War and Obesity: The Role of Eating Habits[1]

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January 2015

Abstract. This study explores the long-run effects of World War II on health conditions and eating habits in later life. Using microdata for adults from the Italian Multipurpose Survey on Households and exploring regional and cohort variation, we show that individuals that experienced World War II during childhood in more affected regions tend to suffer more from obesity and to have a higher probability of myocardial infarction during late adulthood. We provide evidence that the mechanism behind this finding is the excessive consumption of meat later in life as a response to the scarcity of meat at an early age. Consistently with the theory on habit formation, the estimated effect is particularly strong for individuals that experienced the war during early childhood and operates intergenerationally. Several robustness and placebo tests using different waves and cohorts as well as a triple-differences estimation confirm the causal interpretation of the proposed mechanism. Our results shed light on the hypothesis of a behavioral channel from early-life shocks to adult health.

JEL classifications: I10, N44

Keywords: World War II, body mass index, meat consumption, early childhood conditions

[1]First version: June 2014. Many thanks to Manuel Bagues, Lorenzo Burlon, Olympia Bover, Price Fishback, Francesco Manaresi, Alfonso Rosolia, Marco Tonello, Roberta Zizza, the participants of the 6th Italian Congress of Econometrics and Empirical Economics in Salerno, and the XXIX National Conference of Labour Economics in Pisa for useful discussions. The views expressed in this paper are the ones of the authors and do not necessarily reflect those of the Bank of Italy. All the remaining errors are ours.

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1 Introduction

Macroeconomic shocks may have a long-lasting effect on individual health. Several papers suggest causal relationships linking early-life socio-economic conditions and mortality during adulthood. Among others, Galobardes et al. (2008) and Yeung et al. (2014) show that exposure to recessions in early life significantly increases cancer mortality risk of older males and females; Thomasson and Fishback (2014) find that individuals born during the Great Depression in the U.S. had substantially lower incomes and higher work disability rates than those born before the depression. However, this effect is heterogeneous and becomes stronger for individuals born in low-income states. Other papers focus on hunger during early childhood. Havari and Peracchi (2011) and Kesternich et al. (2014) find that hunger during childhood or early adolescence has important negative effects on educational attainment and mental health past the age of 50; Van den Berg et al. (2015), using instrumental variable estimation, find that the effects of undernutrition on adult health are heterogeneous by gender. For men undernutrition leads to a higher level of blood pressure at older ages while for women it also leads to a substantially higher risk of obesity.

Several theories try to explain the causal relationships linking early-life (socio-economic) conditions and mortality during adulthood. First, there is a biological mechanism (see Parsons et al, 1999; Kuh and Ben-Shlomo, 2004; Heckman, 2008; Banerjee et al., 2010; and Almond and Currie, 2011 for a review). Exposure to adverse nutritional conditions while in the womb or during the first years of life may impact height or even result in alterations in the development of vital organs, tissues and/or other human systems. These alterations, though advantageous for short-term survival,

may be detrimental in the long term and may increase the predisposition to chronic diseases during adulthood. According to this theory, health at old ages is the result of exposures to risk factors also across lifetime, so that exposure to adverse environment in early life may set individuals on unfavorable life trajectories. Second, there is a behavioral mechanism at work, which until now has received little attention by the literature: hard times leave a mark on the individual's beliefs, values and attitudes and can thus affect also individual behaviors.[4] Kesternich et al. (2015), using data on consumption expenditures at the household level, argue that an early-life event, such as a prolonged experience of severe hunger during childhood, has an impact on food consumption later in life. However, their data do not allow them to disentangle the effect on consumption due to a change in food quality rather than a change in food quantity. Moreover, higher consumption expenditure does not necessarily imply higher actual consumption as households may increase food storage. Lastly, they cannot distinguish the consumption patterns of each single member of the household. The mechanism that we propose is actually in line with the increase in food expenditures in Kesternich et al. (2015) given that meat is in general more expensive than other food categories.

Our paper explores the behavioral channel at the individual level through a detailed analysis of eating habits. We use data from the Italian Multipurpose Survey on Households. This dataset provides us with information on current dietary habits and health conditions of individuals. In order to identify a causal relationship between childhood shocks and health later in life, we use an early-life experience that is not

[4]Bertoni (2015) shows that exposure to episodes of hunger in childhood makes people adopt lower subjective standards when evaluating life satisfaction in adulthood.

susceptible to endogeneity problems and guarantees randomness in the exposure to the shock. We focus on the major destructive event of the twentieth century, World War II (hereafter WWII), which caused 440,000 deaths in Italy and an average fall in GDP of around 30 per cent. During the war, a large amount of physical capital was destroyed and many individuals were forced to give up their working activity. The fall in economic activity was associated with incidence of hunger especially among families of low socio-economic status. Moreover, a large part of livestock was excised by the German army, died out of malnutrition, or got killed by bombing (non-civilian casualties) that may have affected families regardless of their socio-economic status. We argue that exposure to the war during childhood might have long-term consequences.[5] In particular, we show that meat scarcity during WWII leads to excessive consumption of meat and obesity after the war is over. This is in line with papers documenting that, by contrast, recessions are good for people's health (Ruhm 2000, Miller et al., 2009).

The reason we focus on Italy is threefold. First, the high prevalence of child obesity. According to a recent study (OECD, 2014), although adult obesity is not yet so widespread in Italy (around 10 per cent in 2012 compared to well above 30 per cent in Mexico and the US), the percentage of children aged 5-17 who are overweight or obese is the second highest among 33 OECD countries (around 35 per cent in 2010). Obese children have a higher probability of being obese also during adulthood (see Serdula et al, 1993 for a review). Second, Italy is among the countries directly affected by WWII. Third, the availability of detailed data on height, weight, and eating habits

[5]See Ichino and Winter Ebmer (2004) and Akbulut-Yuksel (2014) for the effects of WWII on human-capital accumulation and long-run earnings.

for different cohorts.

Using a standard difference-in-difference approach we exploit temporal and spatial variation of war-related events in Italy. In particular, we compare eating habits and health conditions of different cohorts of individuals living in areas severely hit by the war to individuals living in less affected areas. Thus, we test whether health and eating habits of individuals who aged 0-12 during the war and live in areas severely hit by the war are different from the ones of other individuals. We also control for possible age effects by employing a triple-differences estimator.

We show that individuals experiencing the war during early-life tend to be more obese and have a higher probability of myocardial infarction in late adulthood. Moreover, we find that the exposure to the war also affects their eating habits. In particular, we find that individuals experiencing the war during childhood have a higher probability of eating meat every day and eating mainly meat in their future life. During WWII most families were unable to consume meat due to the scarcity of livestock. As soon as the war was over, families reacted with an overconsumption of meat. Our proposed mechanism is in accordance with medical studies that examine the influence of dietary patterns on the risk of obesity or weight gain. Meat is rich in energy and fat content, and thus may be associated with higher risk of obesity (Wang and Beydoun, 2009). Moreover, we find that the long-lasting effect of the war is larger for individuals who experienced WWII during early childhood (0-4 years old). This is in line with the literature on habit formation (Rozen, 2010). Our results shed light on the hypothesis of a behavioural channel from early-life shocks to adult health.

Section 2 describes the database and the variables of interest. Section 3 discusses

the empirical strategy and several identification issues. The main results are presented in Section 4 while Section 5 illustrates some robustness checks. Finally, Section 6 concludes.

2 Empirical Strategy

According to the literature on childhood circumstances and health later in life, people who have experienced hunger early in life tend to be obese in late adulthood (Havari and Peracchi, 2011; Kesternich et al, 2014; Van den Berg et al., 2015). We show that this is indeed the case for the war cohorts in our sample. We explore regional variation in a continuous difference-in difference framework in order to establish a causal interpretation of our estimates. We thus do not rely on retrospective self-reported incidences of hunger but compare the outcomes of those that were children during the war to those that were unborn, and those that live in regions more or less severely affected by the war. Retrospective self-reported incidences of hunger suffer from recall bias and depend on the socio-economic status of the family of origin.

We first verify that having lived as a child during the war in a region that was severely affected increases the body mass index in late adulthood and then we analyze the proposed behavioral mechanism behind it, i.e. excessive meat consumption later in life. We argue that meat scarcity was a widespread phenomenon during the war in the affected regions, irrespectively from the socio-economic status of the families. This is the case given that a large part of livestock was excised by the German army, died out of malnutrition or got killed by bombing (non-civilian casualties). We conjecture

that the generations that have passed their childhood during the war developed an excessive preference for meat later in life. According to the medical literature, the excessive consumption of meat is related to obesity (Appleby et al., 1998; Wang and Beydoun, 2009) and to the risk of myocardial infarction (Martínez-Ortiz et al., 2006). We find that individuals who experienced the war during their childhood in highly affected regions have on average a higher body mass index of 3-4 points and that the probability of eating meat every day in late adulthood increases by 6 percentage points. Our proposed mechanism is in line with Ruhm (2000) that shows that, by contrast, during recessions people tend to improve their diet by eating less fat and more fruit and vegetables.

We run numerous robustness checks and a placebo test in order to establish causality. In particular we repeat the analysis using alternative measures of the severity of the recession, different age groups among the treated, and the duration of the war instead of a sole dummy. Moreover, we use eating only meat as an outcome variable in order to test whether affected individuals increased the consumption of meat rather than the one of any type of food as a result of experiencing the war during childhood. In order to address the possibility that BMI changes with age independently from having experienced the war or not, we use both the 2003 and the 2011 wave and we define the treated and control groups as individuals of the same age born during and after the war. We also conduct a placebo exercise assuming that the war took place at a different time period than the real one and a triple-difference estimator using the variation among different regions, cohorts and waves. Lastly, we explore gender differences and the possible channels through which the behavioral mechanism operates,

namely the effect of the war separately on weight and height and on other activities that are related to health (sport, smoking, alcohol consumption).

We start our analysis using data from the 2003 Multipurpose Survey on Households: Aspects of Daily Life conducted by the Italian National Statistical Institute (ISTAT). The survey started in 1993 and it is a repeated cross-section of households that runs in an annual basis. We use the 2003 wave because it is the first that collected information on the respondents' height and weight, thus allowing us to compute the body mass index (BMI). We also use the 2011 wave to conduct some robustness and placebo tests and the triple-differences estimation. The survey collects information on the respondents' habits and everyday problems that they face in daily life. In particular, there is information on the eating habits of the respondents for a variety of categories of food. We construct the binary variable "Eat meat every day" which equals 1 if the respondent eats chicken, pork or beef once or more times per day and 0 if the respondent eats chicken, pork and beef sometimes per week, less than once per week or never. Lastly, we draw information on various socio-economic characteristics of the respondent, namely the age, the gender, the educational and occupational level (Table 1).

The original sample includes 53,708 individuals born between 1900 and 2003. For the purpose of our analysis we restrict the sample to 17,221 individuals born between 1934 and 1958. Italy entered WWII in 1940 and experienced casualties until 1946. Therefore, we define the cohort affected by the war during childhood as those individuals born between 1934 and 1946 (i.e. those aged 0-12 during the war).

The impact of WWII has not been homogeneous across the Italian regions. We

proxy the severity of the war at the regional level with two different indicators, namely, the variation of regional GDP per capita between 1943 and 1945 (Daniele and Malanima, 2007) and the number of war victims (deaths out of firearms and explosives) by region (Istat, 1958). We focus on the period 1943-1945 that was the most severe phase of the war (Figure 1) but results go through if we extend the time span to 1940-1946. We express the number of war victims in per capita terms by dividing it with the population in each region in 1936 (Istat, 1976). As Figure 2 shows there is variation in the severity of the war between regions.

Meat scarcity was a very widespread phenomenon during WWII. A reconstructed article based on historical sources describes the complete lack of meat in a municipality close to Bologna, in the northern part of Italy (Figure 3). One of the major reasons was livestock excise by the German army. According to a survey that took place in 1944 in the liberated territory, livestock decreased during the war by 15-55 per cent compared to 1942 (Istat, 1945). Moreover, there were regions where the German army excised up to 32 per cent of the livestock. As Figure 4 shows, the decrease in livestock correlates with the measure of the severity of war (decrease in per capita GDP). Unfortunately, no official data are available for the decrease in livestock in the northern regions of the country that got liberated in 1945. Given that in those regions animal production was widespread (Figure 5) and the war was more severe, one can expect that the decrease in livestock was potentially large. This is in accordance with newspaper articles and other historical sources for specific villages/cities in the North. Figure 6 shows that meat consumption fell sharply during WWII and increased rapidly immediately after (Istat 1976). By contrast, the change in the consumption of food of vegetal origin was

much smoother. Hence, families reacted to meat scarcity with an overconsumption of it as soon as it became available.

3 Regression analysis

Our benchmark specification is specified in (1):

$$BMI_{i,r} = \beta_1(war * severity)_{i,r} + \beta_2(war)_i + \beta_3 X_{i,r} + \beta_4(region)_r + u_{i,r}, \quad (1)$$

where BMI is a continuous variable given by the formula $weight\ in\ kg/(height\ in\ m)^2$, war_i is a dummy that takes the value 1 if the individual was born between 1934 and 1946 (war cohort), and 0 if the individual was born between 1947 and 1958 (after-war cohort), and $severity_r$ proxies the severity of the war in each region with the fall in GDP per capita. The coefficient of interest is β_1 and it is associated with the interaction term of the difference-in-difference specification. We also add a vector of socio-economic characteristics of the respondents, namely their age, age squared, gender, having a university degree, its interaction with gender, having a high school diploma, and a dummy for high occupational level (present or past for those that are currently not employed). In this way we control for possible wealth effects that may influence the body mass index. Lastly, we include regional dummies in order to capture systematic differences in weight and/or height due to the area of origin.

Table 2 reports our results. The coefficient of interest is positive and statistically significant. This result is robust to the inclusion of the socio-economic variables. Quantitatively, those individuals that lived their childhood during the war in a region

that was severely affected have on average a higher body mass index of around 3 points. Considering that the mean BMI in our sample is close to 26 and the threshold of someone to be considered obese is 30, our results imply an increase in the probability of being obese.

We now turn to the mechanism that drives this result. We estimate a linear probability model given by (2):

$$\begin{aligned}(Eat\ meat\ every\ day)_{ir} &= \beta_1(war * severity)_{i,r} + \beta_2(war)_i + \\ &\quad \beta_3 X_{i,r} + \beta_4(region)_r + u_{i,r}, \end{aligned} \tag{2}$$

where the dependent variable is binary and takes the value 1 if the respondent eats chicken, pork or beef once or several times every day, and 0 otherwise.[6] We also include regional dummies to account for the differences in eating habits due to the weather and the culinary traditions of each area. As Table 3 shows, a 10 per cent decrease in GDP per capita during the war leads to an increase in the probability of eating meat every day in late adulthood by 4.2 percentage points. This is a substantial effect given that less than 13 per cent of individuals in our sample eat meat every day.

However, among those who declare eating meat every day there are some (almost 1/3) that also eat fruit, vegetables or pulses several times per day and some (more than 1/10) that eat fish at least once a day. Although eating meat every day cannot be considered as an equilibrated diet in any way, we reestimate the model excluding those who eat fruit, vegetables, or pulses several times per day and those who eat fish[7]

[6] Eating meat every day does not necessarily mean spending more money. Our definition of meat includes chicken that is relatively cheap. Moreover, meat can be of low quality.

[7] The category of fish also includes other types of seafood.

at least once a day. This also enables us to verify whether the increase in obesity is due to a change in dietary composition rather than a change in consumed quantities overall. The specification becomes:

$$\begin{aligned}(Eat\ mainly\ meat)_{ir} &= \beta_1(war * severity)_{i,r} + \beta_2(war)_i + \\ &\quad \beta_3 X_{i,r} + \beta_4(region)_r + u_{i,r}, \end{aligned} \tag{3}$$

where the dependent variable takes the value 1 if the respondent eats meat once or several times per day and fruit, vegetables, and pulses with a lower frequency. The coefficient of interest is statistically significant when we reestimate the model with eat mainly meat as an outcome variable (Table 4). A 10 per cent decrease in GDP per capita during the war leads to an increase in the probability of eating mainly meat in late adulthood by 2.7 percentage points. Considering that only 8 per cent of individuals in our sample eat mainly meat every day, the estimated effect is large.

4 Robustness

In this section we check the robustness of our estimates. First, we redefine the dependent variable "eat mainly meat" in order to account for other types of food that may be related to obesity, namely, sweets and salty snacks. The dependent variable takes now the value one if the individual reports eating meat at least once a day and vegetables, fish, sweets and salty snacks less frequently. As Table 5 shows the results are robust to the redefinition of the dependent variable. Then, we reestimate the model using the number of victims per capita as an alternative proxy of the severity

of the war (Table 6). The effects of the exposure to the war on BMI and eating habits remain statistically significant and similar in size when using the new measure of war intensity.

We then examine whether the effects are heterogeneous across different age groups. We split the treated group into two categories: pre-school (0-4 years old), and school-age (5-12 years old) children during the war. Exposure to WWII during early childhood turns out to be particularly harmful. The impact of the exposure to the war at age 0-4 on BMI and eating habits is large and statistically significant (Tables 7a-7c). A 10 per cent fall in per capita GDP during the war leads to a 4 points increase in BMI, a 6 percentage points increase in the probability of eating meat every day, and a 3.5 percentage points increase in the probability of eating mainly meat every day for the treated cohort. The effects are milder and not statistically significant for those exposed to the war at older ages. This is in line with the literature on the importance of early life conditions (Cunha et al., 2010).

Next, we refine our definition of exposure to the war. In particular, instead of using a dummy equal to 1 for those individuals who aged 0-4 years old during the war, we use the number of years that each individual spent in war during early childhood. The idea is that the effects might be larger for those individuals who lived a larger fraction of their early childhood during the war (see Giuliano and Spilimbergo, 2013 and Malmendier and Nager, 2011 for a similar argument about exposure to recessions).

The model becomes:

$$\begin{aligned}(BMI)_{ir} &= \beta_1(years\ of\ war * severity)_{i,r} + \beta_2(years\ of\ war)_i + \\ &\beta_3 X_{i,r} + \beta_4(region)_r + u_{i,r}, \end{aligned} \tag{4}$$

Table 8 reports the new estimates. The coefficients of interest remain positive and statistically significant confirming our main results. An additional year of exposure to the war during early childhood in a region that experienced a fall of GDP by 10 per cent results in a 1.5 percentage points increase in the probability of being overweight (BMI$\geq$ 25) and a similar increase in the probability of eating meat every day during adulthood.

Exposure to the war may influence not just the probability of obesity during late adulthood but also the occurrence of different health problems. We are examining this possibility by estimating the following linear probability model for the probability of myocardial infarction:

$$\begin{aligned}(Infarction)_{ir} &= \beta_1(war * severity)_{i,r} + \beta_2(war)_i + \\ &\beta_3 X_{i,r} + \beta_4(region)_r + u_{i,r}, \end{aligned} \tag{5}$$

Indeed, the probability of experiencing a myocardial infarction rises by 1.4 percentage points for the treated individuals (Table 9). This is a substantial increase as only 2 per cent of the sample has ever had an infarction. This result points more towards the mechanism we are proposing since dietary habits are strongly linked to heart-related

disorders (Martínez-Ortiz et al., 2006).

In general, eating habits do not seem to change systematically over the lifecycle. However, the BMI might be influenced by age irrespectively from the exposure to the war. Given that the control group is younger than the treated group the estimated effect of war exposure on BMI might just be an age effect. We address this concern in two ways. First, we use the 2011 wave in order to define a control group of the same age as the treated group and second we employ a triple-differences estimation.

For the first approach we redefine the treated and the control group so as the age difference to vanish. To this end we need to use another wave of the survey (as distant as possible from the 2003 wave). We use the 2011 wave which contains the most recent available information. Given that the two waves are relatively close to each other we are obliged to shrink the treated group to those aged 0-7 during WWII (born in 1939-1946) so as not to coincide with the control group. The treated group comes from the 2003 wave and consists of individuals born between 1939-1946 that are between 57-64 years old in 2003. The control group comes from the 2011 wave and is composed by individuals born between 1947-1954 that are between 57-64 years old in 2011. In this way, the individuals in both the treated and the control group have the same age.

We reestimate equations (1)-(3) and (5) and we obtain results that are very much in line with those of the benchmark specification (Table 10). The coefficients are similar in magnitude and the estimates are more accurate than the benchmark. This reassures us that our results are not due to an age effect.

We also conduct a placebo exercise in order to make sure that the results are not simply driven by changes in BMI and eating habits over time and that the common

trend assumption is not violated. We assume that the WWII took place later than the actual date and we define the placebo treated group as those born between 1947-1954 (aging 49-56 in 2003) and the control as those born between 1955-1962 (aging 49-56 in 2011). When we estimate this placebo specification on BMI and eating habits no coefficient is statistically different from zero and their size is 4 times smaller compared to the benchmark (Table 11).

Lastly we employ a triple-differences estimator

$$\begin{aligned}(Eat\ mainly\ meat)_{irt} &= \beta_1(cohort)_i + \beta_2(severity)_r + \beta_3(wave)_t \\ &+\beta_4(cohort * severity)_{i,r} + \beta_5(cohort * wave)_{i,t} \\ &+\beta_6(severity * wave)_{r,t} \\ &+\beta_7(cohort * severity * wave)_{i,r,t} \\ &+\beta_8 X_{i,r} + u_{i,r}, \end{aligned} \tag{6}$$

where *cohort*=1 if the individual is 57-61 years old and =0 if the individual is 49–56; *severity*=1 if the region is among the most severely affected from the war (top 75 percentile), 0 otherwise; *wave*=1 for the 2003 wave and =0 for the 2011 wave of the survey. The coefficient of interest is the one of the triple interaction β_7. The triple interaction equals 1 for the treated individuals, i.e., for those that live in regions severely affected by the war, are 57-61 years old at the time of the interview and were interviewed in 2003 (aged 0-4 during the war). This model allows for differential trends (1) between people of the same age that live in differently affected regions $(cohort * severity)_{i,r}$, (2) people of the same age that experienced the war during their

childhood or not $(cohort * wave)_{i,t}$, and (3) people that live in the same region and experienced the war or not $(severity * wave)_{r,t}$. The results regarding eating habits are reported in Table 12, column 1 and are in line with the ones obtained from the simple difference-in-difference approach. The impact on obesity though (columns 2 and 3) is like in Van den Berg et al. (2015) limited to females.

5 Mechanism

In this section we explore gender differences and the channels through which the behavioral mechanism operates. Tables 13 and 14 present the results for females and males separately. The results hold only for females. This is in line with Van den Berg et al. (2015) who find using an instrumental-variable approach that females who experienced hunger during childhood are more likely to be obese during adulthood. Females of the war have a much higher BMI and a higher probability of being obese. This is not due to the fact that malnutrition during the war led to a decrease in their height. As Table 15 shows, the war did not affect in the long run the height of females while it did increase their weight. Moreover, the war does not seem to have altered other health-related outcomes of females (Table 16). There is no statistically significant effect on the probability of ever being a smoker or on alcohol consumption. Females that passed their childhood in more affected regions during the war have a higher probability of engaging in some form of physical activity that should actually help them lose weight. Lastly, there does not seem to be an educational gradient at work. Females that experienced the war while they were children in more affected

regions do not have a lower probability of getting a university degree or a highschool diploma than females that were born after the war (Table 17).

A possible explanation for the gender difference lies in parents' preferences. According to Istat (1945) the average weight of 2-year-old girls in urban areas of the liberated Italian territory was 1.1 per cent lower in 1944 compared to 1942. By contrast, the average weight of 2-year-old boys in the same period increased by 2.5 per cent. Similarly, in rural areas the average weight loss was 2.9 per cent for girls and only 0.9 per cent for boys. This is suggestive of a more favorable treatment of boys during the war (see Jayachandran and Kuziemko, 2011 for a similar case in India). If girls were the ones who suffered more from hunger and meat scarcity during the war, they would also be the ones overcompensated with meat afterwards, developing in this way a habit of meat overconsumption (see Rozen, 2010). Habit formation may also explain why our results are concentrated among pre-school children (Tables 7a-7c).

Moreover, there is evidence of an intergenerational effect on meat over-consumption. Going back to our data, eating habits are available for every member of the household. Therefore we can identify households with the mother having experienced the war during childhood and study the effect on the other household members who did not experience the war. In particular we focus on sons/daughters aged 18-35 years old. Results (available upon request) show an increase in the probability of eating meat every day and in the probability of eating mainly meat, which are comparable in size to the direct effects on mothers.

6 Conclusions

This paper explores the long-run effects of a severe economic shock during childhood on individual health conditions and eating habits in later life. In particular, we focus on World War II, a destructive event associated with periods of hunger and with meat scarcity in many Italian regions. We use microdata for adults from the 2003 and 2011 Italian Multipurpose Survey on Households, which allow us to identify individuals who experienced the war during their childhood and live in regions less or more severely hit by the war. We use a standard difference-in-difference approach, where we compare eating habits and health conditions of individuals living in areas severely hit by the war to individuals living in less affected areas and, at the same time, individuals hit by the war during their childhood to other individuals. We also employ a triple-differences estimation in order to exclude the possibility that the results are due to age differences between the treated and the control group.

Consistently with the previous literature, we find that individuals living in regions where the effects of the war were more pronounced, tend to suffer more from obesity during late adulthood. Quantitatively, these individuals have on average a higher body mass index of 3-4 points. From a theoretical point of view, both a biological and a behavioral mechanisms could explain our findings. This paper explores a behavioral mechanism at work using information on individual eating habits. We find that a 10 per cent decrease in GDP per capita due to WWII during early childhood leads to an increase in the probability of eating meat every day in late adulthood by 6 percentage points. This result sheds light on the hypothesis of a behavioural channel from early-life shocks to adult health: meat scarcity during the war in the affected regions may

induce individuals to meat over-consumption later in life.

Our results have important policy implications. Italy during WWII was very similar to a developing country. Natural disasters or other major shocks that are common in developing countries may lead to similar behavioral mechanisms with a long-term impact on individuals' health. Moreover, during the Great Recession in Italy meat consumption by households fell. We conjecture that this will lead to an excessive consumption of meat in the future. Taking into account the literature on the effectiveness of early life interventions (Campbell et al., 2014), policy makers should consider increasing awareness of parents and kindergarten teachers regarding obesity and the effects of a non equilibrated diet.

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Table 1. Descriptive statistics

Characteristic	Mean (s.e.)		
	All	War=0	War=1
% obese	13.41	11.74	15.25
% overweight	54.39	50.72	58.43
BMI	25.80	25.49	26.15
	(3.78)	(3.73)	(3.81)
% who had myocardial infarction	2.08	1.03	3.23
% who eat meat every day	13.06	12.36	13.83
% who eat mainly meat	8.17	8.11	8.23
% females	51.38	51.05	51.73
Age	56.32	50.43	62.83
	(7.17)	(3.50)	(3.74)
% with university degree	7.68	9.56	5.61
% with high school diploma	27.26	34.91	18.82
% with high occupational level	9.23	9.79	8.61
N	17,221	9,135	8,086

Corrected for the survey design using the appropriate weights.

War=1 for individuals aged 0-12 during the war.

Table 2. Effects of war on BMI

	(1)	(2)
War*per capita Δ(GDP)	3.20*	3.43**
	(1.72)	(1.68)
War	-0.65	-1.41**
	(0.71)	(0.70)
Regional dummies	Yes	Yes
Individual controls	No	Yes
N	15,657	15,657
R^2	0.019	0.067

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 3. Effects of war on eating habits: eating meat every day

	(1)	(2)
War*per capita Δ(GDP)	0.42***	0.42***
	(0.16)	(0.16)
War	-0.16***	-0.17***
	(0.06)	(0.06)
Regional dummies	Yes	Yes
Individual controls	No	Yes
N	15,440	15,440
R^2	0.016	0.018

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 4. Effects of war on eating habits: eating mainly meat

	(1)	(2)
War*per capita Δ(GDP)	0.27**	0.27**
	(0.13)	(0.13)
War	-0.11**	-0.12**
	(0.05)	(0.05)
Regional dummies	Yes	Yes
Individual controls	No	Yes
N	15,358	15,358
R^2	0.009	0.012

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 5. Effects of war on eating habits: eating mainly meat (new definition)

	(1)
War*per capita Δ(GDP)	0.26**
	(0.11)
War	-0.11**
	(0.05)
Regional dummies	Yes
Individual controls	Yes
N	15,155
R^2	0.010

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 6. Effects of war on BMI and eating habits-alternative measure of war intensity

	(1)	(2)	(3)
	BMI	Eat meat every day	Eat mainly meat
War*per capita victims	2.60*	0.22	0.19*
	(1.62)	(0.15)	(0.12)
War	-0.10	-0.00	-0.01
	(0.15)	(0.01)	(0.01)
Regional dummies	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes
N	17,221	16,967	16,878
R^2	0.066	0.018	0.012

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 7a. Effects of war on BMI-different age groups

	(1)	(2)
	0-4 during the war	5-12 during the war
	BMI	BMI
War*per capita Δ(GDP)	4.39**	0.96
	(2.20)	(1.90)
War	-1.78**	-0.56
	0.91	0.81
Regional dummies	Yes	Yes
Individual controls	Yes	Yes
N	15,657	15,657
R^2	0.067	0.066

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

Table 7b. Effects of war on eating meat every day-different age groups

	(1)	(2)
	0-4 during the war	5-12 during the war
	Eat meat every day	Eat meat every day
War*per capita Δ(GDP)	0.58***	0.09
	(0.21)	(0.18)
War	-0.24***	-0.05
	(0.09)	(0.07)
Regional dummies	Yes	Yes
Individual controls	Yes	Yes
N	15,440	15,440
R^2	0.018	0.017

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

Table 7c. Effects of war on eating mainly meat-different age groups

	(1)	(2)
	0-4 during the war	5-12 during the war
	Eat mainly meat	Eat mainly meat
War*per capita Δ(GDP)	0.36**	0.06
	(0.17)	(0.14)
War	-0.16**	-0.01
	(0.07)	(0.06)
Regional dummies	Yes	Yes
Individual controls	Yes	Yes
N	15,358	15,358
R^2	0.012	0.011

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

Table 8. Effects of years of war on BMI and eating habits

	(1)	(2)	(3)	(4)
	BMI	Prob(overweight)	Eat meat every day	Eat mainly meat
Years of war*Δ(GDP)	0.88	0.14*	0.15**	0.08*
	(0.62)	(0.08)	(0.06)	(0.05)
Years of war	-0.36	-0.06*	-0.06**	-0.04*
	(0.26)	(0.04)	(0.03)	(0.02)
Regional dummies	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes
N	15,657	15,657	15,440	15,358
R^2	0.067	0.070	0.018	0.012

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree,

gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-4 during the war.

Table 9. Effects of war on the probability of myocardial infarction

	(1)
	Prob(infarction)
War*Δ(GDP)	0.14*
	(0.08)
War	-0.06*
	(0.03)
Regional dummies	Yes
Individual controls	Yes
N	15,363
R^2	0.018

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-4 during the war.

Table 10. Effects of war on BMI, myocardial infarction and eating habits-same age

	(1)	(2)	(3)	(4)
	BMI	Eat meat every day	Eat mainly meat	Prob(infarction)
War*Δ(GDP)	4.29***	0.42**	0.29*	0.31***
	(1.79)	(0.21)	(0.17)	(0.12)
War	-1.91***	-0.16*	-0.11	-0.16***
	(0.74)	(0.09)	(0.07)	(0.05)
Regional dummies	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes
N	8,306	8,180	8,134	7,874
R^2	0.045	0.021	0.014	0.012

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree,

gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-7 during the war.

Table 11. Effects of war on BMI and eating habits-placebo

	(1)	(2)	(3)
	BMI	Eat meat every day	Eat mainly meat
Placebo war*Δ(GDP)	0.98	0.20	0.05
	(1.63)	(0.20)	(0.16)
Placebo war	-0.29	-0.08	-0.01
	(0.67)	(0.08)	(0.07)
Regional dummies	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes
N	9,353	9,245	9,195
R^2	0.089	0.018	0.015

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-7 during the placebo war.

Table 12. Effects of war on eating habits-triple difference

	(1)	(2)	(3)
	Eat mainly meat	BMI	Prob(overweight)
		females	females
cohort	0.02	0.23	-0.02
severe	0.02**	-0.18	-0.06**
wave	0.01	-0.08	-0.01
cohort*severe	-0.01	-0.51	-0.05
cohort*wave	-0.02	-0.35*	-0.02
severe*wave	0.00	-0.40	-0.04
cohort*severe*wave	0.05**	0.82**	0.11*
Regional dummies	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes
N	15,855	7,921	7,921
R^2	0.007	0.015	0.014

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

Table 13. Effects of war on obesity, BMI, and eating habits-females

	(1)	(2)	(3)	(4)
	Prob(obese)	BMI	Eat meat every day	Eat mainly meat
War*Δ(GDP)	0.49**	5.14**	0.50**	0.41**
	(0.22)	(2.60)	(0.21)	(0.17)
War	-0.20**	-2.14**	-0.20**	-0.17**
	(0.09)	(1.08)	(0.09)	(0.07)
Regional dummies	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes
N	7,985	7,985	7,856	7,815
R^2	0.017	0.065	0.021	0.013

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 14. Effects of war on obesity, BMI, and eating habits-males

	(1)	(2)	(3)	(4)
	Prob(obese)	BMI	Eat meat every day	Eat mainly meat
War*Δ(GDP)	-0.06	1.69	0.35	0.13
	(0.22)	(2.08)	(0.23)	(0.20)
War	0.03	-0.68	-0.15	-0.06
	(0.09)	(0.87)	(0.10)	(0.08)
Regional dummies	Yes	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes
N	7,672	7,672	7,584	7,543
R^2	0.009	0.022	0.016	0.009

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 15. Effects of war on height and weight-females

	(1)	(2)
	weight	height
War*Δ(GDP)	15.19**	1.81
	(7.14)	(3.73)
War	-6.15**	-0.49
	(2.96)	(1.56)
Regional dummies	Yes	Yes
Individual controls	Yes	Yes
N	7,985	7,985
R^2	0.040	0.030

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 16. Effects of war on other activities that can affect health-females

	(1)	(2)	(3)
	Prob(sport)	Prob(smoking)	Prob(alcohol)
War*Δ(GDP)	0.59*	-0.07	-0.07
	(0.31)	(0.30)	(0.07)
War	-0.26**	0.01	0.03
	(0.13)	(0.12)	(0.03)
Regional dummies	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes
N	7,689	7,847	7,613
R^2	0.118	0.064	0.005

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

Survey weights used.

Individual characteristics: age, age squared, gender, university degree, gender*university degree, high school diploma, high occupational level.

War=1 for individuals aged 0-12 during the war.

Table 17. Effects of war on educational attainment-females

	(1)	(2)
	Prob(university)	Prob(high school)
War*Δ(GDP)	0.13	0.07
	(0.15)	(0.26)
War	-0.05	-0.03
	(0.06)	(0.11)
Regional dummies	Yes	Yes
Individual controls	Yes	Yes
N	7,985	7,985
R^2	0.018	0.061

*** p<0.01, ** p<0.05, * p<0.1 (robust s.e.).

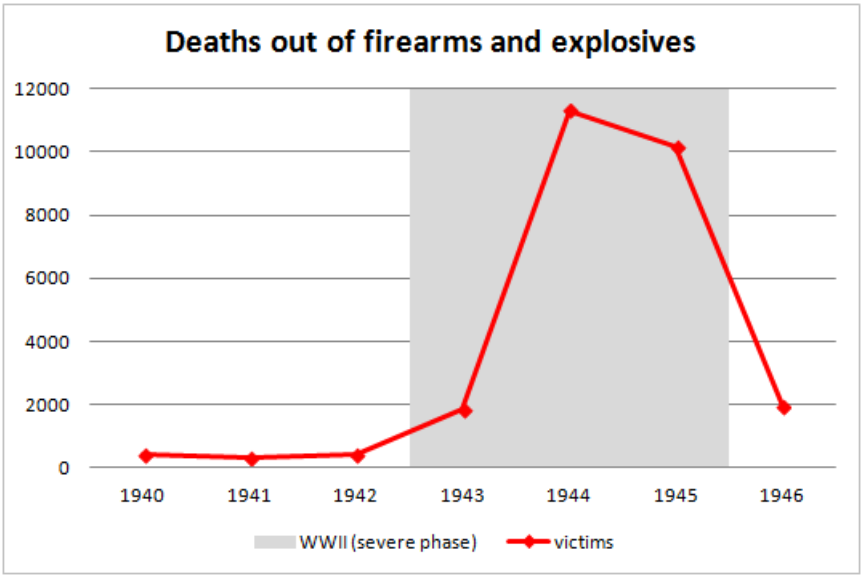
Survey weights used.

Individual characteristics: age, age squared, gender.

War=1 for individuals aged 0-12 during the war.

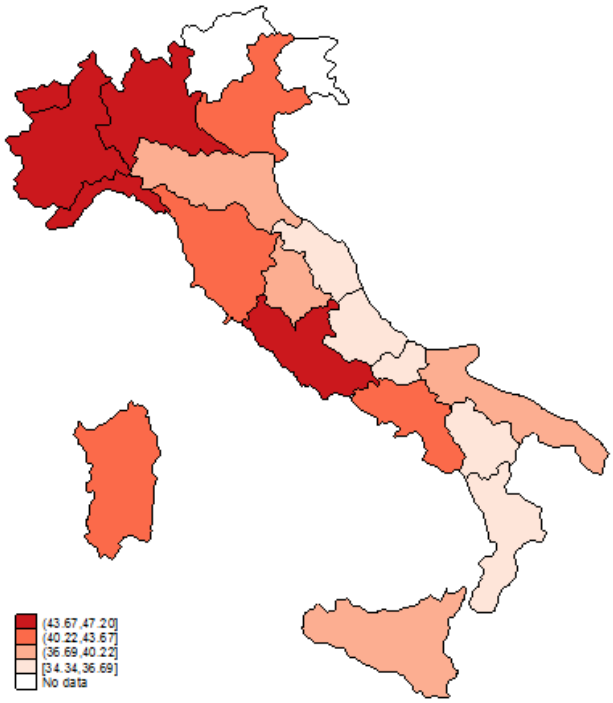
7 Appendix

Figure 1. Number of war victims-entire Italian territory



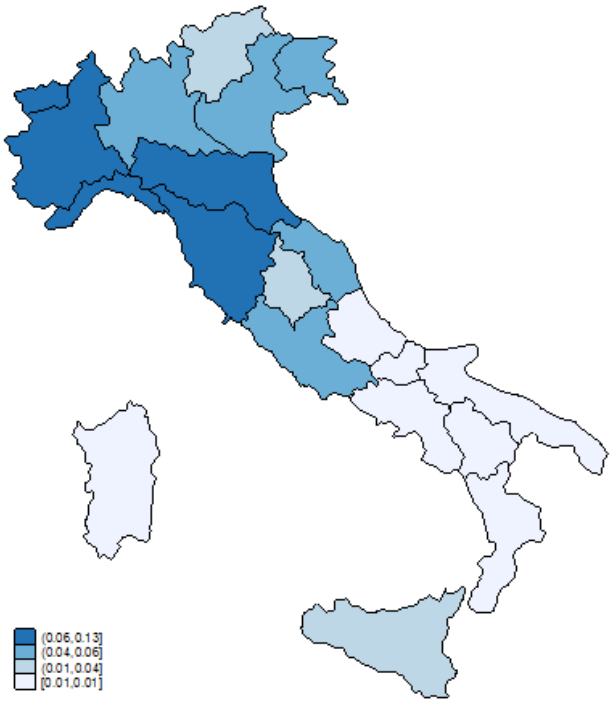
Source: Istat (1958).

Figure 2. Regional measures of the severity of the war



Decrease in GDP per capita

Source: Daniele & Malanima (2007).



Victims per capita

Source: Istat (1958).

Figure 3. A reconstructed article based on historical sources


SASSO MARCONI
maggio 1945

BAMBINI: PRIMO CENSIMENTO DEGLI ORFANI. SONO 1002, DI CUI 400 PER LE DEPORTAZIONI E LE FUCILAZIONI NAZISTE E REPUBBLICHINE

CAMPI MINATI

CALENDARIO SCOLASTICO

IL CONTO DEI PROFUGHI

«Tutto è da ricostruire ed è bene farlo subito. Poi tutto migliorerà»

Alfonso Canova, primo sindaco della Liberazione. Il 2 maggio prende possesso del Comune

VLADIMIR LANG, IL PIÙ GIOVANE SALVATO

«Sono vivo grazie a Canova»

L'aiuto della rete clandestina

LICEO FERMI

PERCHÉ IL 25 APRILE? Giornale storico

TAGLIE, SPARIZIONI, SEQUESTRI E OMICIDI

Il manifesto del CLN contro la violenza

GLI ALBAHARI E I LANG, EBREI, SALVATI DA ANNA DI BERNARDO, GIOVANE SEGRETARIA DEL SINDACO

«Ho fornito documenti falsi, carte d'identità e tessere annonarie»

Emerge il problema della fame: interviene la Prefettura

(Translation from Italian)

The problem of hunger emerges: The prefecture intervenes

The alimentary conditions are anything but encouraging. The assignment of May was not made, because the area does not have enough resources to meet the basic needs. There is absolute lack of fat. There is need for wheat, milk for children, sugar, meat, salt. The city asked the assignment of wine as a supplement for the scarce alimentation. Given that a scarce harvest is foreseen it will be exercised more scrupulous control over threshing in order to fill the "Granai del Popolo" (obligatory wheat storage deposits established by the Government) with the whole allocable wheat. The milk producers have the obligation to deliver it all, except for ¼ liter for each of their family members. It is estimated a loss of 90% of livestock, excised by the Germans. Any abandoned livestock must be recovered. The slaughter is prohibited.

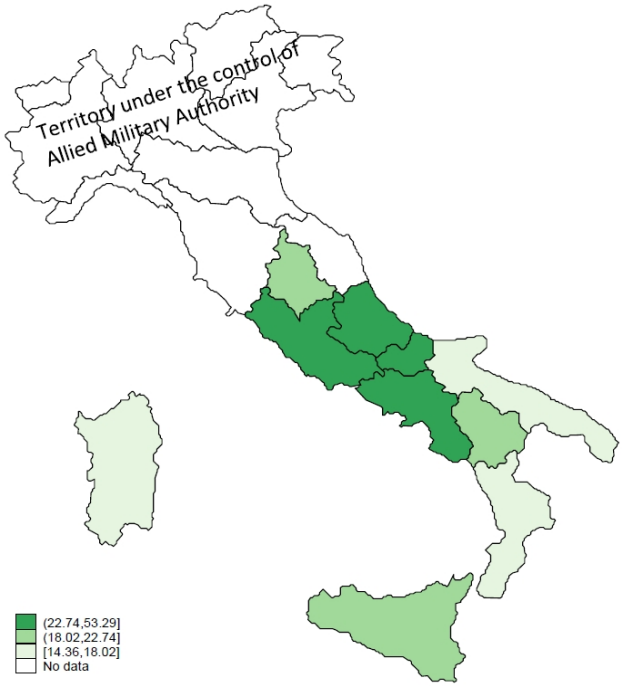
Emerge il problema della fame: interviene la Prefettura

La situazione alimentare è tutt'altro che rallegrante. L'assegnazione di maggio non è stata fatta, perché la zona non ha risorse per soddisfare alle prime necessità. Mancano in modo assoluto i grassi. C'è bisogno di grano, latte per bambini, zucchero, carne, sale. Il Comune ha chiesto l'assegnazione di vino per integrare la scarsa alimentazione. Prevedendosi un raccolto scarsissimo, sarà esercitato il più scrupoloso controllo sulla trebbiatura per far affluire ai Granai del Popolo tutto il grano conferibile. I produttori di latte hanno l'obbligo di consegnarlo, ad eccezione di ¼ di litro a testa per famiglia. Si calcola una perdita del 90% di bestiame, asportato dai tedeschi. Il bestiame abbandonato dovrà essere recuperato. La macellazione è vietata.

Veronica Angelozzi
Francesca Mazza

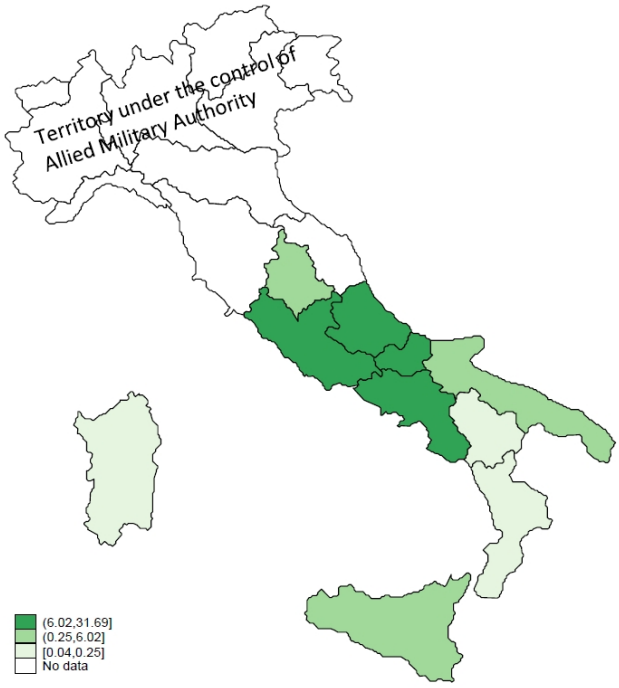
Source: www.storiamemoria.it/node/4883

Figure 4. Regional measures of livestock in 1944-liberated territory



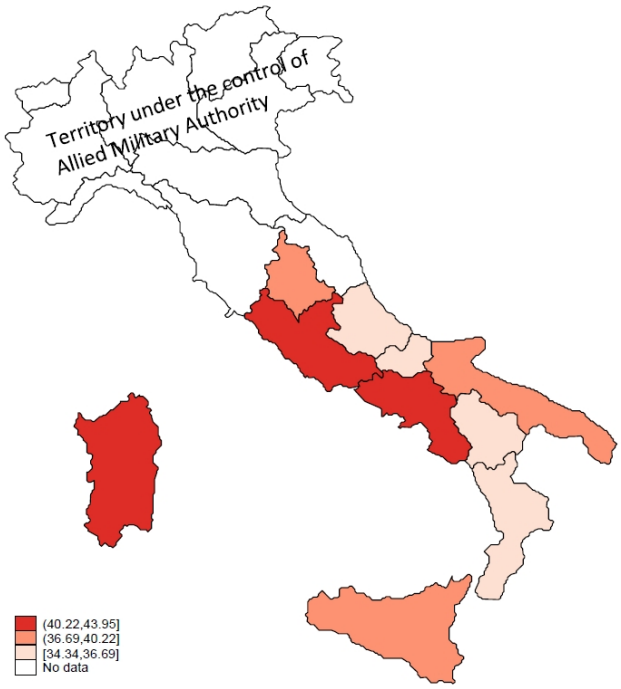
Decrease in livestock

Source: Istat (1945).



Livestock excised by the German army

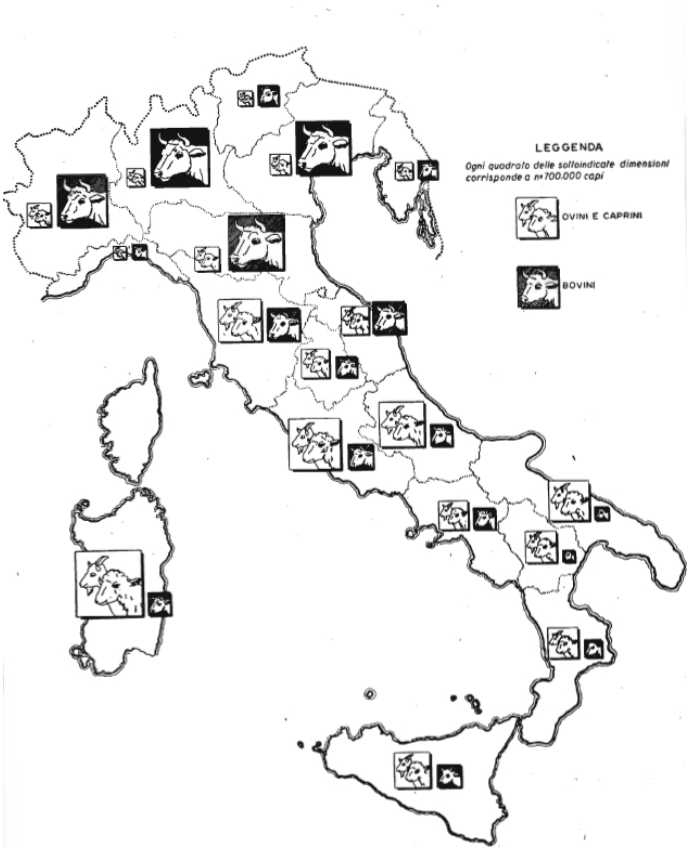
Source: Istat (1945).



Decrease in GDP per capita

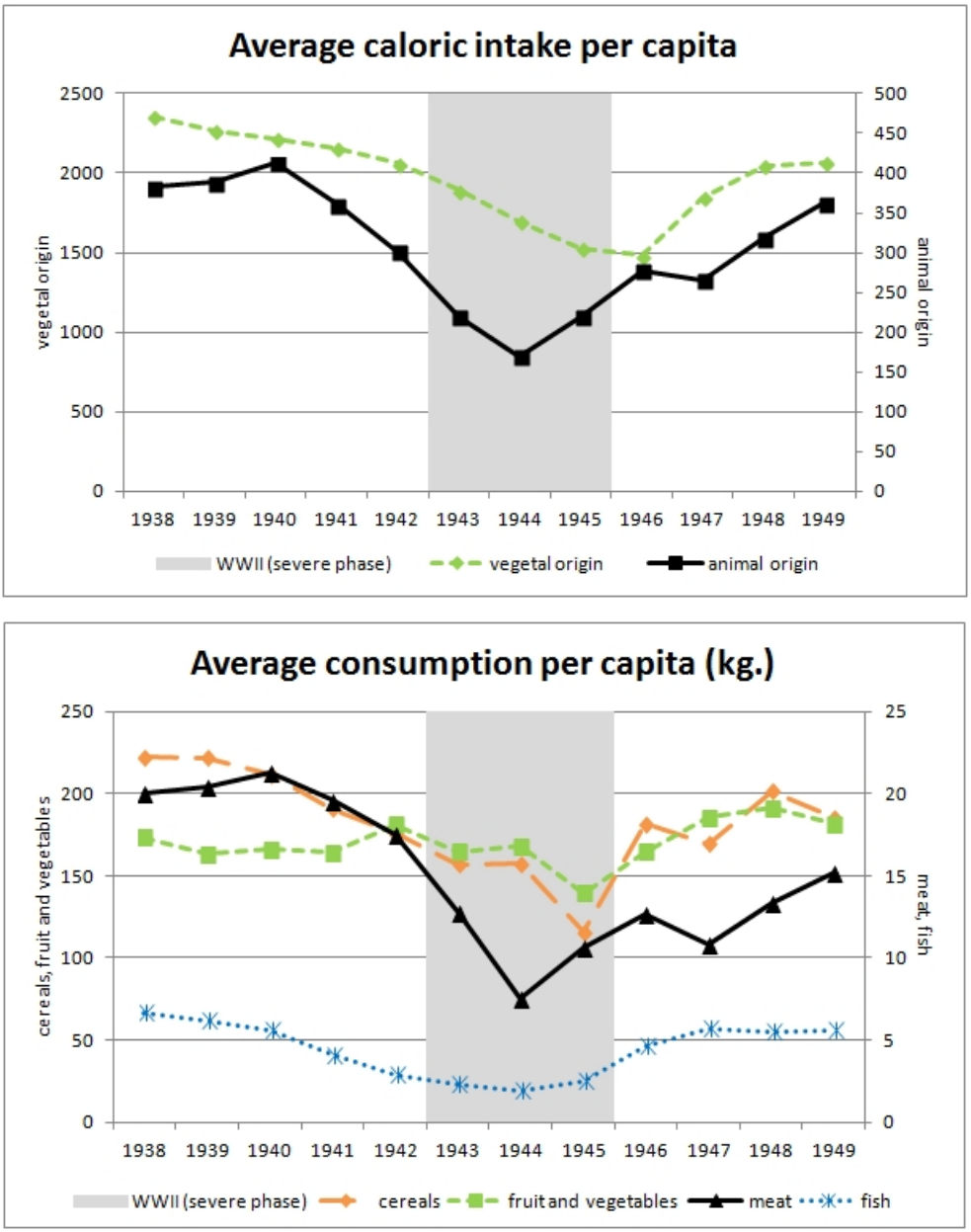
Source: Daniele & Malanima (2007).

Figure 5. Regional measures of livestock before the severe phase of WWII (1942)



Istat (1947).

Figure 6. Caloric intake and consumption by food categories



Source: Istat (1976).