd	Chronic	SRH	Depression	Height	BMI
Panel A: Reduced-form estimates							
German Reich	6–10	.215	.355 ***	.118 **	.029	-.743 *	.060
	11–15	.003	.385 ***	.337 ***	-.008	-.814	.056
Italy	6–10	-1.155 ***	.651 ***	.230 ***	.515 ***	-.696 *	-.434 *
	11–15	-1.425 ***	.709 ***	.291 ***	.571 ***	.028	-.234
Occupied East	6–10	-.337 **	.519 ***	.269 ***	.520 ***	-1.002 ***	-.279
	11–15	-.599 ***	.527 ***	.316 ***	.387 ***	-1.126 ***	-.398
Occupied West	6–10	-1.182 ***	.512 ***	.329 ***	.077	-1.426 ***	.113
	11–15	-1.264 ***	.494 ***	.373 ***	.002	-2.027 ***	-.007
Spain	6–10	-.779 **	.454 ***	.273 ***	.458 *	-1.902 ***	-.512
Panel B: First-stage estimates							
German Reich	6–10	.145 (7.2)	.151 (6.6)	.144 (7.1)	.150 (6.6)	.147 (6.4)	.148 (6.4)
	11–15	.255 (7.6)	.263 (7.4)	.255 (7.7)	.263 (7.4)	.264 (7.3)	.266 (7.4)
Italy	6–10	.119 (8.8)	.119 (8.7)	.117 (8.8)	.125 (8.9)	.113 (8.4)	.117 (8.5)
	11–15	.148 (6.4)	.143 (6.1)	.150 (6.9)	.143 (6.2)	.144 (6.3)	.145 (6.1)
Occupied East	6–10	.060 (8.0)	.063 (7.3)	.062 (8.2)	.064 (7.4)	.063 (7.3)	.064 (7.3)
	11–15	.068 (6.1)	.065 (5.8)	.071 (6.4)	.066 (5.9)	.066 (5.8)	.067 (5.8)
Occupied West	6–10	.067 (15.7)	.076 (16.5)	.075 (18.7)	.076 (16.2)	.078 (17.1)	.077 (16.6)
	11–15	.106 (12.4)	.109 (11.5)	.111 (13.8)	.108 (11.2)	.111 (11.9)	.110 (11.4)
Spain	6–10	.153 (4.6)	.132 (6.0)	.160 (7.5)	.139 (5.6)	.140 (6.6)	.140 (6.3)
Panel C: IV estimates							
German Reich	6–10	1.481	2.359 ***	.818 **	.193	-5.047 *	.408
	11–15	.011	1.462 ***	1.324 ***	-.031	-3.081	.209
Italy	6–10	-9.671 ***	5.465 ***	1.975 ***	4.130 ***	-6.143 *	-3.720 *
	11–15	-9.642 ***	4.960 ***	1.934 ***	3.980 ***	.193	-1.611
Occupied East	6–10	-5.649 **	8.225 ***	4.317 ***	8.147 ***	-15.841 ***	-4.373
	11–15	-8.792 ***	8.170 ***	4.427 ***	5.845 **	-17.098 **	-5.979
Occupied West	6–10	-17.598 ***	6.746 ***	4.375 ***	1.015	-18.312 ***	1.468
	11–15	-11.932 ***	4.553 ***	3.349 ***	.019	-18.200 ***	-.061
Spain	6–10	-5.081 *	3.446 **	1.710 **	3.306	-13.619 **	-3.669

Notes: Standard errors are robust to heteroskedasticity of unknown form.
p-values: * < .10, ** < .05, *** < .01.
The number in parentheses in panel B are the robust F test statistics for the significance of W_{ia} in the first-stage regressions.

Table 6: Reduced-form estimates of model (2).

	AgeLeftEd		Chronic		SRH	
	(a)	(b)	(a)	(b)	(a)	(b)
War 6–10	-.511***	-.294**	.025	.027	.104***	.087***
War 11–15	-.782***	-.694***	.141*	.130	.230***	.222***
War 6–15	-1.007***	-.565***	.089	.063	.196***	.151***
Regmis	-.047	.071	.109	.033	.180***	.166***
Female	-1.044***	-1.089***	.273***	.273***	.117***	.118***
Rural		-.276***		-.062***		.006
Books		2.012***		-.087***		-.203***
Wcollar		1.532***		-.098***		-.125***
Farmer		-.448***		-.133***		-.022
Pdrink		-.711***		.271***		.183***
Nomother		-.344**		.184***		.070*
Badaccomm		-.736***		.162***		.083***
N	19889	19365	18178	17704	20455	19917
k	29	36	29	36	29	36
R^2_a	.146	.263	.092	.102	.101	.122
F	116	225	65.7	56.1	86.8	84
	Depression		Height		BMI	
	(a)	(b)	(a)	(b)	(a)	(b)
War 6–10	.239***	.210***	-.816***	-.605***	.384***	.289**
War 11–15	.068	.031	-1.415***	-1.152***	.632***	.531**
War 6–15	.300***	.223**	-1.449***	-1.054***	.253	.153
Regmis	.366***	.292**	-1.185***	-1.118***	.455*	.388
Female	.912***	.911***	-11.488***	-11.506***	-.232***	-.227***
Rural		-.051		-.432***		-.054
Books		-.349***		1.490***		-.473***
Wcollar		-.078**		.644***		-.627***
Farmer		-.099**		-.205*		-.046
Pdrink		.401***		-.530***		.315**
Nomother		.163*		-.420		.097
Badaccomm		.233***		-.836***		.299***
N	17986	17516	18491	18014	17943	17476
k	29	36	29	36	29	36
R^2_a	.079	.093	.469	.486	.021	.032
F	52.6	48.4	567	470	15	17.1

Notes: Both specifications include country-group fixed effect, cohort fixed effect and their interactions.
Standard errors are robust to heteroskedasticity of unknown form.
p-values: * < .10, ** < .05, *** < .01.

Table 7: First-stage estimates of model (2).

	Hunger 6–10		Hunger 11-15		Hunger 6–15	
	(a)	(b)	(a)	(b)	(a)	(b)
War 6–10	.025 ***	.022 ***	.004	.004	.036 ***	.035 ***
War 11–15	-.048 ***	-.048 ***	.074 ***	.075 ***	.069 ***	.071 ***
War 6–15	-.020 ***	-.023 ***	.026 ***	.025 ***	.092 ***	.090 ***
Regmis	.061 ***	.046 ***	.053 ***	.058 ***	.078 ***	.081 ***
Female	-.004 **	-.004 **	-.003 ***	-.003 ***	-.005 **	-.005 **
Rural		-.005 **		-.001		-.009 ***
Books		-.006 ***		.001		-.013 ***
Wcollar		-.005 **		.001		-.004
Farmer		-.010 ***		-.001		-.001
Pdrink		.013 ***		.003		.019 ***
Nomother		.009 *		-.005		.012 *
Badaccomm		.005 **		.002		.014 ***
N	20461	19922	20461	19922	20461	19922
k	29	36	29	36	29	36
R_a^2	.043	.043	.050	.051	.048	.056
F	33.5	26.7	39.3	31.8	38.0	34.7

Notes: Both specifications include country-group fixed effect, cohort fixed effect and their interactions.
Standard errors are robust to heteroskedasticity of unknown form.
p-values: * $< .10$, ** $< .05$, *** $< .01$.

Table 8: IV estimates of model (2).

	AgeLeftEd		Chronic		SRH	
	(a)	(b)	(a)	(b)	(a)	(b)
Hunger 6–10	4.968	4.880 *	-.120	-.451	.036	.116
Hunger 11–15	8.024	2.663	1.319	.695	.981	1.335
Hunger 6–15	-11.842 ***	-5.305 *	.573	.409	2.011 ***	1.460 **
Female	-1.068 ***	-1.090 ***	.281 ***	.276 ***	.130 ***	.130 ***
Rural		-.296 ***		-.061 **		.021
Books		1.974 ***		-.085 ***		-.184 ***
Wcollar		1.537 ***		-.101 ***		-.121 ***
Farmer		-.407 ***		-.137 ***		-.016
Pdrink		-.694 ***		.266 ***		.151 ***
Nomother		-.305 *		.187 ***		.058
Badaccomm		-.684 ***		.157 ***		.059 ***
N	19889	19365	18178	17704	20455	19917
k	28	35	28	35	28	35
R^2_a	.	.215	.089	.098	.035	.084
J	4.144	4.520	.005	.401	1.925	2.178
	(.042)	(.034)	(.943)	(.526)	(.165)	(.140)
	Depression		Height		BMI	
	(a)	(b)	(a)	(b)	(a)	(b)
Hunger 6–10	1.529	1.701	-.924	-2.079	3.321	3.333
Hunger 11–15	-3.310	-3.128	-1.241	-4.149	4.190	5.006
Hunger 6–15	5.213 ***	4.394 **	-15.559 ***	-11.093 **	1.078	-.169
Female	.940 ***	.935 ***	-11.595 ***	-11.599 ***	-.199 ***	-.199 ***
Rural		-.005		-.539 ***		-.043
Books		-.275 ***		1.327 ***		-.464 ***
Wcollar		-.045		.603 ***		-.614 ***
Farmer		-.077		-.258 *		.002
Pdrink		.307 ***		-.271		.257 *
Nomother		.089		-.291		.085
Badaccomm		.171 ***		-.657 ***		.272 ***
N	17986	17516	18491	18014	17943	17476
k	28	35	28	35	28	35
R^2_a	.083	.096	.403	.451	.003	.010
J	.001	.020	2.049	1.376	4.576	3.157
	(.969)	(.887)	(.152)	(.240)	(.032)	(.076)

Notes: Both specifications include country-group fixed effect, cohort fixed effect and their interactions.
Standard errors are robust to heteroskedasticity of unknown form.
p-values: * < .10, ** < .05, *** < .01.

Table 9: IV estimates. Robustness checks

	AgeLeftEd	Chronic	SRH	Depression	Height	BMI
Panel A: Migrants excluded						
Hunger 6–10	4.996	-.472	.273	2.050	-2.402	2.988
Hunger 11–15	4.714	.591	1.730	-4.450	-5.071	5.896
Hunger 6–15	-7.281 **	.521	1.509 **	5.346 **	-11.724 **	-.492
N	19365	17704	19917	17516	18014	17476
k	34	34	34	34	34	34
R_a^2	.186	.0972	.0774	.	.446	.00792
J	5.325	.330	3.146	.0330	1.619	4.004
	(.021)	(.565)	(.076)	(.855)	(.203)	(.045)
Panel B: Germany, Greece and the Netherlands excluded						
Hunger 6–10	.390	-.689	.283	3.206	-6.779	1.755
Hunger 11–15	-3.043	-1.450	1.946	-10.306	8.281	6.096
Hunger 6–15	-5.026 **	1.139	1.036	6.935 **	-16.622 ***	-1.829
N	14182	13003	14553	12854	13168	12809
k	35	35	35	35	35	35
R_a^2	.278	.076	.116	.	.408	.022
J	1.968	.0554	1.146	.084	.775	1.391
	(.160)	(.814)	(.284)	(.772)	(.379)	(.238)
Panel C: SES interacted with hunger						
Hunger 6–10	8.884 ***	-1.180	-.439	1.400	-2.187	-1.721
Hunger 11–15	5.113	.670	1.215	-3.318	-4.135	2.877
Hunger 6–15	-6.723 **	-.074	1.826 **	5.379 ***	-13.396 **	2.376
SES	1.222 ***	-.064 ***	-.105 ***	-.157 ***	.847 ***	-.354 ***
SES*Hunger 6–10	1.710	-.669	-.464	-.407	.242	-3.967 **
SES*Hunger 11–15	.367	-.053	-.053	.271	-3.565	-2.862
SES*Hunger 6–15	-2.831	-.363	.631	1.319	-3.320	4.090 **
N	19306	17644	19847	17461	17950	17417
k	34	34	34	34	34	34
R_a^2	.156	.082	.069	.	.447	.
J	6.944	2.362	.563	.006	.746	4.824
	(.008)	(.124)	(.453)	(.936)	(.388)	(.028)
Panel D: Latent health index						
	Health index					
Hunger 6–10	-2.063					
Hunger 11–15	4.467					
Hunger 6–15	3.873 *					
N	15375					
k	35					
R_a^2	.					
J	4.116					
	(.043)					

Notes: All specifications include country-group fixed effect, cohort fixed effect, their interactions, and a set of proxies for family SES (books at home, breadwinner's occupation, etc.).
In Panel C we replace these proxies with an overall index of SES constructed via PCA.
Standard errors are robust to heteroskedasticity of unknown form.
p-values: * < .10, ** < .05, *** < .01.

Figure 1: Fraction suffering stress, poor health, financial hardship and hunger by year and country group.

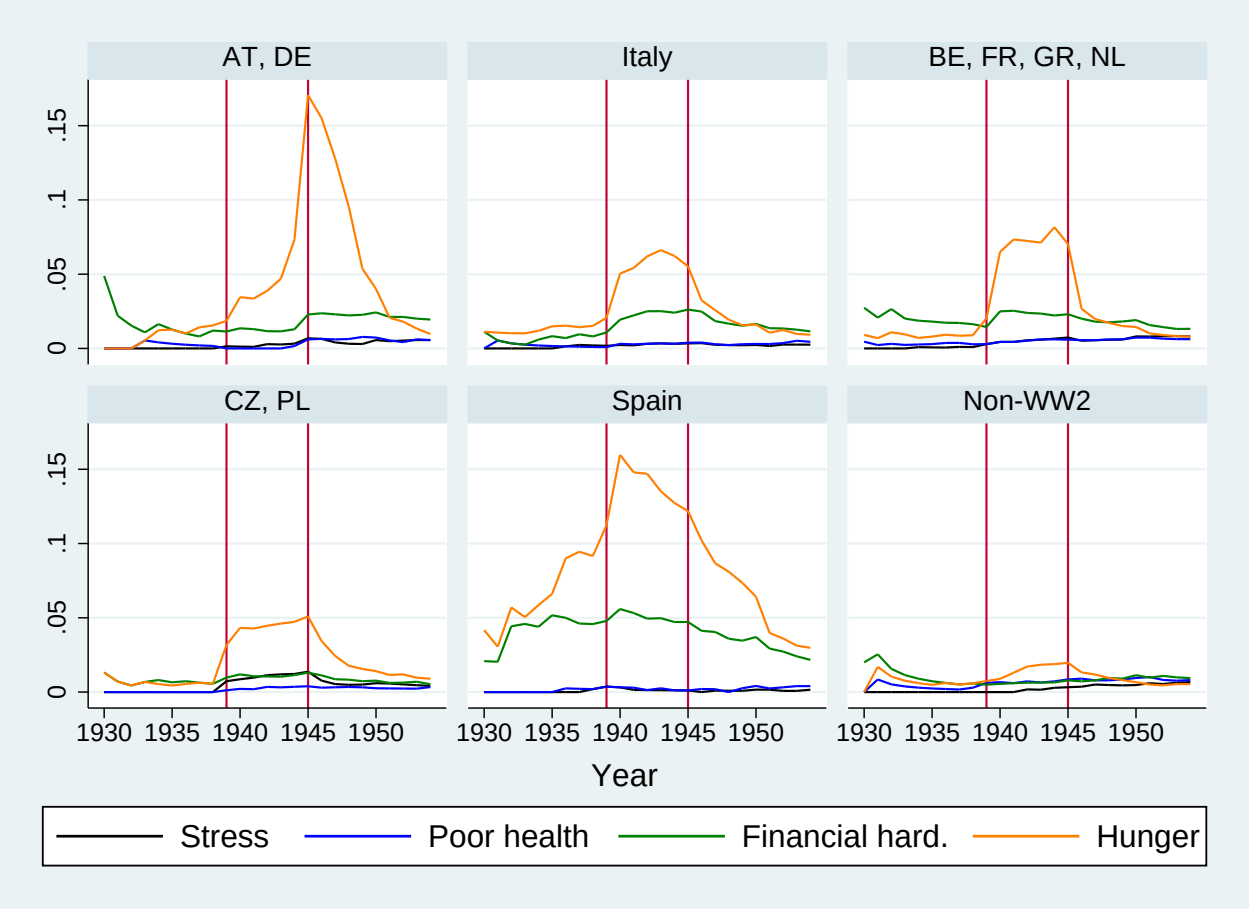


Figure 2: Fraction suffering hunger or financial hardship by year and country group.

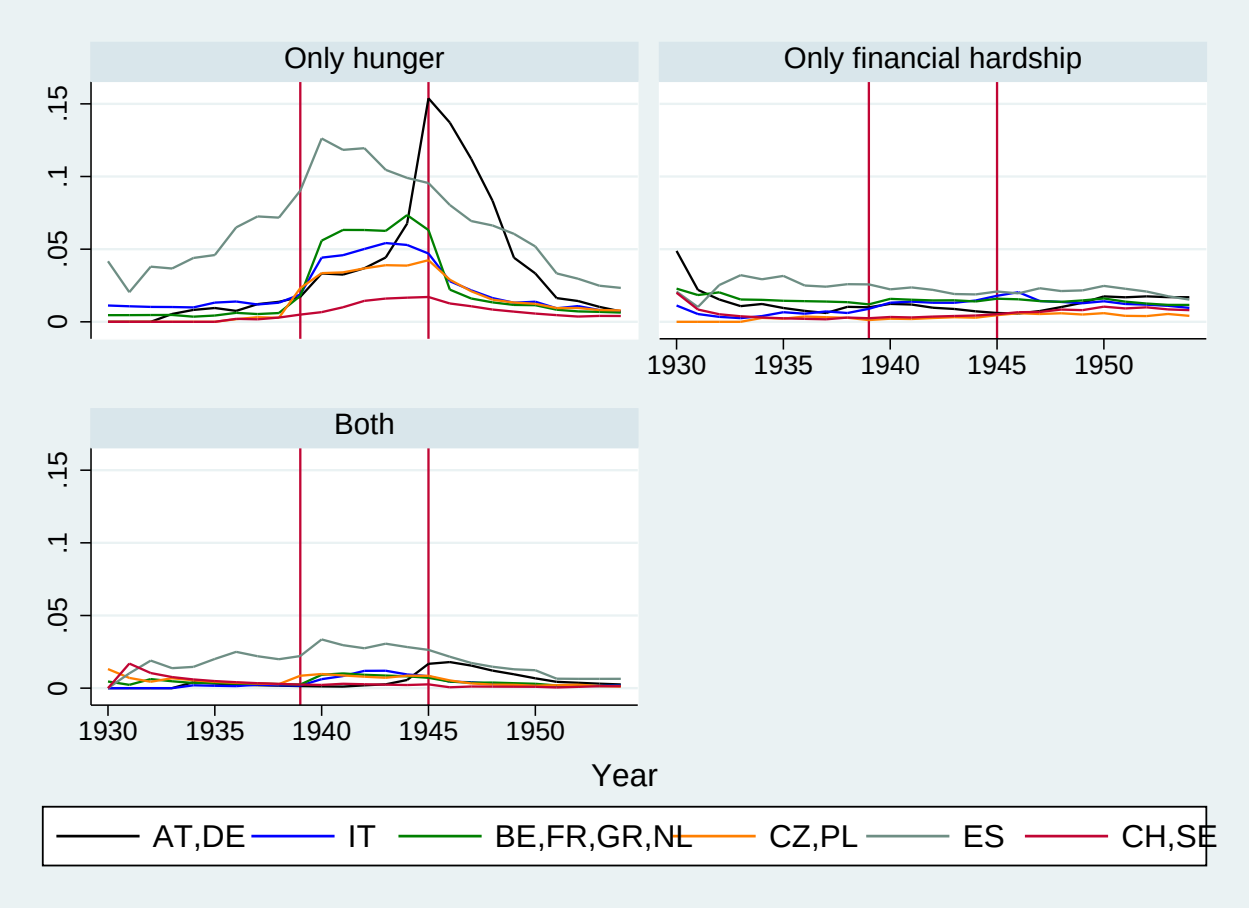


Figure 3: Distribution of start year of hunger by country.

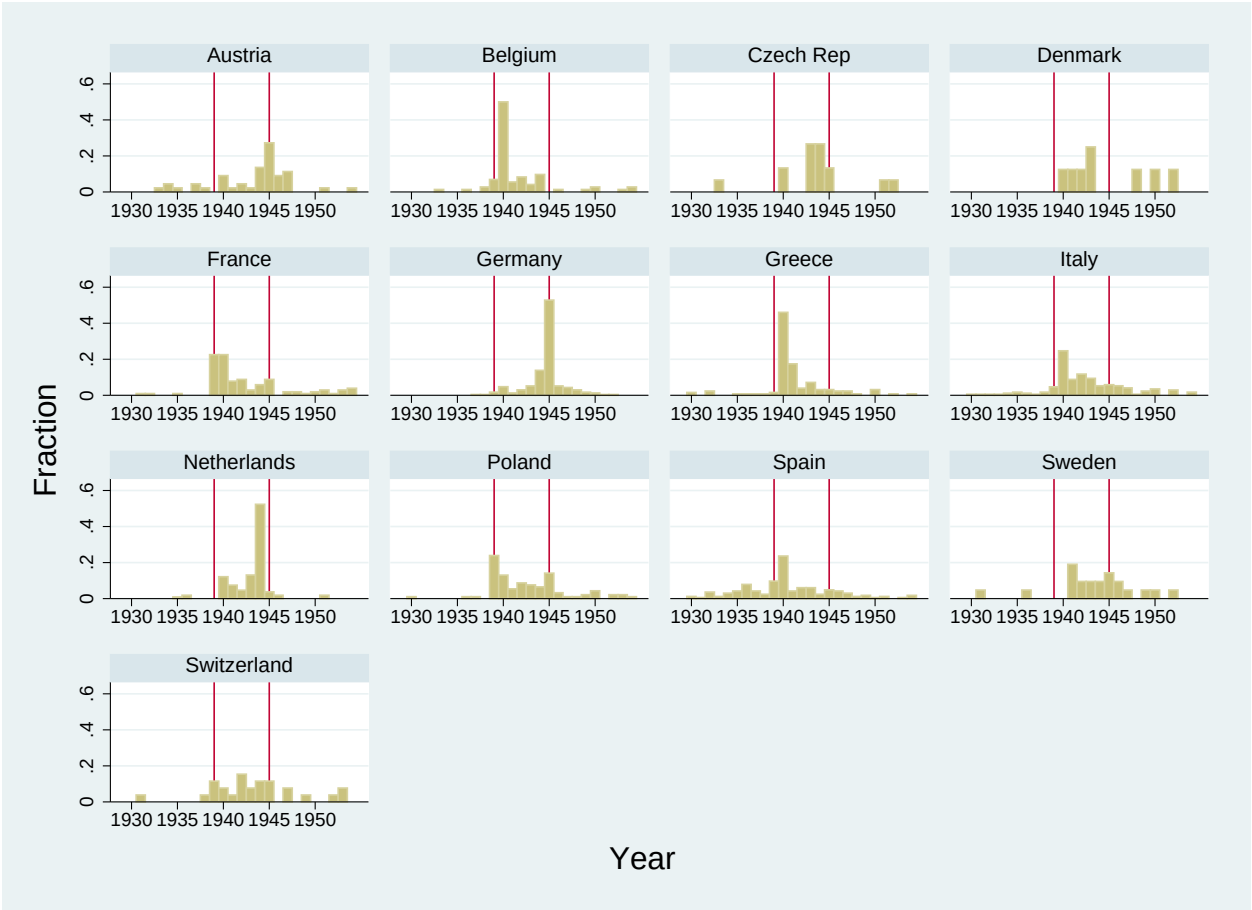


Figure 4: Distribution of hunger duration (number of years) by country.

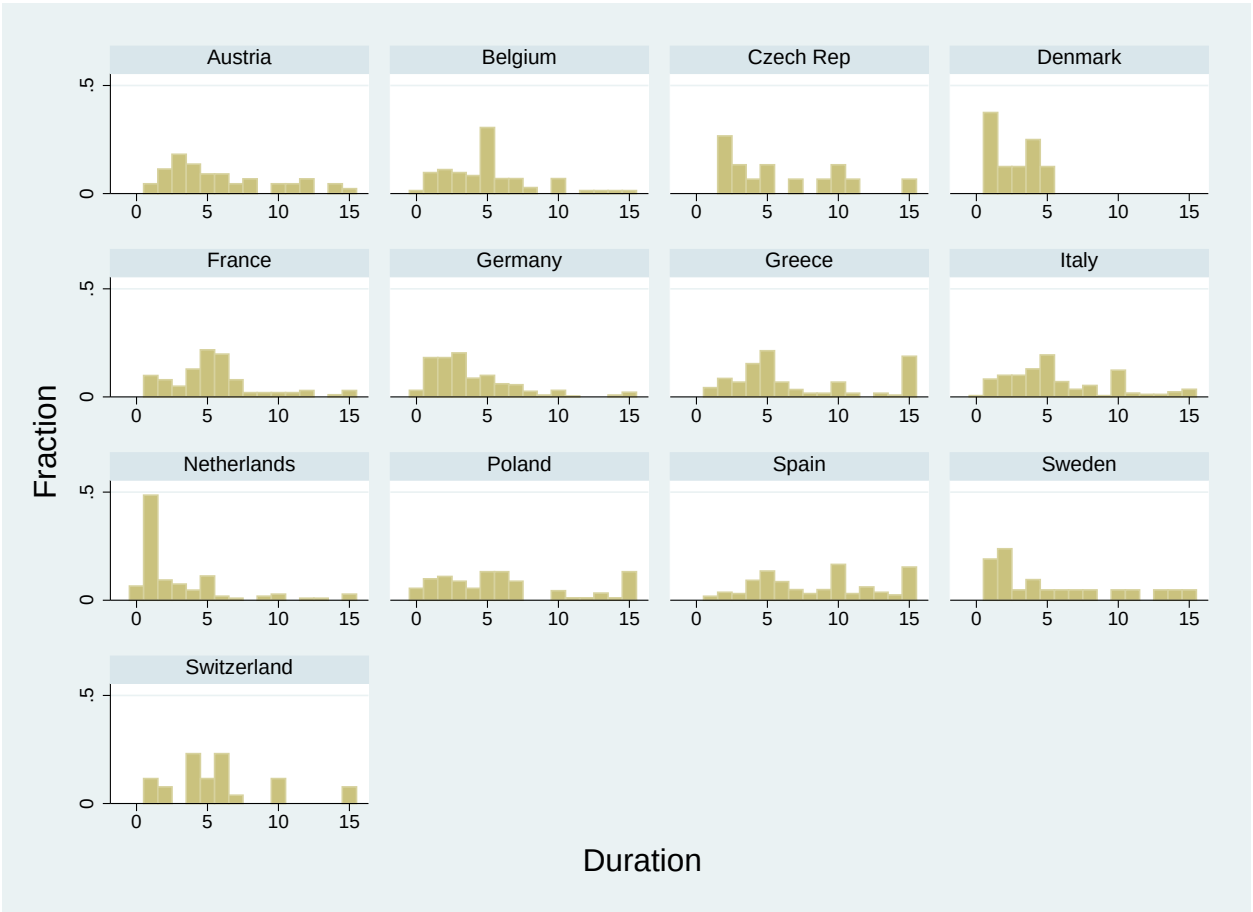


Figure 5: Exposure to hunger: German Reich (left), Italy (right).

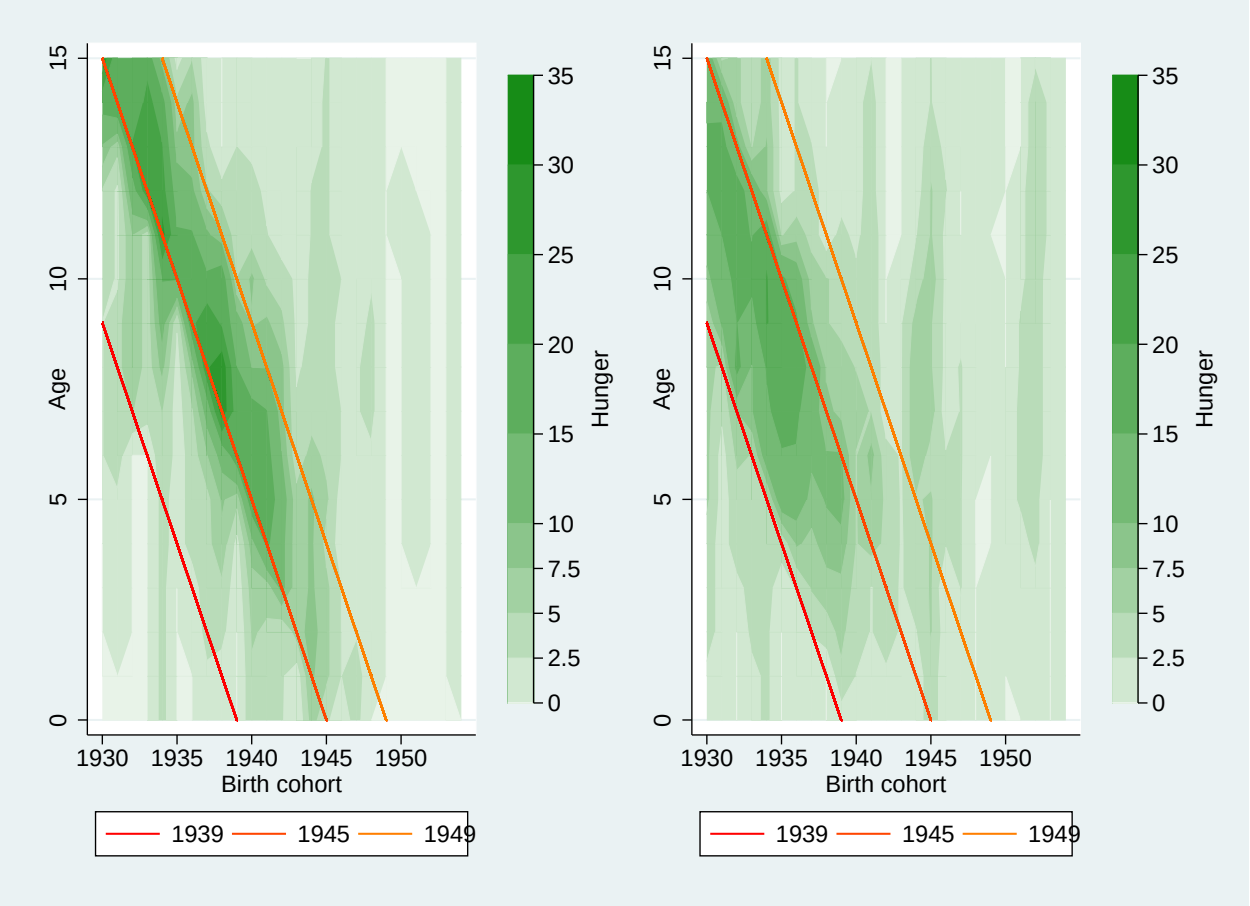


Figure 6: Exposure to hunger: Occupied East (left), Occupied West (right).

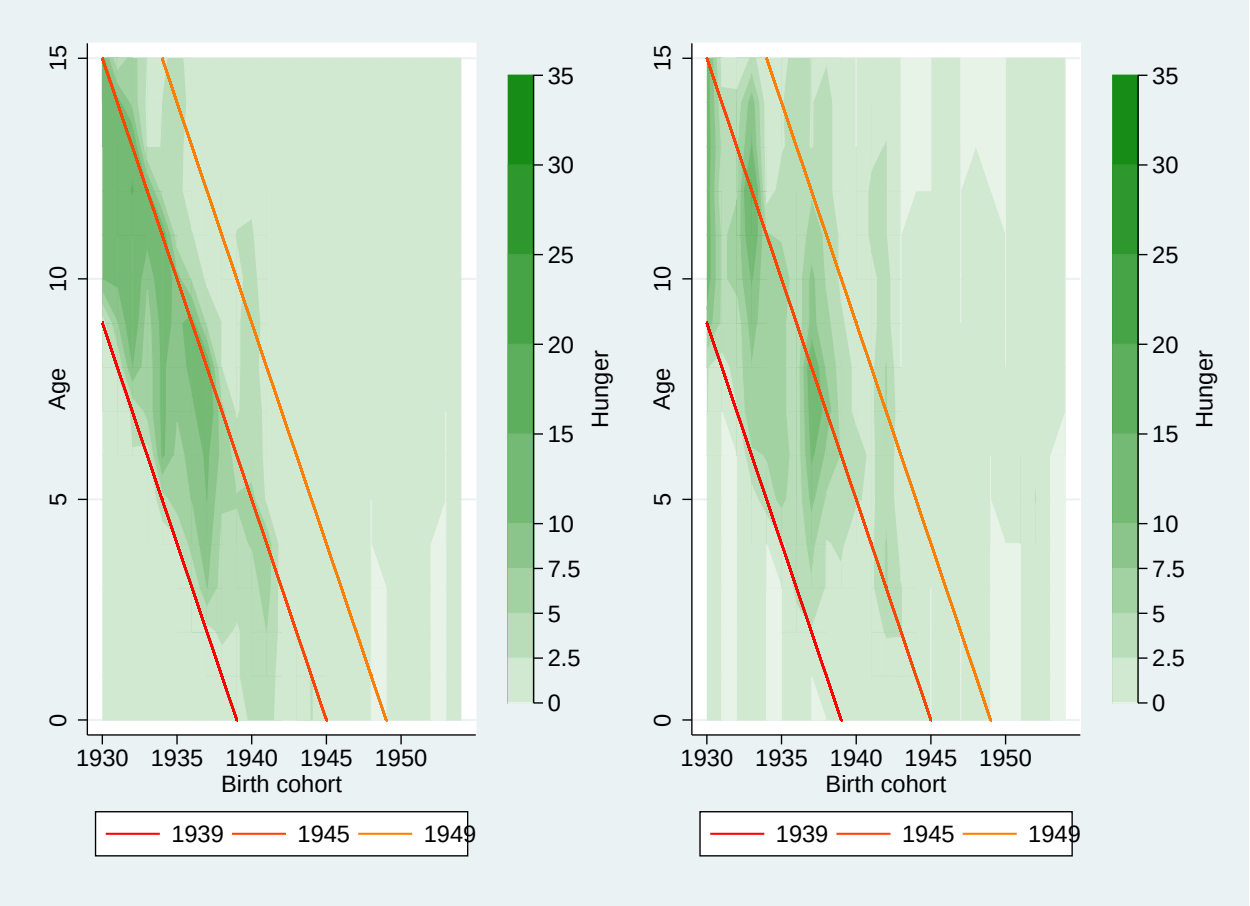


Figure 7: Exposure to hunger: Spain (left), Sweden and Switzerland (right).

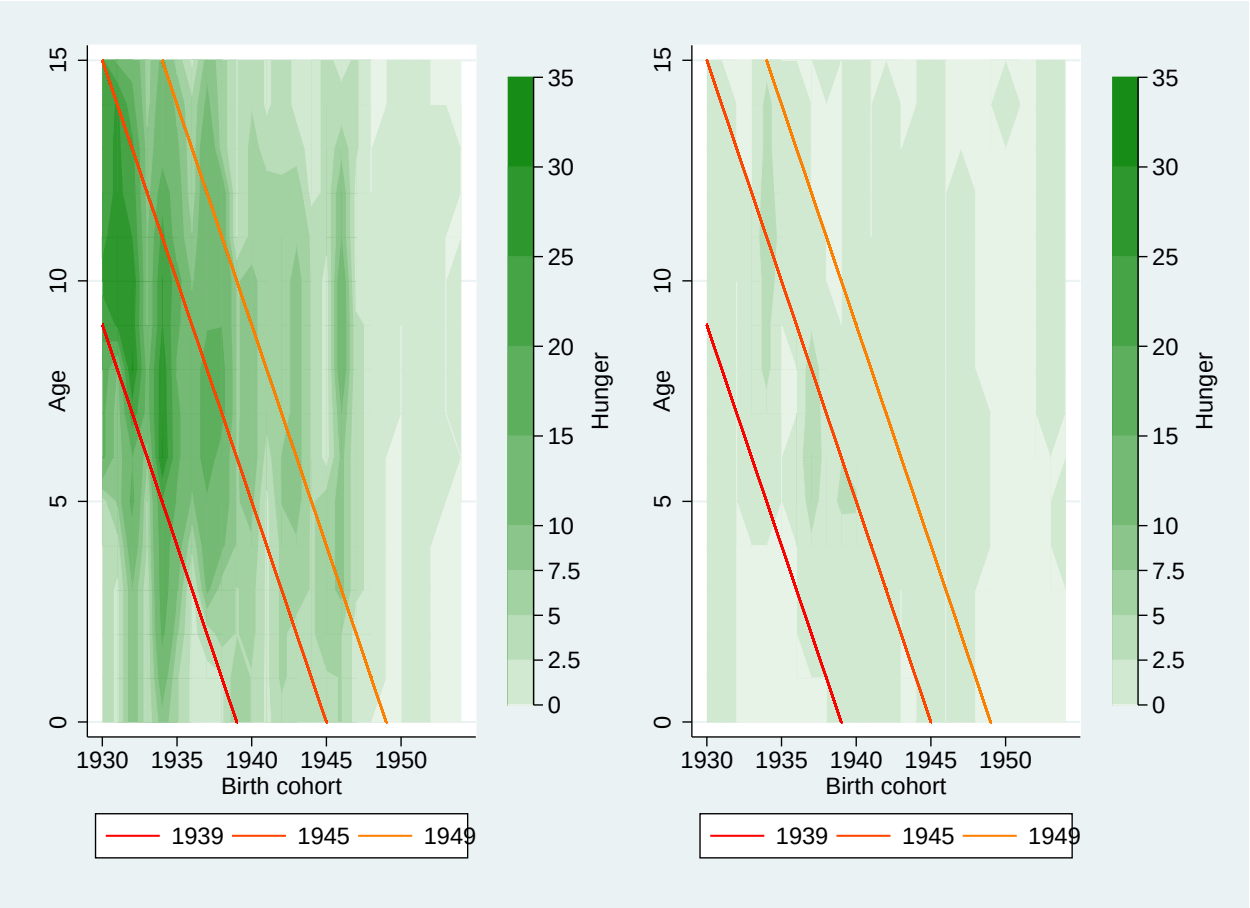


Figure 8: Regions affected by major war operations in 1936–45 (number of years).

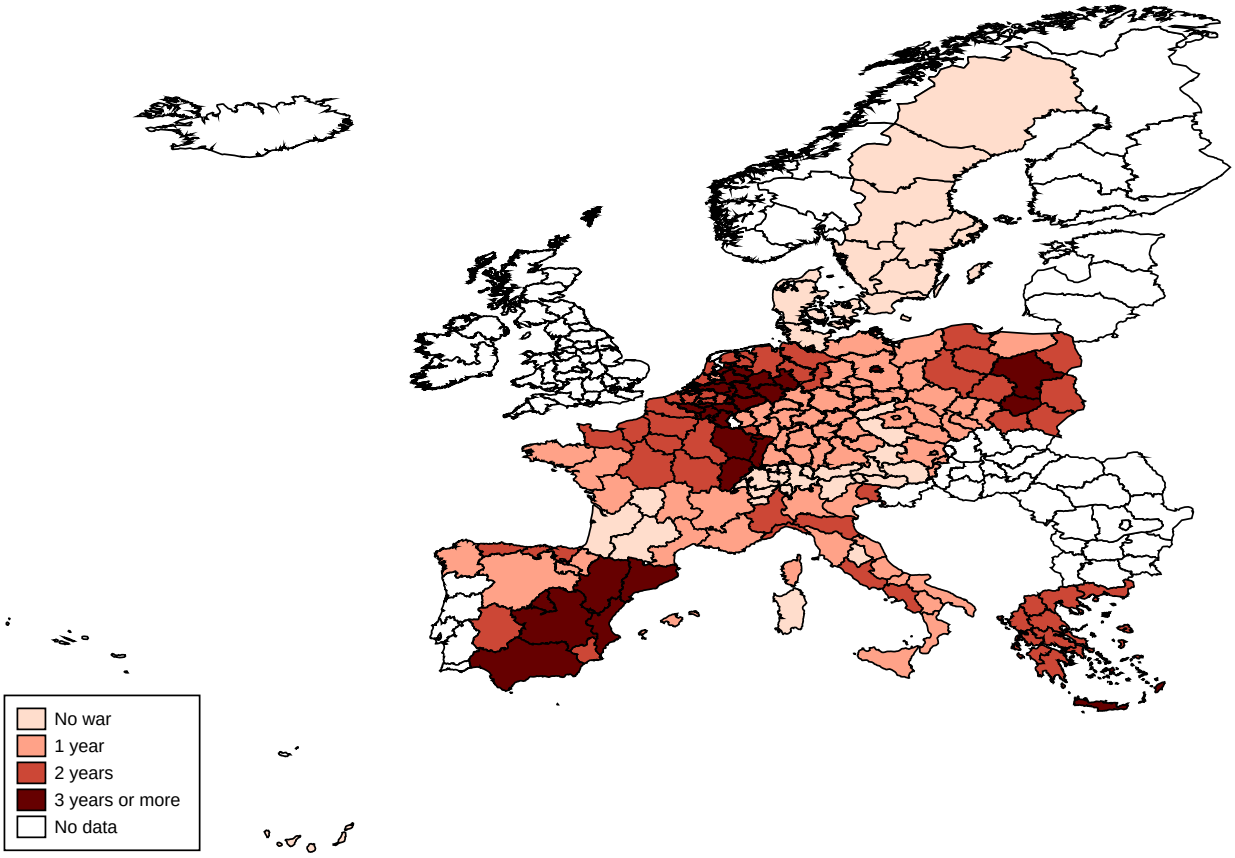


Figure 9: Fraction of people born in 1930–39 who report suffering hunger at ages 6–15 by region.

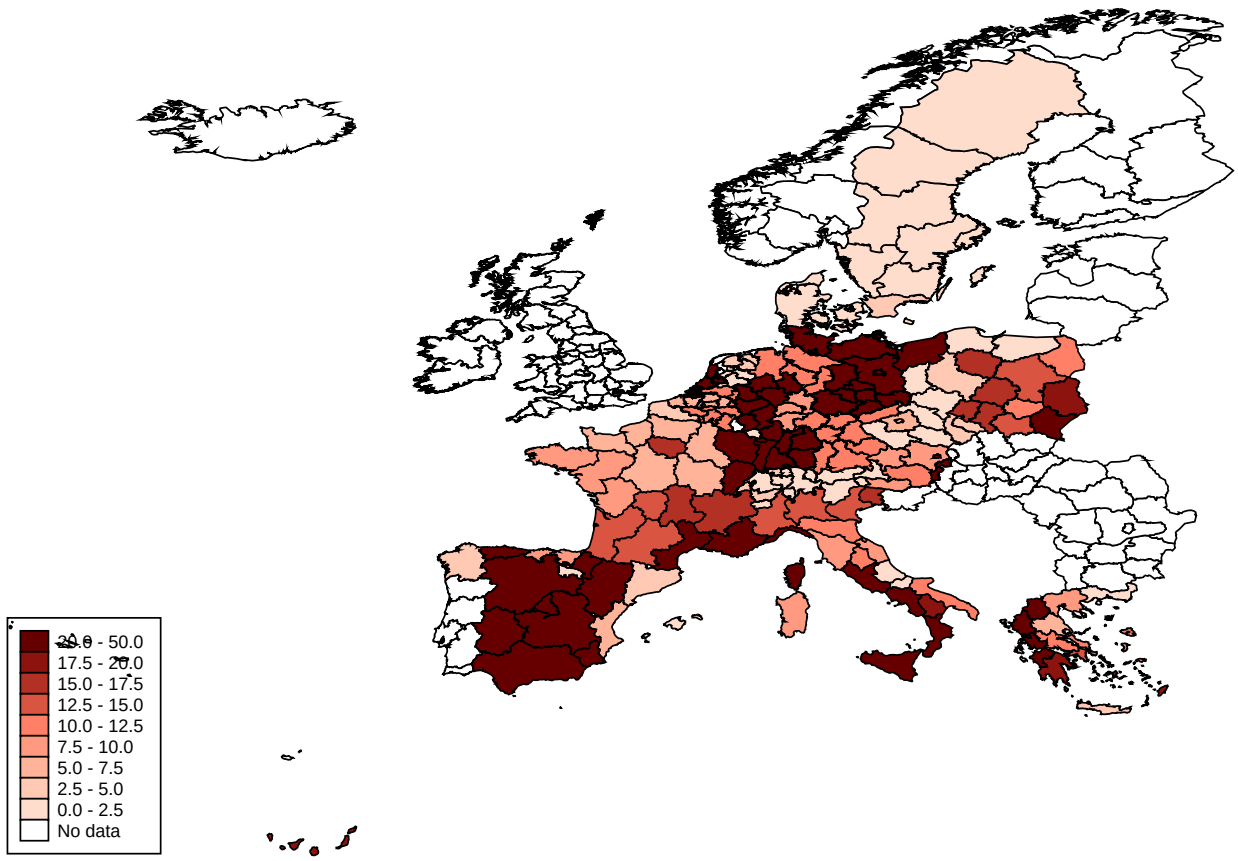


Figure 10: Fraction of people born in 1940–54 who report suffering hunger at ages 6–15 by region.

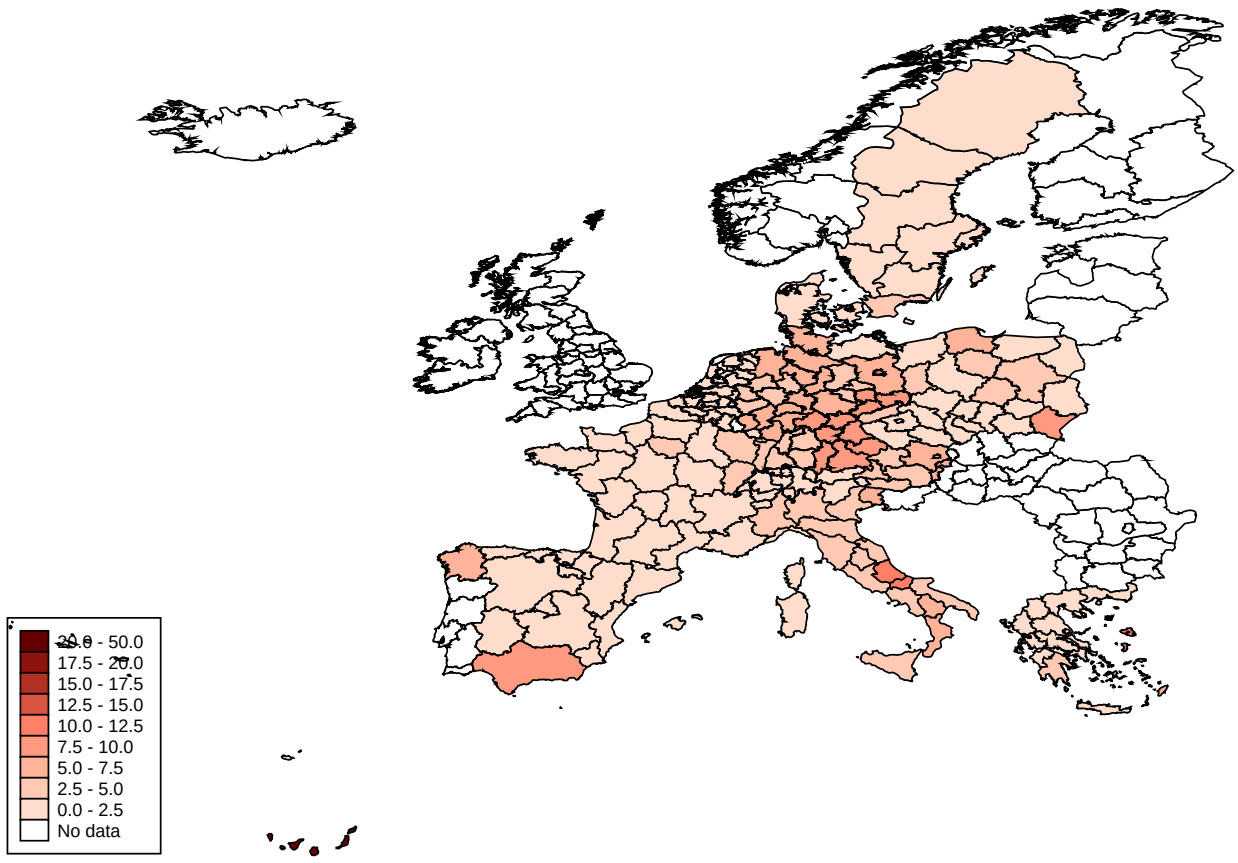
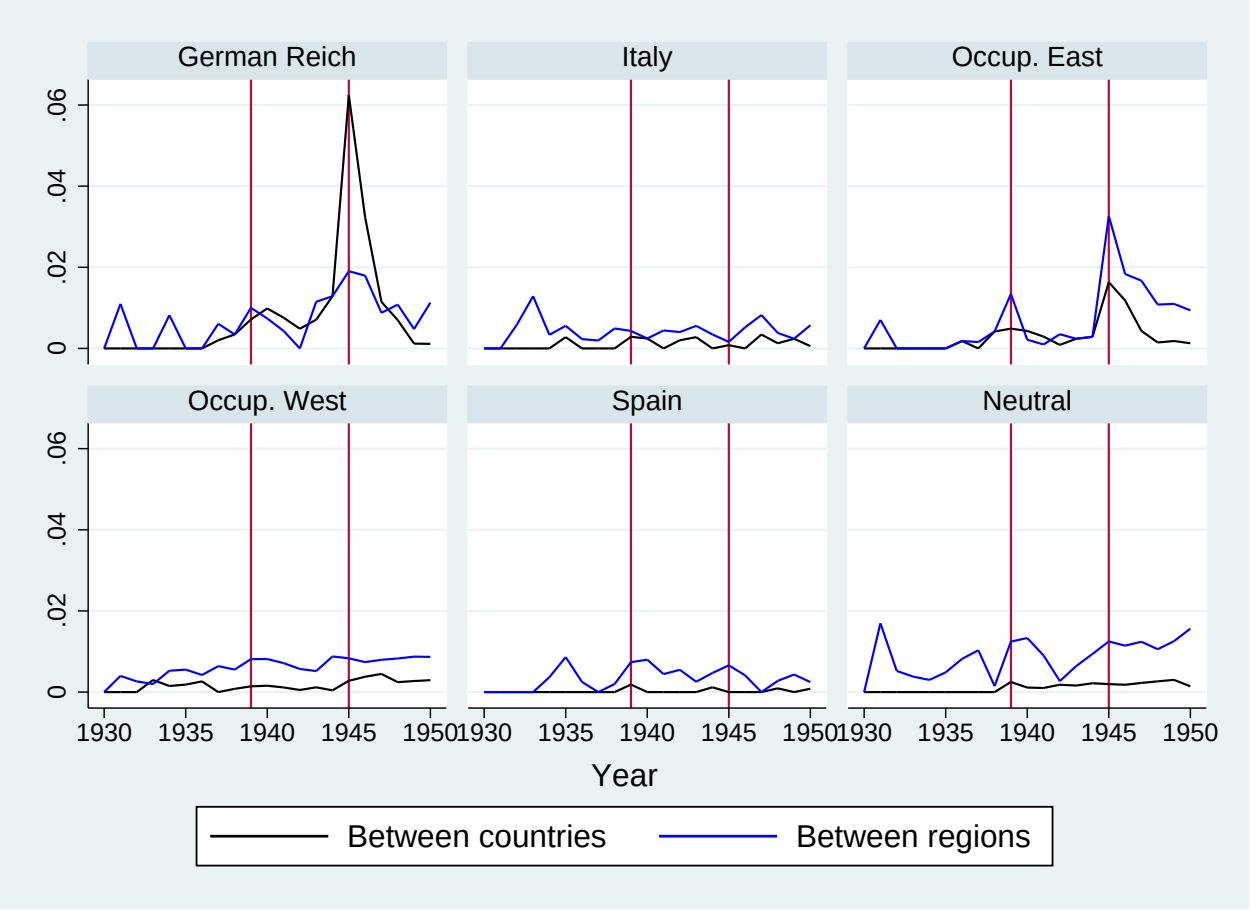


Figure 11: Fraction of individuals who migrated between countries or between regions of the same country during the period 1930–50.



Appendix: Quality of retrospective information in SHARELIFE

SHARELIFE asks individuals to remember events that may have occurred very early in life. Relying on people's recall is faster, less costly, and the risk of respondents dropping out is much smaller than in prospective studies (Schröder 2010). However, there are important concerns about data quality, due to the possibility of recall error and coloring. Recall error arises when individuals do not remember precisely when and how an event took place in the past, whereas coloring is related to the propensity of individuals to report information on their past based on their present.

Quality of recall generally depends on three main aspects: the socio-demographic characteristics of the respondent (age, schooling, etc.), the features of the event (salience, timing, frequency, etc.), and the survey instrument (Smith and Thomas 2003). Berney and Blane (1998) and Krall (1988) show that simple socio-demographic information, such as father's job, accommodation characteristics and past illnesses, can be remembered with good precision after 50 years.

Two approaches are tipically followed when dealing with recall bias or coloring. The first constructs *ex-ante* survey instruments to minimize recall bias. The second assesses the quality of recall *ex-post*, by validating survey information with the use of external sources or by testing the consistency of responses across waves of a survey (Haas 2007, Smith 2009, Havari and Mazzonna 2011).

SHARELIFE adopts the first approach by using the Life History Calendar (LHC) method. This method, developed in psychology, tries to improve the accuracy of recall by using salient events, such as marriage or the birth of a child, as anchors to recall more complicated or frequent events (e.g. employment transitions). SHARELIFE uses a computerized version of the LHC that allows respondents to see on a computer screen the calendar filled in as they answer to questions.

Evaluating *ex-post* the quality of retrospective information in SHARELIFE is not an easy task because of the current lack of linkage to administrative records. Garrouste and Paccagnella (2010) and Havari and Mazzonna (2011) look for evidence of recall bias by analyzing questions that are repeated in all waves of SHARE, or by integrating SHARELIFE data with more objective historical macro-data such as GDP growth rates, schooling level, etc.