Eating Habits: The Role of Early Life Experiences and Intergenerational Transmission

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Abstract

This study explores the long-run effects of a temporary scarcity of a consumption good on individuals' preferences towards that good when the shock is over. We focus on people that passed their childhood during World War II and exploit the temporary fall in meat availability that they experienced early in life. We combine hand collected historical data on the number of livestock at the regional level with microdata on eating habits and meat consumption. By exploiting cohort and regional variation in a difference-in-differences estimation, we show that individuals that as children were more exposed to meat scarcity tend to consume more meat during late adulthood. Consistently with medical studies on the side effects of meat overconsumption, we find that these individuals have also a higher probability of being overweight and suffer from cardiovascular disease. The effects are larger for women and persist intergenerationally as the adult children of mothers who have experienced meat scarcity also tend to over-consume meat. Our results point towards a behavioral channel from early-life shocks into adult health and eating habits that we illustrate through a theoretical model of reference dependence and taste formation.

JEL classifications: D12, I10, N44

Keywords: eating habits, early life experiences, intergenerational transmission, reference dependence, World War II, gender differences.

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1 Introduction

In the public debate, it is often assumed that the widespread availability of food, especially the one with a high fat content, is an important determinant of bad eating habits, obesity, and cardiovascular diseases. In principle, one could infer that the scarcity of food with a high-fat content may be favorable for individual health.[1]

In this paper, we investigate whether experiencing the lack of a good in a certain period induces any long-run reaction in consumption when the good becomes available again. We prove that the link between a temporary scarcity of food and individuals' consumption is long-lasting and it can even go beyond the single generation.

We focus on the causal long-run relationship between meat scarcity during childhood and eating habits later in life and exploit an early-life experience that is not susceptible to endogeneity problems and guarantees randomness in the exposure to the shock. More specifically, we use unique historical information at the regional level on changes in the availability of livestock during World War II (hereafter WWII) in Italy. During WWII, the fall in economic activity was associated with hunger, especially among families of low socio-economic status. Differently from hunger, meat scarcity was a widespread phenomenon irrespectively from the socio-economic status of the families. This is because a large part of livestock was excised in order to fulfill the dietary requirements of the German army, got killed by bombing, or died due to malnutrition. We argue that the reduction in livestock led to a significant reduction in meat availability during those years and examine the effects of the exposure to meat scarcity during childhood on the consumption of meat in later life. To achieve identification we use a difference–in-differences estimator and exploit regional and cohort variation in livestock-related events in Italy. In particular, we compare the eating habits of individuals that belong to different cohorts (passed their childhood during or after WWII) and live in areas differently exposed to the reduction in livestock (continuous measure). To do so, we rely on data from the Italian Multipurpose Survey on Households and select individuals who were differentially exposed to meat scarcity during their childhood, for whom we can observe the eating habits, the BMI, and other health outcomes later in life. We then extend the analysis to the next generation, i.e., the adult children of the control and treated cohorts.

We find that individuals who were exposed to meat scarcity during early life have a higher probability of eating meat every day in their later life. Although the effects are statistically significant among males and females of all ages, they are particularly strong among females that experienced meat scarcity at the ages 0-2. This is in line with the literature on the detrimental effects of shocks that occur early in life (See, for

[1] For example, Ruhm (2000) shows that people tend to improve their diet by eating less fat and more fruit and vegetables during recessions.

example, Conti et al., 2016). We provide suggestive evidence that the gender difference is due to the preferential treatment of sons over daughters by parents during WWII. More specifically, we find that among 2-year-old children, girls on average experienced a bigger weight loss than boys between 1942 and 1944. This gender gap is wider among children of manual workers in rural areas. Presumably, parents prioritized sons over daughters in the allocation of the scarce quantity of meat during WWII. The literature on developing countries documents a similar finding of gender differences in breastfeeding (Jayachandran and Kuziemko, 2011). Since we find that higher relative scarcity during childhood leads to higher consumption later in life, this may explain why the estimated effects are stronger for females. The observed overconsumption of meat later in life among individuals aged 0-2 during WWII may also be a result of a compensatory investment by their parents, in the spirit of Yi et al. (2015). In other words, when WWII ended, parents tried to offset the meat scarcity that their children experienced during the war by providing them with relatively more meat. In this way, these children developed an increased desirability for meat. By contrast, children who were born after WWII and comprise our control group were unaffected as they did not experience any meat scarcity.

Since meat is rich in fat content, its overconsumption can have negative consequences on individual health. Indeed, we find that females that experienced more meat scarcity during childhood tend to have higher BMI and a higher probability of being overweight later in life. This result is consistent with medical studies that examine the influence of dietary patterns on the risk of obesity or weight gain (Wang and Beydoun, 2009). Moreover, for these individuals, we also find an increased probability of suffering from cardiovascular disease, in line with recent medical findings that link red and processed meat consumption with a higher risk of heart disease (Zhong et al., 2020). Therefore, policies such as a consumption tax that is too high and leads to temporary scarcity may backfire in the long-run and have the opposite effects than the intended ones. Moreover, our results stress the importance of compensating adverse early-life conditions through adequate policies in order to avoid side effects on health in later life.

We put forward two sets of evidence in favor of a behavioral mechanism. First, increases in BMI of the treated individuals occur through increases in weight rather than decreases in height. Second, in the spirit of Kesternich et al. (2015) on the effects of hunger, we use additional data at the household level to estimate Engel curves and document an increase in the share of food expenditure over total expenditures among households with a treated female member. However, food expenditures at the household level make it hard to distinguish between price/quality and quantities (Griffith et al., 2016) and are an aggregate measure of the consumption of all household members. Our main dataset on individual eating habits allows us to observe the eating habits of each member of the household separately and to disentangle changes in food quality from changes in food quantity, reinforcing the interpretation of the behavioral channel.

We then extend the analysis to the next generation and find that the effect persists intergenerationally, i.e., we observe it even among the adult children of the women that had experienced meat scarcity. Therefore, regional differences in meat availability affect the tastes and eating habits within and between generations. This is in line with Atkin (2013), who documents that the regional differences in taste depend on the local abundance of foods. This long-lasting effect may occur under a process of habit formation. In this case, current utility depends not only on current consumption but also on a habit stock formed (Rozen, 2010). In such a framework, one temporary shock in the availability of an item may influence its consumption also in the long run.

Our findings speak to a very recent literature that studies the effects of shocks on health and educational outcomes of multiple generations (Akresh et al., 2017; Vågerö et al., 2018; Black et al., 2019; Havari and Peracchi, 2019; Costa et al., 2021). Our paper is the first to document that shocks to food availability lead to intergenerational effects in eating habits and to provide evidence of intergenerational transmission through a behavioral rather than a biological mechanism. We uncover a channel that directly explains the intergenerational linkages in consumption behavior through the transmission of taste from treated mothers to their children and operates beyond the transmission of income (Waldkirch et al., 2004). Furthermore, we show that this is not a mere peer effect among all members of the same family as we do not detect any change in the eating habits of their husbands.

We contribute to the literature that studies how attitudes are transmitted from parents to children. The transmission may include risk or time preferences and beliefs (Fernández et al., 2004; Dohmen et al., 2012; Zumbuehl et al., 2021) and may explain intergenerational persistence in a diverse set of economic outcomes such as income and education, as well as health (See, for example, Heckman, 2008; Björklund and Salvanes, 2011; Black and Devereux, 2011; Holmlund et al., 2011; Lindahl et al., 2016). A common central assumption in these theories is that parents and the socioeconomic environment affect the transmission of preferences and beliefs (Bisin and Verdier, 2001; Doepke and Zilibotti, 2008). In this paper, we show how the parents' past experience and their consumption behavior is affecting the preferences of future generations.

In Section 2, we develop a theoretical model that provides economic intuition on our empirical results. We consider an intertemporal optimization problem with reference dependence and non-separable time preferences in meat consumption and show the importance of the past consumption experience to the current consumption of each generation. To explain current consumption, it should be that past consumption experience is affecting the preferences and the desirability for the good. In line with our empirical evidence, we show that the population that experienced meat scarcity acquires a habit of meat consumption and increased desirability for it. On the other hand, the next generation that experienced abundance develops a taste for meat that reinforces its consumption. The model highlights the role of the economic environment and preferences in shaping food consumption patterns across generations. In a similar vein, Dubois et al. (2014) suggest that the interplay between prices and preferences is key in understanding cross-country differences in food purchases.

Our results are robust to controlling for other effects of WWII at the regional level (casualties or fall in GDP per capita) as well as to the use of different measures of meat scarcity. We show that our findings are not driven by selective fertility or infant mortality or by age differences between the treated and the control group and address concerns related to mobility and the differential evolution over time of regions with different degrees of livestock scarcity during WWII. Moreover, our findings are not driven by the general deprivation induced by WWII as we control for individuals' socio-economic status and we do not find any statistically significant effect of meat scarcity on the consumption of sweets or snacks. Instead, we establish a direct link between meat scarcity and meat overconsumption later in life.

There is a growing literature focusing on the contemporaneous relationship between food availability, eating habits and health. These studies typically exploit an exogenous shock, which changes food availability or price in a certain region or country and look at its consequences on obesity and health. For instance, Fletcher et al. (2010) and more recently Dubois et al. (2020) study the effect of soft drink taxes on the consumption of soda while Lakdawalla et al. (2005 and 2009) show that about 40 per cent of the increase in obesity in the US from 1976 to 1994 is attributable to lower food prices through agricultural innovation. More recently, Dragone and Ziebarth (2017) use the German reunification as a natural experiment and show that East Germans changed their diet after the fall of the Wall by consuming novel Western food products. Other papers explicitly focus on fast food restaurants as potential contributors to obesity. Currie et al. (2010) investigate how changes in the supply of fast food restaurants affect weight outcomes of children and pregnant women. They find a significant effect on childhood obesity rates and the probability of gaining over 20 kilos during pregnancy. Conversely, Anderson and Matsa (2011) find no evidence of a causal link between restaurants and obesity. They deal with the link between eating out and obesity using the presence of Interstate highways in rural areas as an instrument for restaurant density. Davis and Carpenter (2009) use a cross-section of individual-level student data from the California Healthy Kids Survey to examine the relationship between fast-food restaurants near schools and obesity among middle and high school students. They find a significant negative effect on the amount of fruits and vegetables consumed and a positive effect on the probability of being overweight. These papers focus on the short-run effects of either an increase in food quantity or a reduction in its price and rarely observe individual eating habits. In the short run, people's reaction may be driven by both a rational price-based explanation and a behavioral explanation, but it is impossible to disentangle the two effects. Furthermore, most of these papers focus on very specific target groups (students, people living in specific areas or near fast foods, pregnant women) and cannot easily generalize their results to the whole population. Finally, none of them investigates whether there is an intergenerational transmission of these effects. Instead, in this paper, we study the effects of a temporary fall in food availability on eating habits when the shock is over. In this case, the price effect is no longer present, and only a behavioral mechanism is at work. Furthermore, in the long run, we can observe the effects of a shock both within and between generations.

The reason why we focus on Italy is threefold. First, Italy was among the countries directly affected by the negative shock in the availability of meat. Second, unique historical data on livestock availability by region during WWII and detailed survey data allow us to observe height, weight, and individual eating habits for different cohorts and generations. Third, although Italy has a low obesity rate among adults, it exhibits together with Spain and Greece one of the highest childhood obesity rates in Europe (OECD, 2019). Therefore, the intergenerational effects that we document have direct policy implications.

Several papers have shown that past experience matters for individuals when making other types of decisions. For instance, Malmendier and Nagel (2011) study the impact of the exposure to low stock-market returns during the Great Depression on the household's current risk-taking in investment, while Malmendier et al. (2011) focus on the effect of the Great Depression on the behavior of Chief Executive Officers who grew up in the 1930s. Giuliano and Spilimbergo (2014) investigate the effects of having experienced a recession during youth on the formation of beliefs in the future, and Aizenman and Noy (2015) study the degree to which past adverse income shocks increase the saving rates of affected households. Bucciol and Zarri (2015) find that having experienced the loss of a child is associated with lower and less frequent investments in risky assets, even in the long-run. Our paper is the first to show the importance of past experience in shaping consumption and eating habits.

We also contribute to the empirical literature on the impact of macroeconomic conditions and hunger during childhood on health and consumption later in life. 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. Other papers focus on hunger and exposure to warfare while in utero or during early childhood and find negative effects on adult health (See Akbulut-Yuksel, 2014; Kesternich et al., 2014; Havari and Peracchi, 2017; and Atella et al., 2017).[2] Van den Berg et al. (2016) 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. These causal relationships linking early-life (socio-economic) conditions and health during adulthood has been explained by the literature mainly by a biological mechanism.[3] 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. Though advantageous for short-term survival, these alterations 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 results from exposures to risk factors also across the lifetime, so exposure to the adverse environment in early life may set individuals on unfavorable life trajectories. Instead, we shed light on a behavioral mechanism, which until now has received little attention by the literature: scarcity of a specific good leaves a mark on individuals' preferences and attitudes towards that good, which in turn affects their consumption behavior.

The rest of the paper is organized as follows. Section 2 sets out a theoretical model of reference dependence and taste formation to motivate the empirical analysis. Section 3 describes the data and Section 4 sets forth our identification strategy. Section 5 presents the results for both generations and discusses the underlying mechanisms. Section 6 performs various robustness checks and a placebo exercise. Finally, Section 7 concludes.

2 Model

We develop a model to shed light on the economic forces that lead a consumer who suffered from a scarcity of a consumption good in her early life to over-consume it later in her life.

We consider an inter-temporal optimization problem where a forward-looking consumer has a taste for variety. We assume non-separable time preferences, namely that consumption in the past affects current and future consumption. The utility function is

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

[3] See Parsons et al. (1999); Kuh and Ben-Shlomo (2004); Banerjee et al. (2010); Akresh et al. (2012), as well as Almond and Currie (2011) for an excellent review.

represented by the following function:

$$U(m_t, g_t, M_t),$$

where m_t is the consumption of meat, and g_t the consumption of all the other goods. Moreover, M_t is the past consumption experience with meat. We assume that the intertemporal preference for meat consumption is non-separable.

We assume that M_t affects the marginal utility of current consumption. Thus the cross derivative U_{mM} is potentially different than zero. The current consumption choice of m_t will become part of the future past consumption experience. Similarly to Becker and Murphy (1988), the past consumption experience depreciates over time at a constant rate δ:

$$\dot{M}_t = m_t - \delta M_t.$$

Moreover, we assume that the consumer's utility is affected differently by past consumption, depending on whether the cumulative consumption is above or below a reference point. This reference point could be interpreted as the minimum cumulative intake of meat that an individual needs. Suppose the cumulative consumption is below the minimum required cumulative consumption. Then, the consumer has experienced scarcity, which could affect the marginal utility of consumption in a different way than in the case the consumer had experience abundance.

The consumer solves her intertemporal optimization problem subject to her dynamic budget constraint. Given income Y_t, assets A_t, the market interest rate r_t, and the price p_m^t and p_g^t, the dynamic budget constraint is given by:

$$\dot{A}_t = r_t A_t + Y_t - p_m^t m_t - p_g^t g_t.$$

To capture the differences within the same generation in the consumers' experience with meat consumption during early life, we assume that the initial conditions are different. The consumer that experienced significantly less availability of meat has an initial condition, M_o^{nm}, which is smaller than that of a consumer who did not experience such severe unavailability of meat, $M_o^{nm} < M_o^m$.

The consumer maximizes the following inter-temporal utility function choosing the path of meat and other goods consumption subject to the following constraints:

$$\begin{aligned}
&\max_{\{m_t, g_t\}} \int_0^\infty e^{-\rho t} U(m_t, g_t, M_t) dt \\
&s.t. \quad \dot{A}_t = r_t A_t + Y_t - p_m^t m_t - p_g^t g_t \\
&\qquad \dot{M}_t = m_t - \delta M_t,
\end{aligned}$$

where ρ is the inter-temporal discount factor.

We follow Becker and Murphy (1988) and consider a second-order linear approximation of the utility:

$$U(m_t, g_t, M_t) = m_t\left(\hat{m} - \frac{m_t}{2}\right) + g_t\left(\hat{g} - \frac{g_t}{2}\right) + U_{mM}m_t(M_t - M^*).$$

Differently from Becker and Murphy (1988), we introduce $U_{mM}m_t(M_t - M^*)$. As mentioned above, the marginal utility of consumption m_t is different if M_t is smaller or bigger than M^*, namely if the consumer has experienced severe scarcity in the past or not. Thus, the consumer values its consumption not only in absolute terms but also in relative terms with respect to the amount she should have consumed in the past. This means that populations that have experienced scarcity, e.g. because of a war, would value meat differently than a population that did not experience such scarcity during childhood. The next generation, i.e. the offspring of those who experienced the war during childhood, was born during a period of abundance and prosperity.

To solve this maximization problem, we construct the Hamiltonian Jacobian Bellman (HJB) equation. The associated (HJB) with this maximization problem is:

$$\rho V(M_t, A_t) = max_{m_t, g_t}\{U(m_t, g_t, M_t) + V_M\dot{M}_t + V_A\dot{A}_t\},$$

where $V(M_t, A_t)$ is the optimal value function.

The policy functions that result from this maximization problem are provided in Proposition (1)

Proposition 1 *The optimal consumption decision of meat at each point in time is a linear function of the consumption experience at time 0, and a constant that depends on the steady state, M^* and parameters :*

$$m_t = (\delta - \alpha_t)M_{SS} - U_{mM}M^* + \alpha_t M_o. \qquad (1)$$

The policy function can now be used to calculate the differences between the optimal consumption decisions of consumers who experienced relatively severe scarcity and of those who did not. As we show in the appendix, the steady state M_{SS} is independent of the initial conditions, and thus it is the same between the two groups. The intuition is that by the end of their lives, the effect of scarcity in their consumption vanishes.

Within generation consumption difference. Let's first analyze the differences in consumption within the first generation, namely the ones who experienced meat scarcity during WWII. The sign of the difference Δm_t depends on α_t and the difference in the initial conditions:

$$\Delta m_t = m_t^{nm} - m_t^m = \alpha_t (M_0^{nm} - M_0^m). \quad (2)$$

If past cumulative consumption is not relevant and is not affecting the utility of the consumer, namely meat is not habit forming, then it should be that $U_{mM} = 0$. In this case, there should be no difference between the consumption of those who experience relative more scarcity of meat, m_t^{nm}, and those who experienced less scarcity, m_t^m, $\Delta m_t = m_t^{nm} - m_t^m = 0$. If past cumulative consumption is affecting the utility then $U_{mM} \neq 0$. The empirical analysis can identify the value and sign of U_{mM} using the difference in the initial conditions, namely the consumption during their early life, and their consumption during the transition to the long run equilibrium.[4]

Interestingly, the sign of the difference Δm_t is independent of the level of the reference point since both the M^* and the preferences are the same within the same generation. The coefficient α_t is positive if $U_{mM} > 0$ and it is negative if $U_{mM} < 0$.[5] Thus, we can derive conclusions observing the initial conditions, that are summarized in the following Proposition (2).

Proposition 2 *Let* $M_{0,1st}^{nm} < M_{0,1st}^m$ *then:*

1. *If* $U_{mM}^{1st} = 0$ *then* $\Delta m_t^{1st} = 0$ *and* $m_{t,1st}^{nm} = m_{t,1st}^m$.
2. *If* $U_{mM}^{1st} < 0$ *then* $\Delta m_t^{1st} > 0$ *and* $m_{t,1st}^{nm} > m_{t,1st}^m$.
3. *If* $U_{mM}^{1st} > 0$ *then* $\Delta m_t^{1st} < 0$ *and* $m_{t,1st}^{nm} < m_{t,1st}^m$.

When we link the theoretical model with the empirical results, we see that the first generation which experienced different degrees of meat scarcity during WWII has later a relatively higher desirability for it. Thus, the empirical result is that the consumer who suffered at her early life from low availability of meat[6], $M_{0,1st}^{nm} < M_{0,1st}^m$, will demand more meat in the future $m_{t,1st}^{nm} > m_{t,1st}^m$. The theory predicts that this happens when $U_{mM}^{1st} < 0$, consequently when this generation acquired a habit for consuming meat. The intuition is, that if this cross derivative is negative, $U_{mM}^{1st} < 0$, then, the shock of the scarcity of meat at an early age makes meat much more desirable. The more scarcity someone has experienced, the more desirable meat becomes and this is why we observe $m_{t,1st}^{nm} > m_{t,1st}^m$.

[4]In the theoretical model, we do not make any assumption about the sign of U_{mM}.

[5]See Appendix.

[6]The initial conditions of those that experienced relatively more scarcity are positive and not zero, hence meat is not an unknown food for anybody.

How the next generation is affected. The next generations, namely the children of the generation born during WWII, did not experience any scarcity in meat consumption. They were born and brought up during a period of prosperity and abundance. Suppose our assumption that the meat's valuation depends on whether the population has experienced abundance or scarcity is correct. In that case, it should be that the next generation has a different U_{mM}. In other words, the state of the economy affects the preferences of consumers.

Moreover, we assume that the second generation's initial condition in their early life is their parents' consumption in that period. Thus, we can assume that the parents that experience relatively more scarcity during the war and consume relatively more later during their life, will provide more meat to their children. This means that their children will have higher initial conditions than the children of parents who experienced relatively less scarcity, namely $M^{nm}_{0,2nd} > M^{m}_{0,2nd}$.[7] Then, the difference in consumption within the generation of the children depends again on equation (2).

Proposition 3 *Let* $M^{nm}_{0,2nd} > M^{m}_{0,2nd}$ *then:*

1. *If* $U^{2nd}_{mM} = 0$ *then* $\Delta m_{t,2nd} = 0$ *and* $m^{nm}_{t,2nd} = m^{m}_{t,2nd}$.
2. *If* $U^{2nd}_{mM} < 0$ *then* $\Delta m_{t,2nd} > 0$ *and* $m^{nm}_{t,2nd} < m^{m}_{t,2nd}$.
3. *If* $U^{2nd}_{mM} > 0$ *then* $\Delta m_{t,2nd} < 0$ *and* $m^{nm}_{t,2nd} > m^{m}_{t,2nd}$.

Empirically, the preferences of the new generation are revealed because we observe that if the parents have relatively higher desirability for meat, and they consume relatively more during the early life of their children, then their children tend to consume relatively more, $\Delta m_{t,2nd} > 0$. Based on our model, if the consumers have not experienced scarcity, and since $M^{nm}_{0,2nd} > M^{m}_{0,2nd}$, then they acquire over time a taste for meat and thus it should be that $U^{2nd}_{mM} > 0$.

We observe that there is a change in preferences between the two generations. The generation that experienced scarcity during early life was forced to consume less meat than the minimum required intake and therefore developed a habit and increased desirability for meat, $U^{1st}_{mM} < 0$. On the other hand, the generation that experienced abundance developed a taste for meat that reinforces its consumption, $U^{2nd}_{mM} > 0$. We could infer that the desirability for meat and how the consumer forms her preferences depends on the main difference that these two generations have with respect to their experience with meat consumption, i.e. scarcity for the first and abundance for the second generation.

[7] Meat consumption in the family is not rival. We assume that there is enough quantity of meat for both generations to over-consume.

This observation leads to interesting conclusions with respect to the link that exists between the socio-economic[8] situation during the period the consumer is a child, and the consumption choices later in her life. We see that populations that experience scarcity have different preferences than populations that did not. The more severe the scarcity that they experienced, the higher the desirability for the good and the quantity they consume. On the other hand, in the good state, when there is abundance in the specific good, we still observe non-separable time preferences, but mostly as a persistent taste for meat.

Moreover, we model a link between the consumption choices that a parent makes, and how these choices instil consumption habits into their kids later in life. The fact that the parent has formed this increased desirability for meat, and within their generation consumes relatively more, leads to relatively higher initial conditions for their children and thus relatively more consumption of meat later in their life.

Between generations' consumption difference. Let us now consider the difference between the consumption of the first and the second generation given their difference in their preferences, namely $U^{1st}_{mM} < 0$ and $U^{2nd}_{mM} > 0$. Moreover, we take as given that the initial condition of the 1st generation that experienced different degrees of meat scarcity during WWII, is smaller than the initial condition of the second generation, $M_{o,1st} < M_{o,2nd}$. Proposition 4 highlights the importance of the reference point in the prediction of which generation is consuming more.

Proposition 4 *Let $M_{o,1st} < M_{o,2nd}$, $U^{1st}_{mM} < 0$ and $U^{2nd}_{mM} > 0$, then if $M^* = 0$ then $m^{1st}_t < m^{2nd}_t$. Moreover, if $M^* > 0$ then $m^{1st}_t > m^{2nd}_t$ for relatively persistent habit formation.*

This means that if the utility function was independent of the reference point, or the reference point was equal to zero[9] then, we would expect to observe that the first generation consumes relative less than the second generation. On the other hand, if there is a positive reference point then, the first generation consumes more than the second generation.

The reference point M^* also affects the steady state m_{ss}, and M_{ss} through the equation $m_s s = \delta M_{ss}$. In the proof of Proposition (4) in the Appendix, we show that if $M_{ss,1st} < M_{ss,2nd}$, then $(\delta - \alpha_{t,1st})M_{ss,1st} < (\delta - \alpha_{t,2nd})M_{ss,2nd}$ for relative persistent habits. Moreover, given that $M_{o,1st} < M_{o,2nd}$, then we would expect that $m^{1st}_t < m^{2nd}_t$.

[8]Dupois et al. (2014) emphasizes the role of differences in preferences in explaining cross country differences in food consumption.

[9]The reference point cannot be equal to zero because we assume that M^* is the minimum required intake of meat.

We observe in the data, that the children of the generation, who experienced relatively more scarcity, consume relatively more as well but not as much as their parents. In equation (1), we see that $\frac{\partial m_t}{\partial M^*} = -U_{mM}$ for given M_{ss}, thus m_t depends also on $-U_{mM}M^*$. If $U_{mM} > 0$ and the consumption depends also on a reference point, then m_t should be relatively lower than the one of their parents even if the initial conditions of the parents were lower, since $-U_{mM}M^* < 0$ for the children and $-U_{mM}M^* > 0$ for the parents.

Interestingly, the larger the difference between the cumulative consumption M_t and the reference point M^*, the higher the marginal utility of consumption. Moreover, as the consumption converges towards the reference point the marginal utility is decreasing. The intuition of this result is that the consumer suffers a positive adjustment cost the further away is her consumption from the reference point, since she needs more consumption to reach the same level of utility.

Figure 1 summarizes graphically the theoretical predictions and links them with the empirical results.

3 Data

For our analysis, we bring together unique historical information on livestock availability at the regional level and rich survey data on eating habits and health outcomes at the individual level. We proxy meat scarcity at the regional level using hand-collected data from the livestock censuses that took place in 1941, 1942 and 1944 (Istat, 1945 and 1948) as well as information on the number of slaughtered animals for meat in 1941, 1942 and 1945 from the Annual Agricultural Statistics (Istat, 1948 and 1950a). The data report the number of breed animals by species (See Figure B1 in the Appendix). We consider the sum of cattle, pigs, poultry, goats and sheep to measure the availability of meat in each region. In addition to the number of livestock by region, the 1944 census also reports the number of livestock excised by the German army.

WWII affected regions in several dimensions. There are two available indicators of the severity of WWII at the regional level, which can serve as control variables for the effects of the war: the change in regional GDP per capita between 1943 and 1945 (Daniele and Malanima, 2007) and the number of war victims in the same period (casualties by firearms and explosives) by region (Istat, 1957). We express the number of war victims per 1000 population in each region in 1936 (Istat, 1976).

A number of surveys were carried out together with the 1944 census in the liberated territory. In particular, the Survey of Living Conditions-Public Health provides us with information at the regional level on the average weight of 2-year-olds by gender and parental occupation in 1944 as well as the corresponding figures in 1942. Additionally, there is the same type of information distinguishing between urban and rural areas. We also obtain data on fetal and infant mortality (stillbirths and children deceased in the first year of life per 1000 live births) by region in 1942 and 1945 from the statistics on death causes (Istat, 1950b).

We merge the historical data on livestock availability by region to individual level data from the 2003 Multipurpose Survey on Households: Aspects of Daily Life conducted by the Italian National Statistical Institute (Istat). To do so, we use the region of residence of the respondents. Although the information on the region of birth is not available, the respondents reported whether they reside far away from their relatives. In this way, we can reduce the presence of "potential internal migrants" in our sample by excluding those whose region of residence and region of birth do not coincide.[10] 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 earliest one that collected information on the respondents' height and weight that are necessary in order to compute the respondent's body mass index (BMI) using the formula BMI=(weight in kg)/(height in m)^2. We define as overweight those with a BMI equal to 25 or higher. The survey collects information on the respondents' eating habits and health conditions. In particular, there is information on the respondents' eating habits for a variety of categories of food. We construct the binary variable "Eat meat every day" which takes the value 1 if the respondent eats pork, beef, chicken or other white meat once or several times per day. In our sample, around 13% of the respondents eat meat every day. We follow the same methodology also for other categories of food, namely, fish, sweets, and snacks. There is also information related to health conditions. More specifically, we consider whether the respondent suffers from cardiovascular disease (CVD), or has a history of myocardical infarction (MI) or tumor. Lastly, we draw information on various socio-economic characteristics of the respondents, namely the age, the gender, the educational and occupational level. We use the 2011 wave of the survey to conduct a robustness exercise regarding the role of age. The survey reports information for all household members. Therefore, we are also able to observe the eating habits of the coresident children and study intergenerational persistence.

Lastly, we merge the historical data to the 2004 wave of the Survey on Household Income and Wealth (SHIW). The SHIW is a biennial survey, conducted by the Bank of Italy, that contains information at the household level on total and food consumption expenditures, total household income as well as socio-economic characteristics of the household members (age, gender, educational level). We compute the share of food over total consumption to estimate Engel curves. The advantage of SHIW is that it contains

[10] We complement the analysis using the Survey on Household Income and Wealth that contains information on food expenditures and records both the region of birth and the region of residence of the individuals.

information both on the region of birth and the region of residence of the household members. In this way we can perfectly identify internal migrants and assign them the meat scarcity of the region where they were born and possibly lived as children. Moreover, we can test whether results change if we restrict the sample to non-migrants. In the next section, we describe in detail our identification strategy.

4 Identification

4.1 Measuring meat scarcity at the regional level

We construct a measure of meat availability at the regional level using the historical data from the livestock census and the Annual Agricultural Statistics. We focus on the most severe phase of WWII also in terms of casualties, which was the period 1943-1945 for the North of Italy and the period 1943-1944 for the Center-South (Figure B2 in the Appendix). Information from the livestock census is available for all regions in 1941 and 1942, i.e., before the start of the severe phase of WWII. In 1944 a livestock census took place in the Central-Southern part of the country, which was already liberated.[11] We complement the information for the Northern regions using the number of animals slaughtered for meat from the Annual Agricultural Statistics in 1941, 1942 and 1945.[12] We construct a proxy of meat scarcity at the regional level by calculating the percentage difference in the number of livestock between the average of 1941-42 and 1944, which is available only for the Central-Southern regions. For the Northern regions, we use instead the percentage difference in the number of animals slaughtered for meat between the average of 1941-42 and 1945. As an alternative measure, we consider the percentage difference in the number of animals slaughtered for meat in all regions.

Figure 2 shows that the number of animals slaughtered for meat decreased substantially during WWII. There is considerable variation across regions that ranges between 9 and 72 per cent. Figure 3 compares the decrease in the number of animals slaughtered for meat with the decrease in the number of livestock in the Central-Southern regions, for which there are available data from the census. The two measures are correlated and both point towards a decrease in the availability of meat. One reason was livestock excise by the German army for the fulfilment of their dietary requirements. For example, as shown in the same figure, the German army excised up to 32 per cent of the livestock in some regions.

[11] The liberated territory in 1944 consisted of the following regions: Umbria, Lazio, Abruzzo, Campania, Apulia, Lucania (Molise), Calabria, Sicily, and Sardinia.

[12] The next available livestock census took place in all regions in 1948 but the number of livestock had already recovered by that time.

Using the decrease in the number of livestock as treatment has several advantages. First, we do not need to rely on retrospective self-reported incidences of hunger that may suffer from recall bias and depend on the socio-economic status of the family of origin. The decrease in the number of livestock is arguably exogenous, especially in regions where the German army excised a large part of livestock. Second, contrary to other regional measures of exposure to WWII (e.g. the number of casualties or decrease in GDP), the decrease in livestock is tightly linked to meat scarcity.[13] During WWII, a ration card was introduced in Italy and different types of food, including meat, could only be purchased in the established quantities using this special card. Rations differed by region depending on local availability. For example, in Turin in 1941, they were: 20 grams of meat, 150 of bread, 33 of potatoes, 25 of legumes, 25 of vegetables, 6 of rice, 7 of pasta, 50 of fruit, 12 of fat, 5 of cheese, 200 of milk, 16 of sugar (plus one egg per week), to guarantee a total of 819 calories per capita (Massola, 1951). The collection and distribution of food was administered by the State exclusively at the local level through the so-called "Sezioni provinciali dell'alimentazione" (Luzzatto-Fegiz, 1948). This led people to rely on the black market to acquire basic goods (Daniele and Ghezzi, 2019). The black market was also predominantly local (at most between city and countryside). Therefore, the decrease in the number of livestock at the regional level is likely to capture the overall local availability of meat (both through rationing and the black market) and act as a good measure of the meat scarcity that individuals experienced during the war.

The inefficiency of the rationing system (Morgan, 2007) and the very high inflation rate intensified the shortage.[14] Some food was completely missing in some cities because it could not come from outside. For some items (e.g., milk) trade between provinces was completely forbidden. Moreover, transport infrastructures suffered substantial damage, further hampering the trade and the provision of products (Daneo, 1975). Therefore, in our setting, spillover effects between treated and control regions (the so-called SUTVA) are unlikely to pose a threat to identification.

4.2 Methods

In order to estimate the causal effect of meat scarcity during childhood on eating habits and health conditions in later life, we exploit cohort and regional variation in a continuous difference–in-differences framework. More specifically, we use the 2003 wave

[13] The number of slaughtered animals records meat consumption well, but its drop may also reflect reduced trade. The livestock census captures the overall availability of meat, but also includes livestock that in theory was not intended for consumption. This is why we consider both measures as proxies of meat availability.

[14] In 1943, the consumer price index increased by 67.7% compared to the previous year, and in 1944 by 344.4% (Istat, 2012).

of the Multipurpose Survey on Households: Aspects of Daily Life to compare individuals that belong to different cohorts (the treated, that experienced meat scarcity and the control, that did not) and lived in regions with different degrees of meat scarcity.[15] We use the decrease in the number of livestock to proxy meat scarcity at the regional level. In other words, we assume that individuals living in regions that experienced a large decrease in livestock were more exposed to meat scarcity and estimate an intention to treat (ITT). Figure B3 in the Appendix shows that livestock before the severe phase of WWII was present all over the Italian territory. This means that people used to consume meat in all regions and therefore, a decrease in livestock could be detrimental to individual consumption.

We define the treated and the control cohort using the individuals' year of birth. The original sample includes around 54,000 individuals born between 1900 and 2003. For our analysis purposes, we restrict the sample to around 13,000 individuals born between 1934 and 1957. Italy entered WWII in 1940 but experienced most casualties (severe phase) in the period 1943-1945 (Figure B2 in the Appendix). Therefore, we define the cohort affected by meat scarcity during childhood as those individuals born between 1934 and 1945 (i.e., those aged 0-11 during the severe phase of the war; 58-69 at the time of the interview in 2003).The cohort born right after the war, in the years between 1946 and 1957, comprise the control group (i.e., those aged 0-11 in the post-war period; 46-57 at the time of the interview). Figure B4 in the Appendix shows that the average per capita annual consumption of meat fell sharply during the severe phase of WWII but recovered after the end of the war.[16] This confirms that individuals in the treated cohort, who passed their childhood during the war experienced meat scarcity while individuals in the control cohort, who were born after the war, did not.

Table 1 shows some descriptive statistics for the treated and control cohorts. Individuals in the treated cohort are more likely to eat meat every day than in the control cohort (14.5% vs 12.6%). They are also more likely to be overweight and to have health problems. The composition of the treated and control cohorts is similar in terms of gender. There are differences with respect to age, education and occupation that we account for in the empirical analysis using controls and by exploiting regional variation within cohorts.[17]

[15] This is the earliest wave of the survey that contains all the necessary information for our analysis (eating habits, height, weight, health) and allows us to minimize survival bias (maximum age in our sample=69).

[16] Average per capita consumption of meat fell sharply in 1943 and 1944. The consumption of other food products (sweets, cereals, fruit and vegetables) also dropped but mostly in 1945.

[17] For example, Ichino and Winter-Ebmer (2004) show that WWII had long run consequences on individuals' education and earnings. Therefore, we control for individuals' educational attainment and occupation throughout the analysis.

We estimate the following specification:

$$\begin{aligned}(Eat\ meat\ every\ day)_{ir} &= \beta_1(cohort)_i + \beta_2(cohort * \Delta(livestock))_{i,r} \\ &+\beta_3 X_i + y_r + u_{i,r}, \end{aligned} \tag{3}$$

where i stands for the individual and r for the region. The dependent variable is a dummy=1 for those who eat meat every day and 0 otherwise, *Cohort*=1 if the individual is born in 1934-1945 and 0 if the individual is born in 1946-1957, and $\Delta(livestock)$ is the percentage change in livestock, which is continuous and ranges between 14 and 72 per cent.[18] The coefficient of interest is β_2, i.e., that of the interaction between the cohort dummy and the decrease in livestock. We also add a vector of socio-economic characteristics of the respondents X_i, 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 (manager, middle manager or entrepreneur).[19] In this way, we control for age, wealth, and educational differences that may influence eating habits. We include regional dummies, y_r to account for the differential effect of WWII across regions.[20] The regional dummies also capture systematic differences in eating habits, for instance, due to the culinary traditions of each region. Given that the dependent variable is binary, we estimate a linear probability model. We cluster standard errors at the regional level (18 regions). We conduct a robustness exercise with two-way clustering by region and age.

Our aim is to estimate the effect of meat scarcity during childhood on later behavior. As we mentioned in the data section, the data only record the current region of residence, which may not coincide with the region of birth. Internal migrants could pose a threat to our identification strategy if they passed their childhood in one region and afterwards migrated to a different region as we would not be able to assign to them the meat scarcity they experienced during childhood. However, respondents also reported whether they reside far away from their relatives, which allow us to mitigate the issue of internal migration. More specifically, we exclude from the analysis those who reported that they live far away from their relatives as they are likely to have migrated (around 18%). This increases the precision of our estimates. We elaborate further on this issue using the SHIW that does record the region of birth of the individuals. By defining internal migrants as those whose region of birth is different than that of residence, we obtain a

[18]Throughout the analysis we also report the results using the percentage change in the number of animals slaughtered for meat for all regions as a proxy of meat scarcity. This ranges between 9 and 72 per cent.

[19]The occupational level is current (past) for those who are currently employed (retired or unemployed). The dummy high occupational level is equal to 0 for those who never worked, e.g., housewives.

[20]The regional dummies absorb $\Delta(livestock)$ in the estimation.

similar figure (around 19%). Therefore, using the variable "reside far away from relatives" is a plausible way to pin down internal immigrants in our main dataset.[21]

Another potential concern is non-random fetal or infant mortality. If the most vulnerable children died or were never born due to meat scarcity, there could be issues of selection in our sample. To address this concern, we use historical statistics on fetal (stillbirths) and infant (first year of life) mortality at the regional level and correlate them with our measure of meat scarcity. Figure B5 in the Appendix shows that there is no correlation between meat scarcity and fetal-infant mortality during WWII. A possible explanation is that milk is more important than meat intake for survival at this early age. Moreover, infants were entitled to more generous rations in terms of calories than adults or older children (Daniele and Ghezzi, 2019). Therefore, fetal or infant mortality is unlikely to affect our results for those aged 0-2 during WWII.[22]

A similar type of bias could arise from selective fertility. However, contraception was still limited in the period of analysis (Greenwood et al., 2019). Moreover, our results reveal large differences by gender that are hard to reconcile with selective abortions (there was no way to predict the gender of the child back in the 1940s).

We also use (1) to estimate the effects of meat scarcity on other categories of food, such as fish, sweets, and snacks. In this way, we can verify that the treatment at the regional level indeed captures meat scarcity rather than the overall hardship of WWII. To this end, as a robustness check, we specifically control for the effects of the war at the regional level using the decrease in the GDP per capita and the number of casualties per 1000 population in the period 1943-1945 including geographical area dummies instead of regional dummies.

We then estimate variants of (1) to analyze the effects on BMI defined as (weight in kg)/(height in m)^2, and separately on weight and height. Then, we focus on health outcomes related to meat overconsumption, i.e., the probability of i) being overweight, ii) suffering from a cardiovascular disease (CVD), ii) having had a myocardical infarction (MI), iii) having had a tumor.

To estimate intergenerational effects, we focus on the children of treated and control mothers, i.e., the outcome variable in (1) in this case refers to the children but the treatment (cohort and regional meat scarcity) refers to the mother. Thus, we examine whether the mother's meat scarcity experience during her childhood is transmitted to the eating habits of the next generation. We focus on mothers as they are traditionally the ones in charge of preparing the meals and thus more likely to transmit eating habits

[21] In Section 5.5. we use the SHIW to estimate the effect of meat scarcity on food expenditures and obtain similar results if we consider the individuals' region of birth or if we consider their region of origin and exclude internal migrants.

[22] There are no available data at the regional level on child mortality at older ages.

to their children. Moreover, in our sample more than 45% of women declare "housewife" as their main occupation. We analyze adult children aged 18-26, who are able to choose where and what to eat and have well-formed eating habits. We are only able to analyze the effects on children who live with their parents as we do not observe any information about the mother when children move out. However, selection issues are not a concern since 90% of young Italians in the age group 18-26 still live with their parents (Eurostat). Moreover, mobility for studies is also limited as less than 18% of university students in Italy study in a different region than the region of origin (Adamopoulou and Tanzi, 2017). We also verify that the effect on children's eating habits operates through intergenerational transmission rather than peer influence among household members by examining the eating habits of the fathers.

We follow a similar strategy to define treated and control households when we study the effects of meat scarcity on food consumption at the household level. Namely, the treatment (cohort and meat scarcity in the region of birth) refers to the female head or spouse of the household.[23] We use data from the SHIW and estimate a specification similar to (1) but at the household level, where the dependent variable is the share of food over total consumption expenditures. The advantage of this dataset is that it contains information on the region of birth, making the assignment of treatment to individuals more accurate. It also allows us to check whether excluding internal migrants from the analysis bias our results. However, in the SHIW we are only able to observe food rather than meat consumption expenditures and the information is aggregated at the household level. Therefore, our preferred specification is the analysis of eating habits at the individual level.

Eating habits as well as the BMI and health conditions typically vary with age. Although we control for age and its square in the benchmark specification, we conduct an additional robustness check using the 2011 Wave of the Multipurpose Survey. We adopt a triple-differences framework (DDD) and exploit variation by cohort, region and wave by including in the analysis individuals who at the time of the interview in 2011 had the same age as the treated and the control in 2003. In this way we are able to account for the age difference between the treated and the control cohorts.

Lastly, we verify that the estimated effects are due to the meat scarcity experienced during WWII rather than a time trend by conducting a placebo exercise. In the placebo exercise, we assume that WWII took place at a later date and define the placebo cohort as those born between 1958-1969 while the control cohort is the same as in the benchmark (born in 1946-1957).

[23]Both in the analysis of household expenditures and of intergenerational transmission, treated mothers are those aged 0-2 during WWII as they are young enough to have coresident children.

5 Results

5.1 Effects on individual eating habits

We first run a linear probability model as described in (1) to estimate the effect of meat scarcity during childhood on the probability to eat meat every day later in life. Table 2, panel A, column 1, reports the results of the benchmark specification. The coefficient of interest β_2, which is associated with the interaction term, is positive and statistically significant. Quantitatively, the exposure to a 10 per cent decrease in the number of livestock during childhood increases the probability of eating meat every day during adulthood by 1.3 percentage points. This is a substantial effect, given that less than 14 per cent of individuals in our sample eat meat every day. The dependent variable measures the frequency of eating meat of any quality and price. Nevertheless, we control for the individuals' socio-economic status (educational and occupational level) to also account for their awareness regarding bad eating habits. The inclusion of regional dummies controls for regional differences and the well known Italian North-South gradient.[24]

In the benchmark specification and throughout the analysis, we exclude those individuals who declared living far away from relatives as they are likely to be internal immigrants. The results are fairly robust in terms of magnitude if we include the latter in the analysis (Table 2, panel A, column 2). The estimates are less precise but continue to be statistically significant. This is not surprising as individuals who declared living far from relatives are likely to live in a different region than their region of birth. By excluding them from the analysis, we are able to mitigate the presence of internal migrants in the sample, thus increasing the accuracy of our estimates.

As we described in the previous section, we proxy meat scarcity at the regional level using the decrease in the number of livestock (available from the census only for the Central-Southern regions) and the number of animals slaughtered for meat (for the Northern regions). We obtain similar estimates when we use the number of animals slaughtered for meat for all regions (Table 2, panel B).[25]

Apart from meat, other food categories such as fish, sweets, and snacks were also scarce during WWII. We estimate (1) for these categories of food and find that meat scarcity during childhood does not affect the probability of eating fish, sweets, or snacks every day (Figure 4). The estimated coefficients are small in size and are not statistically significant. This suggests that our treatment variable at the regional level captures meat scarcity rather than the overall hardships of WWII, thus allowing us to establish a direct

[24] In Section 6, we show that the results are not driven by a time trend via a placebo exercise. We present evidence that the evolution of meat consumption over time at the regional level is unrelated to the regional meat scarcity during WWII.

[25] Throughout the analysis, we report the estimates obtained with both proxies of meat scarcity.

link between meat scarcity in childhood and meat overconsumption later in life.[26]

5.2 Heterogeneous effects and mechanisms

Previous studies of the long term health effects of shocks during childhood have found important gender differences (See Yeung et al., 2014 for the effects of recessions and Van den Berg et al., 2016 for the effects of hunger). Moreover, a recently growing literature emphasizes the role of early lifetime conditions and shows that shocks during the first three years of life can be particularly detrimental (e.g., Conti et al., 2016). Therefore, we examine whether the effects of meat scarcity on eating habits are heterogeneous across genders and whether they vary by the age of exposure. Figure 5 reports separate estimates for males and females who experienced meat scarcity at age 0-2 and 3-11. We find that meat scarcity during childhood increases the probability of eating meat every day for all groups, but the effect is particularly strong among females who were exposed to meat scarcity at age 0-2.

To shed light on the underlying mechanism, we resort to historical information at the regional level and plot the change in the average weight of 2-year-old girls and boys before and after the severe phase of the war (1942-1944). Figure 6 shows that in six out of the nine regions with available information, the average weight of 2-year-old girls dropped more than that of boys. Figure B6 further distinguishes by paternal occupation (blue/white collar) for 2-year-olds living in rural and urban areas. Girls fared worse than boys especially if their father was a manual worker (blue collar). Among the children of blue collars in rural areas, the average weight loss in the period 1942-1944 was 4.0 per cent for girls and only 1.4 per cent for boys in total (Figure B6, panel a). This gender gap was evident in seven out of nine regions. Similarly, among the children of blue collars in urban areas, the average weight of 2-year-old girls in 1944 was 2.0 per cent lower compared to 1942 while the average weight of 2-year-old boys in the same period increased by 4.3 per cent (Figure B6, panel b). Instead, among children of white collars there is either no gender gap (rural areas-Figure B6, panel c) or boys fared worse than girls (urban areas-Figure B6, panel d). Although the evidence is only suggestive, it points towards a preferential treatment of sons over daughters in blue collar families. According to Istat (1945), agricultural workers in rural areas required a very high amount of calories (around 4,000 daily in normal times) while average consumption in 1944 was below 2,800 calories. In urban areas, where more than 90% of total consumption expenditures was paid for food in the black market, the average weekly consumption expenditures of blue collar families in 1944 was 482 lire vs 576 lire of white collar families. Therefore, blue

[26]In Section 6, we further elaborate on this issue by including in the regressions the decrease in the GDP per capita and the number of casualties per 1000 population to control for the effects of the war.

collar parents in both rural and urban areas may have prioritized sons over daughters in the allocation of the scarce quantity of meat, in line with the literature on preferential breastfeeding in developing countries (Jayachandran and Kuziemko, 2011). According to the model predictions, higher relative scarcity leads to higher consumption in the future, which may explain why the estimated effects are stronger for females.

Presumably, as soon as WWII ended, parents provided their daughters with larger quantities of meat as a form of compensatory investment (See Yi et al., 2015). In this way, daughters aged 0-2 during WWII subsequently developed increased desirability for meat.

5.3 Effects on individual health outcomes

Meat overconsumption may have direct consequences on individuals' BMI and health conditions. We examine this possibility by estimating first the effect of meat scarcity on the BMI. Figure 7 reports the results by gender. We find that meat scarcity during childhood leads to an increase in the BMI of females. By contrast, we do not detect any statistically significant effect on males (coefficients are always close to zero). We then decompose the effect on BMI into weight and height. We find that the increase in females' BMI is due to an increase in weight rather than a decrease in height (the effect on height is null). This is supportive evidence of the behavioral mechanism that we illustrated in the theoretical model.[27] If the mechanism was biological, we would expect to find instead a decrease in height.

An increased BMI can be harmful if it translates into an increased probability of being overweight (BMI$\geq$25) and/or poor health. Therefore, we explore whether meat scarcity influences the probability of being overweight during late adulthood and the occurrence of various health problems that are often related to meat consumption (cardiovascular diseases, myocardial infarction, tumor). Figure 8 presents the results for females by age of exposure. The exposure to a 10 per cent decrease in the number of animals slaughtered for meat at age 3-11 increases the probability of being overweight during adulthood by 0.9 percentage points and the probability of suffering from cardiovascular disease by 0.5 percentage points. The latter is substantial, considering that the average incidence of cardiovascular diseases in our sample is just 3.5 per cent.[28] Our results are in line with the medical literature's most recent findings (e.g., Zhong et al., 2020) linking red and processed meat consumption with a higher risk of heart diseases. Again, we do not

[27] In Section 5.5, we provide further evidence in favor of a behavioral mechanism by analyzing the effect on food expenditures.

[28] We also find a 0.9 p.p. increase in the probability of having tumor among females aged 0-2 during WWII. This effect is large (average incidence in the sample is just 2.3) but it is only marginally significant.

find any statistically significant effect of meat scarcity during childhood on the health conditions of males (Figure 9).

5.4 Intergenerational transmission of eating habits

In this section, we explore whether the effects on eating habits persist intergenerationally. Going back to our data, eating habits are available for every member of the household. Therefore, we can identify households with mothers that belong to the control and treated cohorts and study the effects on the other household members. We focus on mothers who are traditionally the ones in charge of preparing the meals and therefore more likely to transmit eating habits to their children. Moreover, in our sample, more than 45 per cent of women declare "housewife" as their main occupation.

In particular, we analyze the effects on coresident sons/daughters aged 18-26 years old. These are adult children whose eating habits are well-formed and are able to choose where and what to eat. Selection issues are not a concern since more than 90 per cent of young Italians in this age group still live with their parents (Eurostat). We employ the same diff-in-diff framework, and we compare the eating habits of adult children whose mothers were exposed to meat scarcity at age 0-2 during WWII (treated) to those of adult children with mothers that belong to the control cohort, who live in regions that witnessed different degrees of meat scarcity. We find a statistically significant increase in the probability of eating mainly meat every day (Table 3, column 2).[29] In line with the theoretical model's predictions, the indirect effect on children is smaller in size than the direct effect on mothers (Table 3, columns 1 and 2 and Figure 10). Our results suggest that a temporary fall in the availability of a consumption good during childhood can affect not only the eating habits of the individual later in life but also those of the next generation. We confirm that this occurs through a process of intergenerational transmission rather than a mere peer effect by examining the effects on fathers. Indeed, among fathers, we do not find any spillover effects from their wives (Table 3, column 3). In their case, eating habits were already formed and could not be influenced much.

5.5 Effects on household consumption expenditures

Analyzing the effect of meat scarcity on food consumption expenditures can offer additional evidence supporting the behavioral mechanism. More specifically, we use data at the household level from the 2004 wave of the SHIW and estimate Engel curves in the spirit of Kesternich et al. (2015). We adopt a similar diff-in-diff framework as in (1) and

[29] Additional results (available upon request) indicate that the intergenerational effects are equally strong on sons and daughters.

compare households with a female head or spouse in the treated and control cohort, who were exposed to different degrees of meat scarcity at the regional level. In this case, the dependent variable is the share of food over total consumption expenditures. We include regional dummies and control for the total household income as well as the age and the educational level of the female head or spouse. Table 4, column 1 shows that meat scarcity leads to an increase in the share of food expenditure over total expenditures.

The advantage of SHIW is that it contains information both in the region of birth and the region of residence of the household members. In this way, we can perfectly identify internal immigrants and assign to them the meat scarcity of the region where they were born and possibly lived as children. We obtain fairly similar estimates if we use the region of residence instead and exclude internal immigrants (Table 4, column 2). This validates the strategy we follow in the analysis of eating habits, where we are not able to observe the individuals' region of birth.

All in all, we find that individuals who experienced the scarcity of a food during childhood tend to increase the share of food expenditures at the household level later in life. Given that meat has a higher price on average than vegetables, pasta or other common food items, an increase in food expenditures may signal an increased consumption of meat. Still, higher food expenditures may reflect higher price/quality of vegetables (e.g. organic) or increased consumption of fish, which also tends to be expensive. Therefore, this result complements our main analysis, which is tied to meat quantities and allows to observe individual eating habits rather than an aggregate measure of all household members' consumption.

6 Robustness and placebo exercise

In this section, we check the robustness of our estimates. In our benchmark specification, we cluster standard errors by region, given that meat scarcity varies at the regional level. This results in 18 clusters. To increase the number of clusters, we reestimate the model using two-way clustered standard errors by age and region following the method of Cameron and Miller (2011). The results are almost identical to the benchmark estimates (Table 5, columns 1 and 2). This suggests that in our setting, having 18 clusters does not affect the correctness of inference. Our estimates do not change either if we define meat scarcity during WWII using 1940 instead of 1941-42 as base year (Table 5, column 3).[30] This validates our choice to focus on the most severe phase of WWII. In the last two columns, we specifically control for the effects of the war at the regional level using the decrease in the GDP per capita and the number of casualties per 1000 population in the

[30] There are available data only on the number of animals slaughtered for meat in 1940.

period 1943-1945, including geographical area dummies instead of regional dummies. The estimated effect on eating habits is robust to the inclusion of these controls suggesting that our treatment at the regional level is likely to capture meat scarcity rather than the overall hardship of WWII.

Eating habits may vary over the lifecycle. Given that the control group is younger than the treated group, the estimated effects might be driven by the age difference although we control for age and its square. We address this concern using the 2011 wave to employ a triple-differences estimation. We estimate the following equation:

$$
\begin{aligned}
(Eat\ meat\ every\ day)_{irt} &= \beta_1(cohort)_i + \beta_2(wave)_t \\
&+\beta_3(cohort * scarcity)_{i,r} + \beta_4(cohort * wave)_{i,t} \\
&+\beta_5(scarcity * wave)_{r,t} \\
&+\beta_6(cohort * scarcity * wave)_{i,r,t} \\
&+\beta_7 X_i + y_r + u_{i,r},
\end{aligned} \tag{4}
$$

where *cohort*=1 if the individual at the time of the 2003 or 2011 interview is 58-60 years old and =0 if the individual is 55-57 years old; *scarcity*=1 for regions above the 75^{th} percentile of both proxies of meat scarcity and =0 if below; *wave*=1 for the 2003 wave and =0 for the 2011 wave of the survey. The coefficient of interest is that of the triple interaction, β_6. This model allows for differential trends (1) between people of the same age that live in more or less severely affected regions $(cohort * scarcity)_{i,r}$, (2) people of the same age that experienced WWII during their early childhood or were born later $(cohort * wave)_{i,t}$, and (3) people that live in the same region and experienced or did not experience WWII $(scarcity * wave)_{r,t}$. In this way, the age difference between the treated and the control group is accounted for via the triple difference. Table 6 presents the results. The coefficient of the triple interaction term is positive, statistically significant, and similar in terms of magnitude to the benchmark estimates. This reassures us that our results are not due to an age effect.

Lastly, we conduct a placebo exercise to ensure that the results are not driven by time trends in eating habits and that the common trend assumption is not violated. In the placebo exercise, we assume that the outbreak of WWII was in 1958 and define the placebo cohort as those born between 1958-1969 while the control cohort is the same as in the benchmark specification (born in 1946-1957). Table 7 reports the results. The coefficient of interest of the placebo exercise is not statistically different from zero and is less than half in size compared to the benchmark estimate. This suggests that meat scarcity rather than a time trend lies behind the estimated overconsumption of meat. Figure B7 in the Appendix presents additional evidence at the regional level using data on the number of slaughtered animals in 2002. It shows that meat consumption increased significantly between 2002 and 1940 in all regions but the increase is not correlated with the regional meat scarcity during WWII.

7 Conclusions

Past experiences matter for several economic decisions ranging from individuals' savings and risk taking to the formation of beliefs. We show that past experiences also shape individuals' eating habits, which are then transmitted to the next generation. More specifically, we show that adult preferences towards a specific good are influenced by the individual experience with this good early in life and that parents subsequently form the preferences of their children through their own consumption behavior. We do so by exploiting historical and modern survey data that allow us to study the effects of an exogenous regional shock to food availability on later outcomes using a difference-in-differences framework. We find that individuals, especially females, who were more exposed to meat scarcity during childhood tend to over-consume meat and to be overweight later in life. This result sheds light on a behavioral channel from early-life shocks to food availability into eating habits. We provide suggestive evidence that the gender difference can be traced back to more favorable nutrition of infant sons over daughters during WWII. Moreover, we find that treated individuals have a higher probability of suffering from cardiovascular disease.

Our findings have important policy implications. We show that a temporary scarcity of a good has long-run effects on future consumption decisions both of the generation that experienced the scarcity but also of the next one. Therefore, policies, such as a tax designed to decrease consumption today, which may create a current temporary scarcity, can lead to overconsumption in the future and the inverse results. In this way, a temporary tax on sugar or fat could have unintended consequences on the future consumption of the individuals who were subject to the tax and of the next generation.

Our results stress the importance of compensating adverse early-life conditions through adequate policies in order to avoid side effects on health in later life (See Cunha et al., 2010). Furthermore, our findings shed light on the long run effectiveness of policies designed to bring awareness regarding the effects of a non-equilibrated diet. Since, the mechanism we uncover operates intergenerationally, i.e., we observe it also among the adult children of women who had experienced meat scarcity during WWII, these policies can be beneficial for the health of both the current and future generations.

Our analysis may also inform the recent debate on the environmental consequences of meat consumption (greenhouse gas emissions, sustainability, animal rights, see Katare et al., 2020) and the implementation of mitigating policies, such as the meat tax in Denmark (Caro et al., 2017). Policy design should consider the behavioral channel and the possibility to backfire as a very high tax on meat in the short run may have the opposite long-run effect than the intended one.

To sum up, our findings suggest that temporary shocks or policies may have persistent effects on preferences and attitudes of multiple generations. Transmission of attitudes in turn may act as an additional channel through which economic outcomes such as consumption and savings significantly correlate across generations.

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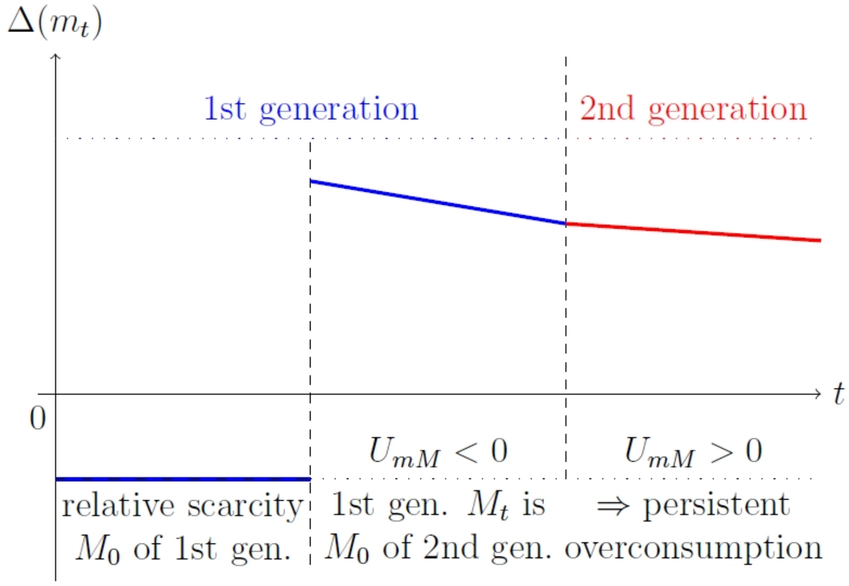
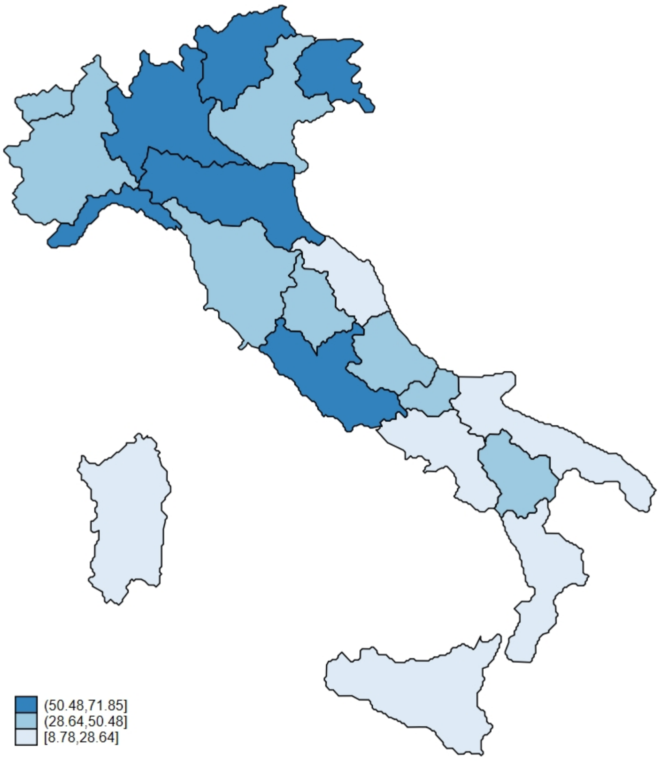
Figures

Figure 1. Model predictions when scarcity leads to overconsumption



Note: Main predictions of the theoretical model when the scarcity of a good early in life leads to overconsumption in the long run: i) the evolution of meat consumption over time differs between populations that had experienced different degrees of meat scarcity during childhood. Scarcity affects preferences and as a result individuals who experienced more severe meat scarcity acquire an increased desirability for meat, ii) the exposure of the first generation to meat scarcity during childhood has persistent implications for the meat consumption patterns of the second generation. Children acquire a habit by observing their parents overconsuming meat.

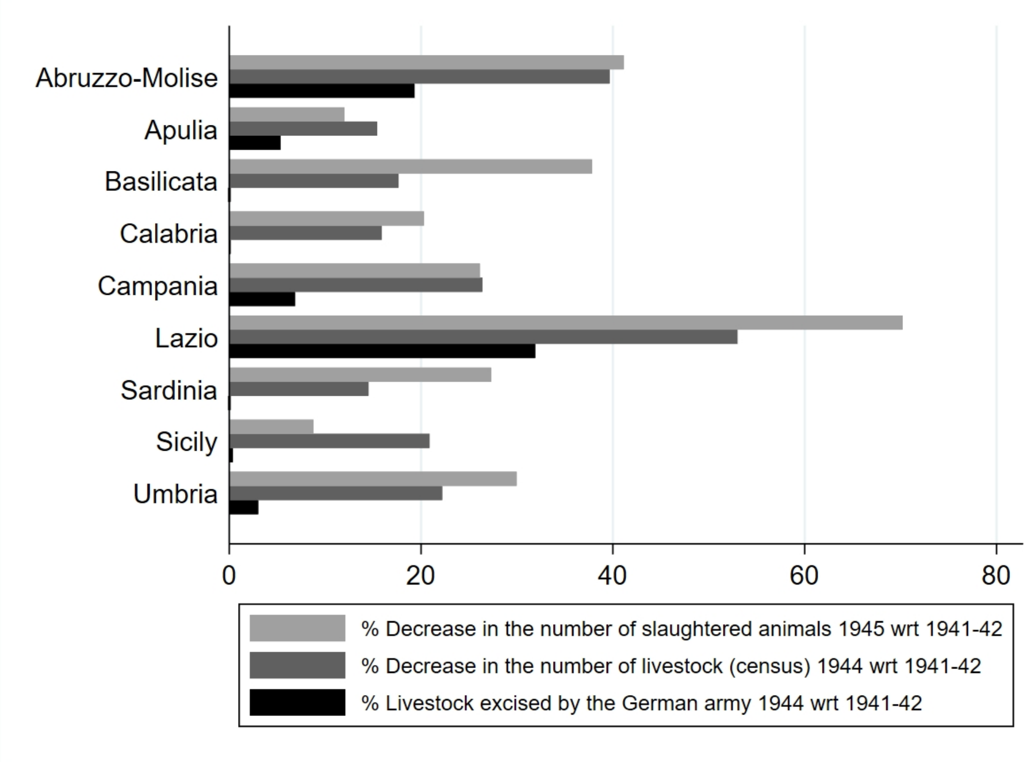
Figure 2. Change in the number of animals slaughtered for meat (%)



Note: Percentage difference in the number of animals slaughtered for meat between 1945 and 1941-1942 as a proxy of meat scarcity at the regional level. The drop ranges between 9 and 72%.

Sources: Annual Agricultural Statistics 1941, 1942 (Istat, 1948) and 1945 (Istat, 1950a).

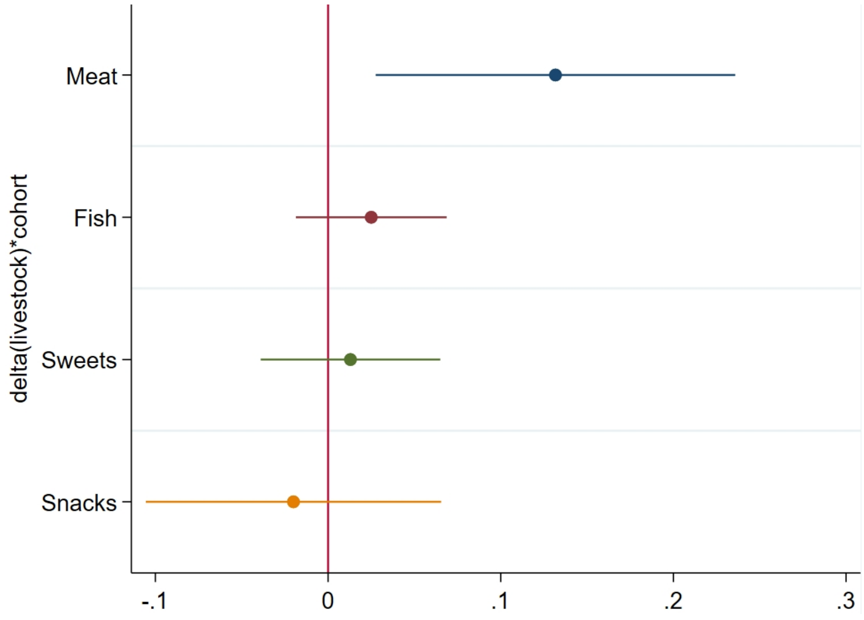
Figure 3. Proxies of meat scarcity and % livestock excised by the German army



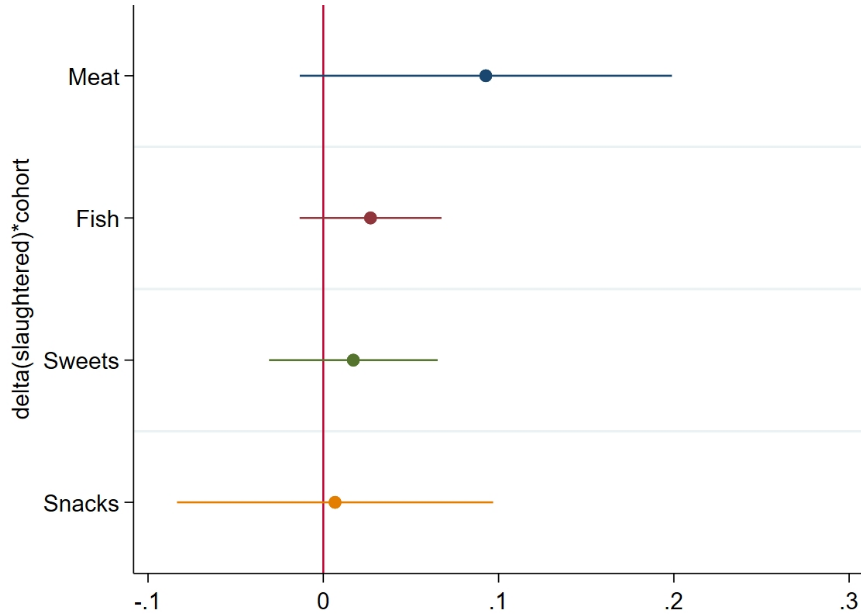
Notes: The figure shows two different proxies of meat scarcity in the Central-Southern regions (% decrease in the number of slaughtered animals and % decrease in the number of livestock) and the percentage of livestock excised by the German army. The latter can explain part of the drop in the number of livestock in some regions.

Sources: Number of slaughtered animals from the Annual Agricultural Statistics 1941, 1942 (Istat, 1948) and 1945 (Istat, 1950a) and number of livestock and excised livestock from the Census of Agriculture 1941, 1942 (Istat, 1948) and 1944 (Istat, 1945).

Figure 4. Effects of meat scarcity on eating habits-meat vs other food categories



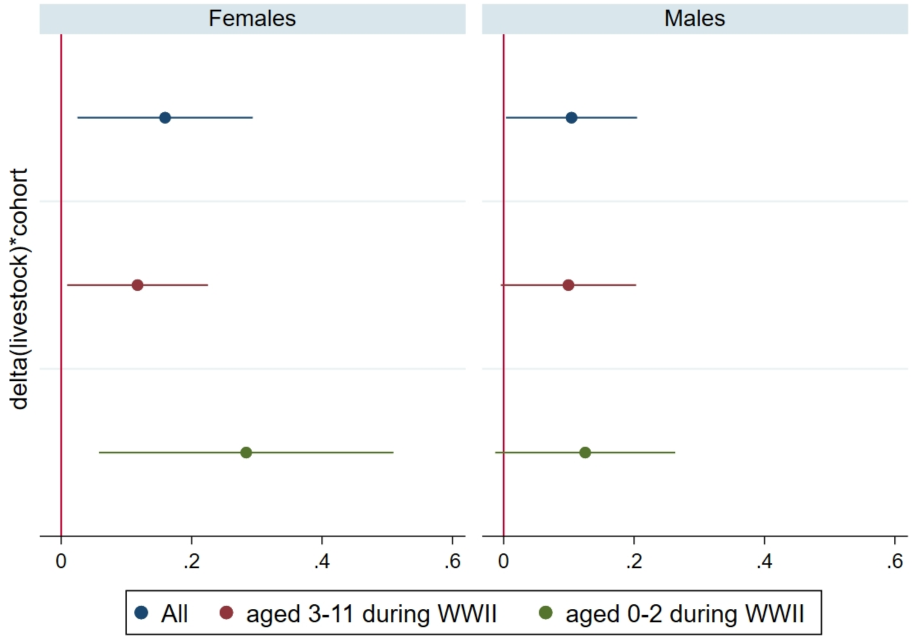
(a) Δ(Livestock) as proxy of meat scarcity



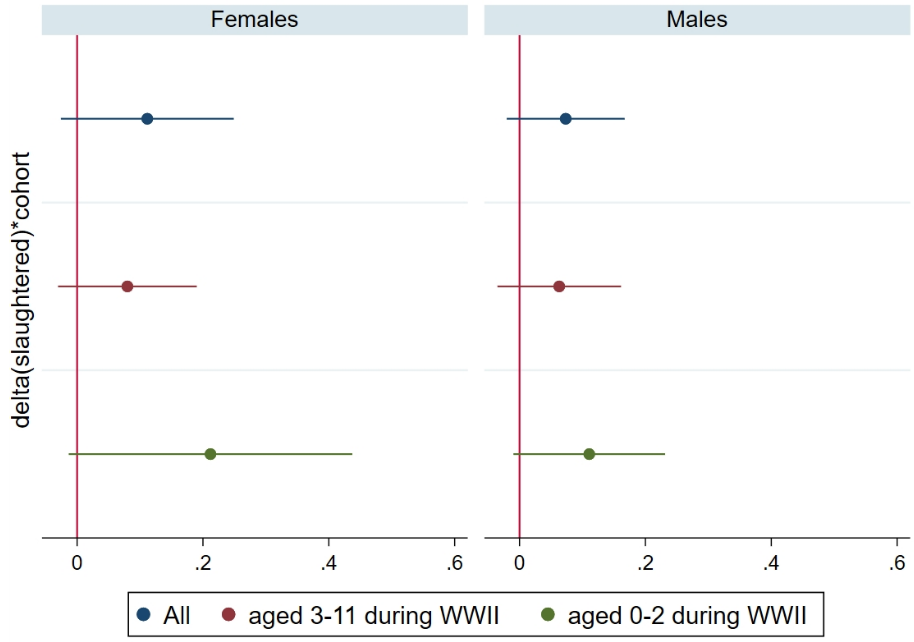
(b) Δ(Slaughtered) as proxy of meat scarcity

Notes: Estimated coefficients of the interaction term in the diff-in-diff specification and 95% confidence intervals. Standard errors clustered at the regional level. The dependent variable is a dummy=1 if the individual eats meat every day and 0 otherwise. Similarly for the regressions on fish, sweets and snacks. See equation (1) and notes of Table 2 for a detailed description of the specification. $\Delta(Livestock)$ is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region; $\Delta(Slaughtered)$ is the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each region.

Figure 5. Effects of meat scarcity on meat eating habits-by gender and age of exposure



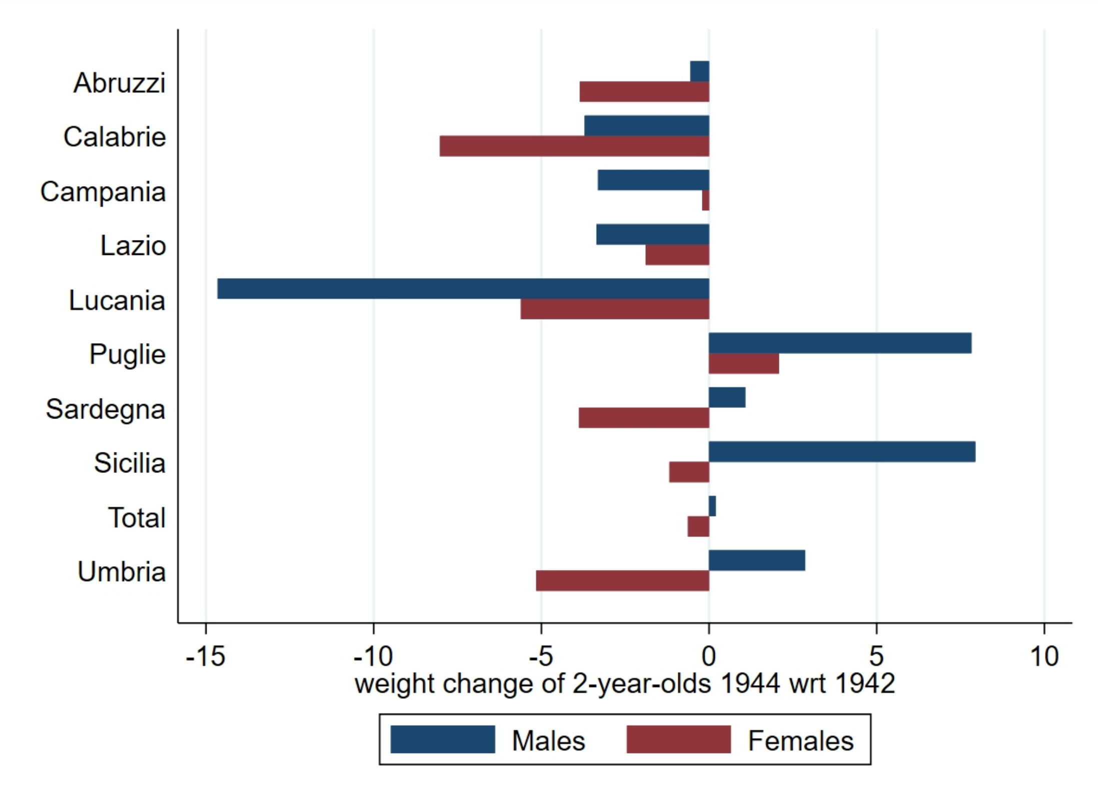
(a) Δ(Livestock) as proxy of meat scarcity



(b) Δ(Slaughtered) as proxy of meat scarcity

Notes: Estimated coefficients of the interaction term in the diff-in-diff specification and 95% confidence intervals. Standard errors clustered at the regional level. The dependent variable is a dummy=1 if the individual eats meat every day and 0 otherwise. See equation (1) and notes of Table 2 for a detailed description of the specification. Treated: all (born in 1934-1945); aged 3-11 during WWII (born in 1934-1943); aged 0-2 during WWII (born in 1943-1945). Control: born in 1946-1957. $\Delta(Livestock)$ is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region; $\Delta(Slaughtered)$ is the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each region.

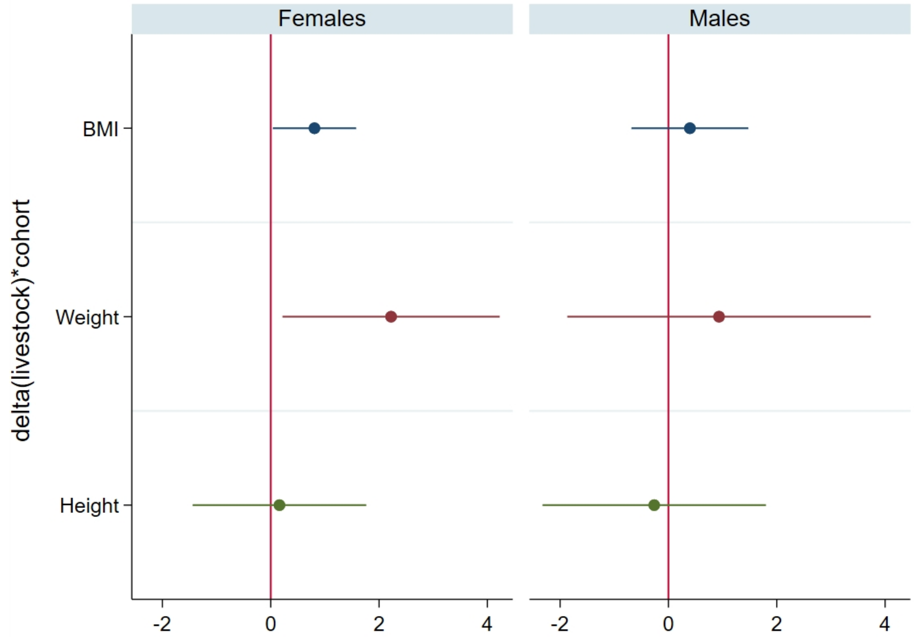
Figure 6. Change in average weight of 2-year-olds (%) by gender, 1942-1944



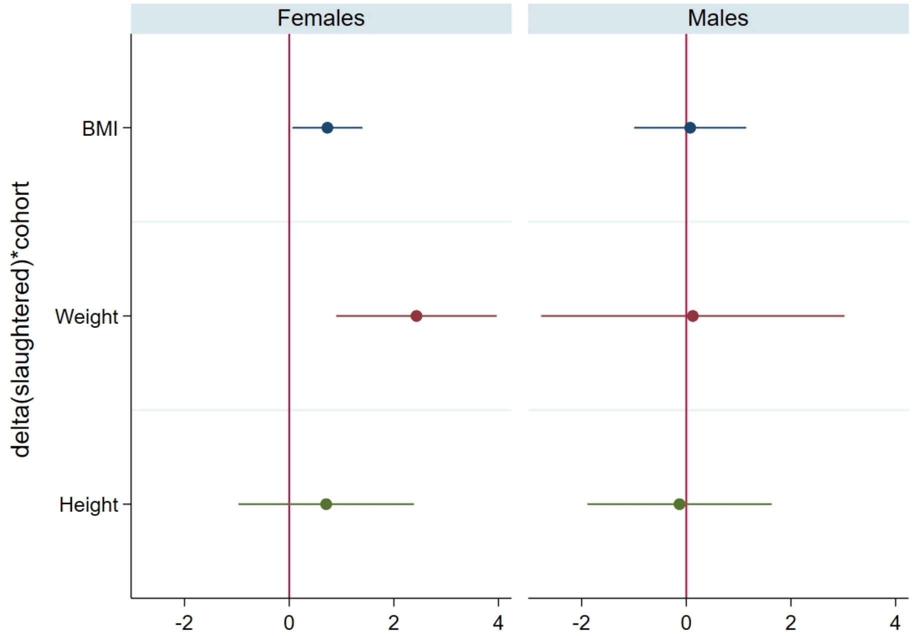
Notes: The figure shows the percentage change in average weight of 2-year-olds by gender between 1942 and 1944 in a set of regions with available data (liberated territory). In most regions, females were more severily affected than males.

Sources: Census and Surveys for the National Reconstruction 1944, Survey on Living Conditions-Public Health, Istat (1945).

Figure 7. Effects of meat scarcity on BMI, weight and height-by gender



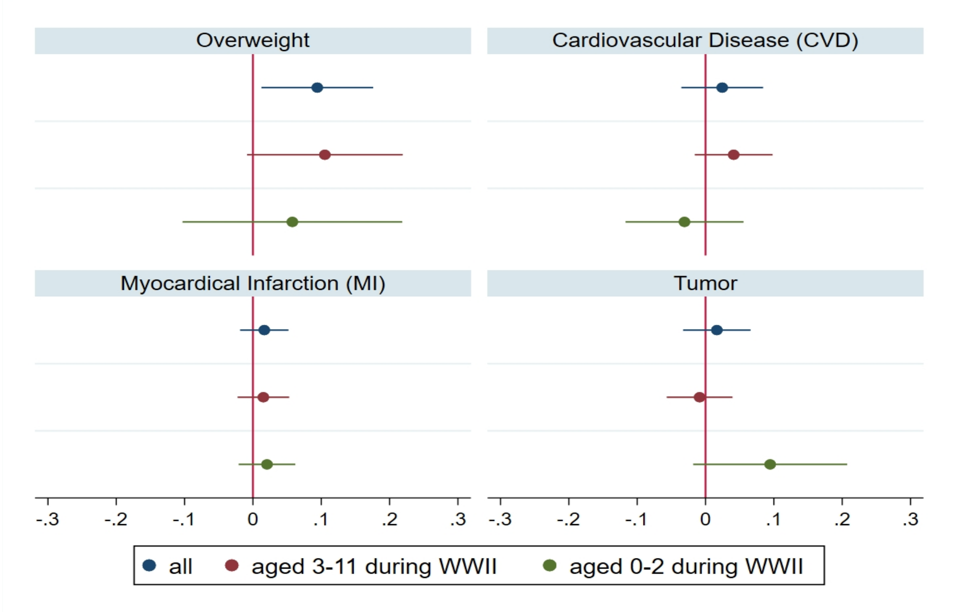
(a) Δ(Livestock) as proxy of meat scarcity



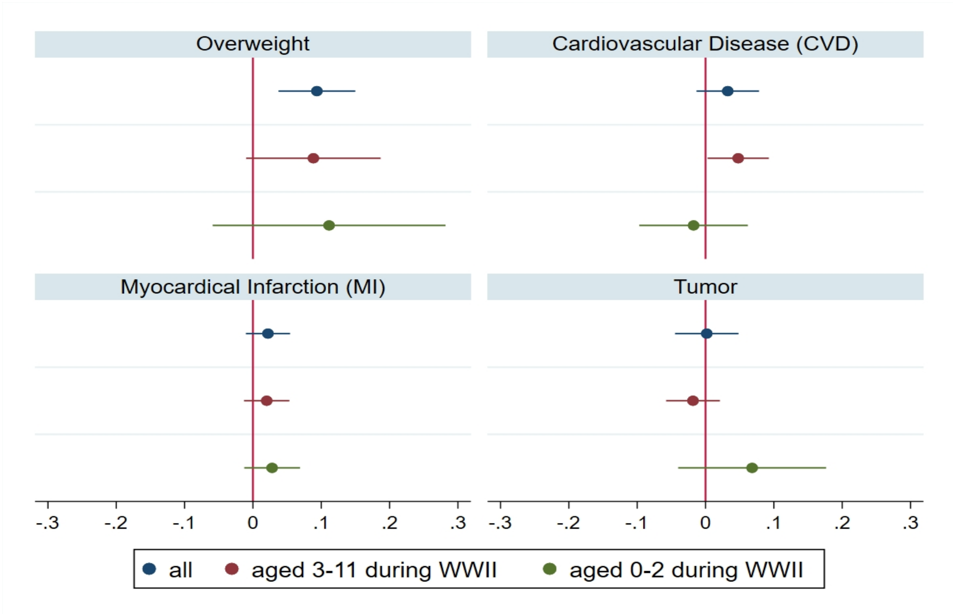
(b) Δ(Slaughtered) as proxy of meat scarcity

Notes: Estimated coefficients of the interaction term in the diff-in-diff specification and 95% confidence intervals. Standard errors clustered at the regional level. The dependent variable is BMI=(weight in kg)/(height in m)^2 in the first regression, weight in kg in the second and height in cm in the third. See equation (1) and notes of Table 2 for a detailed description of the specification. $\Delta(\textit{Livestock})$ is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region; $\Delta(\textit{Slaughtered})$ is the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each region.

Figure 8. Effects of meat scarcity on health outcomes-females by age of exposure



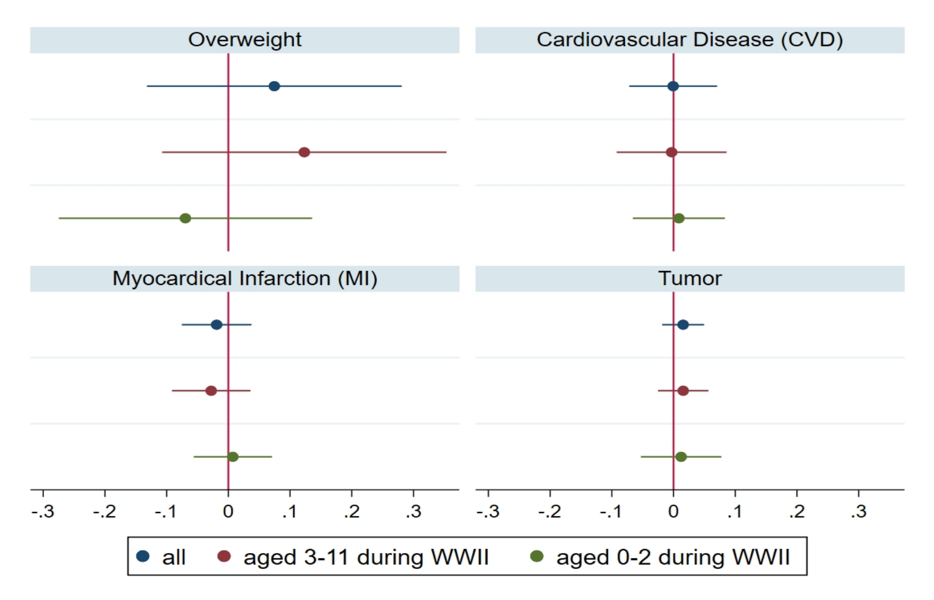
(a) Δ(Livestock) as proxy of meat scarcity



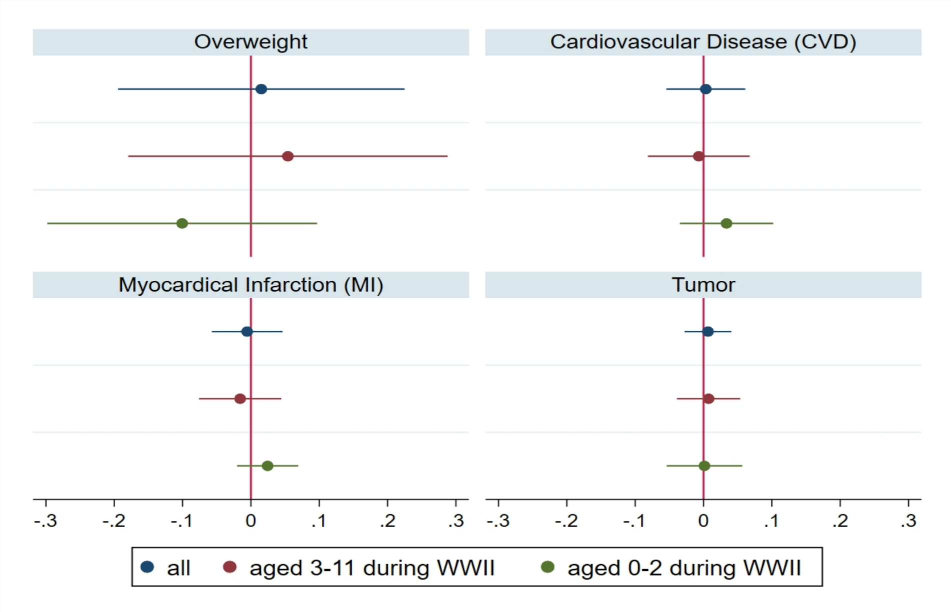
(b) Δ(Slaughtered) as proxy of meat scarcity

Notes: Estimated coefficients of the interaction term in the diff-in-diff specification and 95% confidence intervals. Standard errors clustered at the regional level. The dependent variable is a dummy=1 if the individual is overweight (BMI$\geq$25) and 0 otherwise (upper left). Similarly, the other dependent variables are a dummy=1 if the individual suffers from cardiovascular disease (upper right), from myocardical infarction (lower left), or tumor (lower right). See equation (1) and notes of Table 2 for a detailed description of the specification. Treated: all (born in 1934-1945); aged 3-11 during WWII (born in 1934-1943); aged 0-2 during WWII (born in 1943-1945). Control: born in 1946-1957. $\Delta(Livestock)$ is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region; $\Delta(Slaughtered)$ is the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each region.

Figure 9. Effects of meat scarcity on health outcomes-males by age of exposure



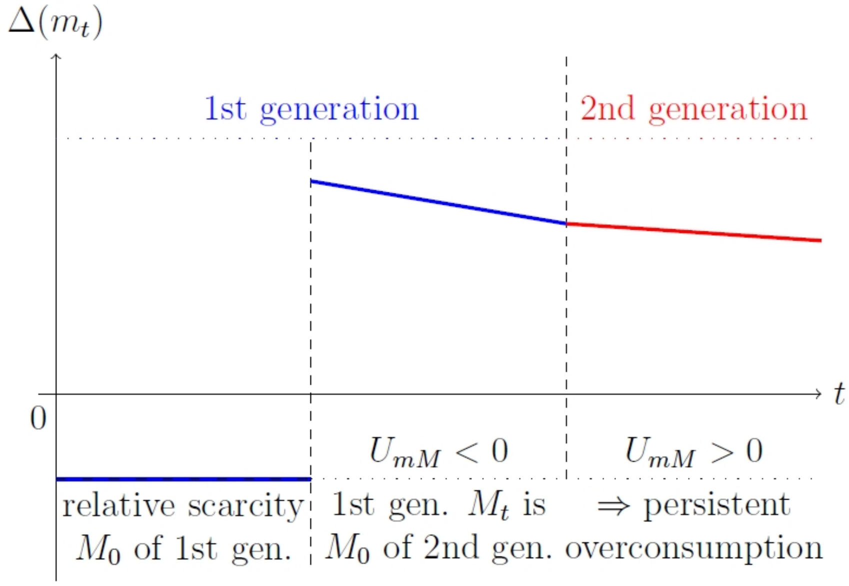
(a) Δ(Livestock) as proxy of meat scarcity



(b) Δ(Slaughtered) as proxy of meat scarcity

Notes: Estimated coefficients of the interaction term in the diff-in-diff specification and 95% confidence intervals. Standard errors clustered at the regional level. The dependent variable is a dummy=1 if the individual is overweight (BMI≥25) and 0 otherwise (upper left). Similarly, the other dependent variables are a dummy=1 if the individual suffers from cardiovascular disease (upper right), from myocardical infarction (lower left), or tumor (lower right). See equation (1) and notes of Table 2 for a detailed description of the specification. Treated: all (born in 1934-1945); aged 3-11 during WWII (born in 1934-1943); aged 0-2 during WWII (born in 1943-1945). Control: born in 1946-1957. $\Delta(Livestock)$ is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region; $\Delta(Slaughtered)$ is the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each region.

Figure 10. Intergenerational transmission-model predictions vs empirical estimates



(a) Model predictions

(b) Empirical estimates

Notes: Model predictions and estimated coefficients of the interaction term in the diff-in-diff specification and 95% confidence intervals. Standard errors clustered at the regional level. The dependent variable is a dummy=1 if the individual eats meat every day and 0 otherwise. The treatment always refers to the mother. There is a large effect on mothers (direct), a statistically significant but smaller effect on coresident children aged 18-26 and no peer effect on fathers (husbands). See Table 3, panel A for the full specification.

Tables

Table 1. Descriptive statistics

	(1)	(2)	(3)
Cohort	All	Treated	Control
Characteristic	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)
% Eat meat every day	13.43	14.47	12.58
BMI	25.80 (3.74)	26.14 (3.75)	25.51 (3.71)
Weight	71.89 (12.73)	72.18 (12.28)	71.65 (13.08)
Height	166.7 (8.27)	165.9 (7.99)	167.3 (8.45)
% Overweight	54.94	59.09	51.55
% Cardiovascular disease	3.50	5.75	1.65
% Myocardical infarction	1.97	3.13	1.02
% Tumor	2.30	2.94	1.79
% Males	49.08	49.19	49.00
Age	56.85 (6.83)	63.37 (3.39)	51.52 (3.51)
% University degree	7.47	5.04	9.45
% High occupational level	9.29	8.00	10.34
N	13,234	5,859	7,375

Means and standard deviations in paranthesis. Treated cohort: born in 1934-1945; Control cohort: born in 1946-1957. BMI is defined as (weight in kg)/(height in m)^2; Overweight are individuals with BMI$\geq$25. High occupational level if manager, middle manager or entrepreneur. Survey weights used.

Table 2. Effects of meat scarcity on meat eating habits-benchmark

	(1)	(2)
Panel A	Dep. Var.: Eat meat every day	
	Benchmark (excluding "migrants")	All
Cohort*Δ(Livestock)	0.132**	0.107**
	(0.049)	(0.050)
Cohort	-0.038**	-0.033*
	(0.015)	(0.016)
Individual controls	Yes	Yes
Region FE	Yes	Yes
N	13,234	16,189
R^2	0.020	0.019
Panel B	Dep. Var.: Eat meat every day	
	Benchmark (excluding "migrants")	All
Cohort*Δ(Slaughtered)	0.093*	0.073
	(0.050)	(0.047)
Cohort	-0.023	-0.020
	(0.014)	(0.014)
Individual controls	Yes	Yes
Region FE	Yes	Yes
N	13,234	16,189
R^2	0.020	0.019

*** p<0.01, ** p<0.05, * p<0.1. Robust s.e. in parenthesis clustered at the regional level, survey weights used. *Cohort*=1 if born in 1943-1945 and 0 if born in 1946-1957; Δ(*Livestock*) is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region; Δ(*Slaughtered*) is the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each region. Individual characteristics: age, age squared, university degree, gender*university degree, high school diploma, high occupational level. "Migrants" are those who declare living far away from their relatives.

Table 3. Intergenerational transmission of eating habits-DD direct & indirect effect

	(1)	(2)	(3)
Panel A		Dep. Var.: Eat meat every day	
	Mothers	Coresident children 18-26	Fathers
Mother's cohort*Δ(Livestock)	0.514***	0.376**	0.273
	(0.150)	(0.142)	(0.233)
Mother's cohort	-0.154**	-0.096	-0.082
	(0.067)	(0.054)	(0.089)
Regional dummies	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes
N	2,015	2,629	1,820
R^2	0.043	0.037	0.031
Panel B		Dep. Var.: Eat meat every day	
	Mothers	Coresident children 18-26	Fathers
Mother's cohort*Δ(Slaughtered)	0.426**	0.344*	0.296
	(0.154)	(0.184)	(0.204)
Mother's cohort	-0.124*	-0.087	-0.096
	(0.068)	(0.077)	(0.075)
Regional dummies	Yes	Yes	Yes
Individual controls	Yes	Yes	Yes
N	2,015	2,629	1,820
R^2	0.042	0.037	0.031

*** p<0.01, ** p<0.05, * p<0.1. Robust s.e. in parenthesis clustered at the regional level, survey weights used. *Mother's cohort*=1 if mother born in 1943-1945 and 0 if born in 1946-1957; Δ(*Livestock*) is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region; Δ(*Slaughtered*) is the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each region. Individual characteristics: age, age squared, university degree, gender*university degree, high school diploma, own high occupational level in col. (1) and (3), high occupational level of the father in col. (2).

Table 4. Effects of meat scarcity on food expenditures over total consumption

	(1)	(2)
Panel A	Dep. Var.: Share of food expenditures	
	region of birth	region of residence excluding migrants
Cohort*Δ(Livestock)	0.062*	0.075**
	(0.034)	(0.035)
Cohort	-0.005	-0.011
	(0.015)	(0.016)
Individual controls	Yes	Yes
Region FE	Yes	Yes
N	2,216	1,826
R^2	0.203	0.222
Panel B	Dep. Var.: Share of food expenditures	
	region of birth	region of residence excluding migrants
Cohort*Δ(Slaughtered)	0.051*	0.063**
	(0.027)	(0.026)
Cohort	-0.001	-0.007
	(0.013)	(0.013)
Individual controls	Yes	Yes
Region FE	Yes	Yes
N	2,216	1,826
R^2	0.203	0.223

*** p<0.01, ** p<0.05, * p<0.1. Robust s.e. in parenthesis clustered at the regional level, survey weights used. *Cohort*=1 if a female houseshold member was born in 1934-1945 and 0 if born in 1946-1957; Δ(*Livestock*) is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region; Δ(*Slaughtered*) is the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each region. Individual characteristics: age, age squared, university degree; Household characteristics: log(income). Consumption and food expenditures are equivalized using the ISEE scale. Migrants are those whose region of birth is different than the region of origin.

Table 5. Effects of meat scarcity on eating habits-robustness

	(1)	(2)	(3)	(4)	(5)
Dep. Var.:	Eat meat every day				
	Benchmark	Different clustering	Different base year	Control for GDP	Control for casualties
Cohort*Δ(Livestock)	0.132**	0.132**	0.134**	0.130**	0.120**
	(0.049)	(0.053)	(0.048)	(0.053)	(0.049)
Cohort	-0.038**	-0.038*	-0.042**	-0.035**	-0.031**
	(0.015)	(0.017)	(0.017)	(0.015)	(0.014)
Δ(Livestock)	(absorbed by FE)	(absorbed by FE)	(absorbed by FE)	-0.220**	-0.180**
				(0.099)	(0.074)
Individual controls	Yes	Yes	Yes	Yes	Yes
Cluster	By region	Two way region, age	By region	By region	By region
Base year	1941-42	1941-42	1940	1941-42	1941-42
Regional controls	No	No	No	Δ(GDP)	Casualties
FE	Region	Region	Region	Macro area	Macro area
N	13,234	13,234	13,234	11,957	13,234
R^2	0.020	0.020	0.021	0.014	0.014

*** p<0.01, ** p<0.05, * p<0.1. Robust s.e. in parenthesis clustered at the regional level, survey weights used. *Cohort*=1 if born in 1934-1945 and 0 if born in 1946-1957; Δ(*Livestock*) is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region. Individual characteristics: age, age squared, university degree, gender*university degree, high school diploma, high occupational level. Col. (1) presents the benchmark estimates, col. (2) with two-way clustered standard errord by region and age, col. (3) using the number of slaughtered animals for meat in 1940 (available only for the North), col. (4) controlling for the % change in GDP per capita between 1942 and 1945 and col. (5) controlling for the number of casualties per 1000 population in 1936.

Table 6. Effects of meat scarcity on meat eating habits-DDD

	(1)
Dep. Var.:	Eat meat every day
Cohort*Scarcity*Wave	0.083**
	(0.038)
Cohort	-0.007
	(0.018)
Cohort*Scarcity	-0.006
	(0.015)
Wave	0.000
	(0.010)
Cohort*Wave	0.013
	(0.018)
Scarcity*Wave	0.003
	(0.013)
Individual controls	Yes
Region FE	Yes
N	9,518

*** p<0.01, ** p<0.05, * p<0.1. Robust s.e. in parenthesis clustered at the regional level, survey weights used. *Cohort*=1 if aged 58-60 and 0 if aged 55-57; *Scarcity*=1 for regions in the 75th percentile of the % decrease in the number of breed and slaughtered animals between 1941-42 and 1945 and 0 otherwise. Wave=1 refers to the survey wave 2003 and 0 to 2011. Individual characteristics: age, age squared, university degree, gender*university degree, high school diploma, high occupational level.

Table 7. Effects of meat scarcity on eating habits-placebo

	(1)	(2)
Dep. Var.:	Eat meat every day	Eat meat every day
	benchmark	placebo
Cohort*Δ(Livestock)	0.132**	0.047
	(0.049)	(0.051)
Cohort	-0.038**	-0.010
	(0.015)	(0.024)
Individual controls	Yes	Yes
Regional FE	Yes	Yes
Treated	born in 1934-1945	born in 1958-1969
Control	born in 1946-1957	born in 1946-1957
N	13,234	15,351
R^2	0.020	0.017

*** p<0.01, ** p<0.05, * p<0.1. Robust s.e. in parenthesis clustered at the regional level, survey weights used. *Cohort*=1 if born in 1934-1945 and 0 if born in 1946-1957 in col. (1); *Cohort*=1 if born in 1958-1969 and 0 if born in 1946-1957 in col. (2). $\Delta(Livestock)$ is the % change in the number of breed animals between 1941-42 and 1944 in each Central-Southern region and the % change in the number of animals slaughtered for meat between 1941-42 and 1945 in each Northern region. Individual characteristics: age, age squared, university degree, gender*university degree, high school diploma, high occupational level. Col. (1) present the benchmark estimates and col. (2) the placebo estimates assuming that the outbreak of WWII was in 1958.

Appendix A

Proof of Proposition 1

The optimal first order conditions are:

$$\frac{\partial U}{\partial m_t} + V_M \frac{\partial \dot{M}}{\partial m_t} + V_A \frac{\partial \dot{A}}{\partial m_t} = 0 \Rightarrow U_m = p_t^m V_A - V_M$$
$$\frac{\partial U}{\partial g_t} + V_A \frac{\partial \dot{A}}{\partial g_t} = 0 \Rightarrow U_g = p_t^g V_A.$$

The linear-quadratic structure of the utility function allows us to assume that the following value function solves the problem:

$$V(M, A) = \alpha_1 M + \alpha_2 M^2 + \alpha_3 A + \alpha_4.$$

The first order derivatives of the value function are:

$$V_M = \frac{\partial V}{\partial M} = \alpha_1 + 2\alpha_2 M$$
$$V_A = \frac{\partial V}{\partial A} = \alpha_3.$$

From the first order conditions with respect to m and g:

$$U_m = V_M + p_t^m V_A \Rightarrow \hat{m} - m_t + U_{mM}(M_t - M^*) = V_M + p_t^m V_A$$
$$U_g = p_t^g V_A \Rightarrow \hat{g} - g_t = p_t^g V_A.$$

Then the optimal consumption of meat and other goods is obtained as a function of the unspecified parameters of the optimal value function:

$$m_t = \alpha_1 + \hat{m} + U_{mM}(M_t - M^*) + 2\alpha_2 M_t - p_t^m \alpha_3 \tag{5}$$

$$g_t = \hat{g} - p_t^g \alpha_3. \tag{6}$$

We replace the above expressions in the Hamiltonian-Jacobian-Bellman equation, then the HJB function depends only on state variables and parameters. Let $r = \rho$ then using the Method of Undetermined Coefficients, the coefficients are:

$$\alpha_1 = \frac{\hat{m} - \alpha_3 p^m - U_{mM} M^*}{\rho + \sqrt{(2\delta + \rho)(2\delta + \rho - 4U_{mM})}} \left(2\delta + \rho - \sqrt{(2\delta + \rho)(2\delta + \rho - 4U_{mM})}\right)$$
$$\alpha_2 = \frac{1}{4}\left(2\delta + \rho - \sqrt{(2\delta + \rho)(2\delta + \rho - 4U_{mM})} - 2U_{mM}\right)$$
$$\alpha_4 = \frac{(\hat{g} - \alpha_3 p^g)^2 + (\alpha_1 + \hat{m} - \alpha_3 p^m - U_{mM} M^*)^2 + 2\alpha_3 Y}{2\rho}.$$

Moreover, the shadow value of the assets, α_3, is determined by replacing the FOCS into $\dot{M}, \dot{A}$ and solving the system of linear differential equations. α_3 must be positive to ensure that the marginal utility of the utility function (10) with respect to other goods is positive: $\frac{\partial U}{\partial g} = \hat{g} - g = \alpha_3 p_t^g > 0$.

Substituting now the coefficients α_1, α_2, α_3 and α_4 into equations (5) we obtain:

$$m^* = -\frac{2(\delta + r)(\hat{m} - a_3 p^m - U_{mM} M^*)}{r + \sqrt{(2\delta + r)(2\delta + r - 4U_{mM})}} + \frac{1}{2}(2\delta + r - \sqrt{(2\delta + r)(2\delta + r - 4U_{mM})}) M_t. \quad (7)$$

In the long-run equilibrium, the consumption of meat is:

$$m_{ss} = \delta M_{ss} = \frac{(\hat{m} - a_3 p^m)(\delta + r)}{\delta(\delta + r) - (2\delta + r) U_{mM}} + \frac{M^*(\sqrt{(2\delta + r)(2\delta + r - 4U_{mM}} - 2\delta - r) U_{mM}}{2\delta(\delta + r) - 2(2\delta + r) U_{mM}}. \quad (8)$$

Then substituting the policy function (7) in the differential equations $\dot{M}_t$ and $\dot{A}_t$, and solving with respect to M_t and A_t, for initial conditions M_0 and A_0 yields the time path of meat consumption experience:

$$M_t = e^{1/2t(r-\Psi)} Mo + (1 - e^{1/2t(r-\Psi)}) M_{ss}, \quad (9)$$

where $\Psi = \sqrt{(2\delta + r)(2\delta + r - 4U_{mM})}$.

Then, replacing equation (9) into equation (7) we get:

$$\begin{aligned} m_t = & e^{1/2t(r-\Psi)} \frac{\delta\Psi - (2\delta + r)(\delta - 2U_{mM})}{r + \Psi} M_o + \\ & - M^* U_{mM} + \left(d - e^{1/2t(r-\Psi)} \frac{\delta\Psi - (2\delta + r)(\delta - 2U_{mM})}{r + \Psi} \right) M_{ss}, \end{aligned} \quad (10)$$

which is the equation (1) in Proposition (1), namely

$$m_t = (\delta - \alpha_t) M_{SS} - U_{mM} M^* + \alpha_t M_o,$$

, where $\alpha_t = e^{1/2t(r-\Psi)} \frac{\delta\Psi - (2\delta + r)(\delta - 2U_{mM})}{r + \Psi}$.

Proof of Proposition 2

The sign of the difference $\Delta m_t = \alpha_t (M_0^{nm,1st} - M_0^{m,1st})$ depends on the sign of α_t. The denominator is positive, hence the sign depends on the nominator of α_t. The nominator of α_t is:

$$\delta\Psi - (2\delta + r)(\delta - 2U_{mM}) < 0 \qquad \text{if} \quad U_{mM} < 0$$

$$\delta\Psi - (2\delta + r)(\delta - 2U_{mM}) > 0 \qquad \text{if} \quad U_{mM} > 0.$$

Thus, given the sign of α_t, the Proposition (2) follows.

Proof of Proposition 3

The sign of the difference $\Delta m_t = \alpha_t(M_0^{nm,2nd} - M_0^{m,2nd})$ depends on the sign of α_t. The denominator is positive, hence the sign depends on the nominator of α_t. The nominator of α_t is:

$$\delta\Psi - (2\delta + r)(\delta - 2U_{mM}) < 0 \qquad \text{if} \quad U_{mM} < 0$$
$$\delta\Psi - (2\delta + r)(\delta - 2U_{mM}) > 0 \qquad \text{if} \quad U_{mM} > 0.$$

Thus, if $M_0^{nm,2nd} > M_0^{m,2nd}$, then $\Delta m_t > 0$ if $U_{mM} > 0$.

Proof of Proposition 4

Let $M^* = 0$, then the consumption difference between the two generations is:

$$m_t^{1st} - m_t^{2nd} = [(\delta - \alpha_{t,1st})M_{SS,1st} + \alpha_{t,1st}M_{o,1st}] - \\ - [(\delta - \alpha_{t,2nd})M_{SS,2nd} + \alpha_{t,2nd}M_{o,2nd}] .$$

We know that $M_{o,1st} < M_{o,2nd}$, since the initial condition of the 1st generation is the one during the period of scarcity and the initial condition of the second generation is equal to the consumption of their parents during their children early life, i.e. during the abundance period. Thus, the initial conditions of the first generation is significantly lower than the one of the second generation. Then, given that $\alpha_{t,1st} < \alpha_{t,2nd}$ then $\alpha_{t,1st}M_{o,1st} < \alpha_{t,2nd}M_{o,2nd}$.

Moreover, from equation (8) follows that $m_{ss,1st} < m_{ss,2nd} \Rightarrow M_{ss,1st} < M_{ss,2nd}$ then $(\delta - \alpha_{t,1st})M_{ss,1st} < (\delta - \alpha_{t,2nd})M_{ss,2nd}$ for relative persistent habits, namely $\frac{\alpha_{t,1st}M_{ss,1st} - \alpha_{t,2nd}M_{ss,2nd}}{M_{ss,1st} - M_{ss,2nd}} < d < 1$ or significant 1st generation scarcity.

Let $M^* > 0$ the presence of a reference point M^* affects m_t indirectly through the steady state cumulative consumption M_{ss} and directly from the coefficient of M^*, namely $-U_{mM}$. The overall effect of the reference point on each generation consumption is $\frac{\partial m_t^{1st}}{\partial M^*} > 0$ and $\frac{\partial m_t^{2nd}}{\partial M^*} < 0$ for relative persistent habits $\frac{1}{4}(1 - 2r + r^2) < d < 1$. The difference in consumption between the two generation, when we consider the reference point, becomes:

$$m_t^{1st} - m_t^{2nd} = [(\delta - \alpha_{t,1st})M_{SS,1st} - U_{mM,1st}M^* + \alpha_{t,1st}M_{o,1st}] - \\ - [(\delta - \alpha_{t,2nd})M_{SS,2nd} - U_{mM,2nd}M^* + \alpha_{t,2nd}M_{o,2nd}]$$

and $m_t^{1st} - m_t^{2nd} > 0$ for relatively persistent habits.

Appendix B

Figure B1. An extract of the historical livestock census

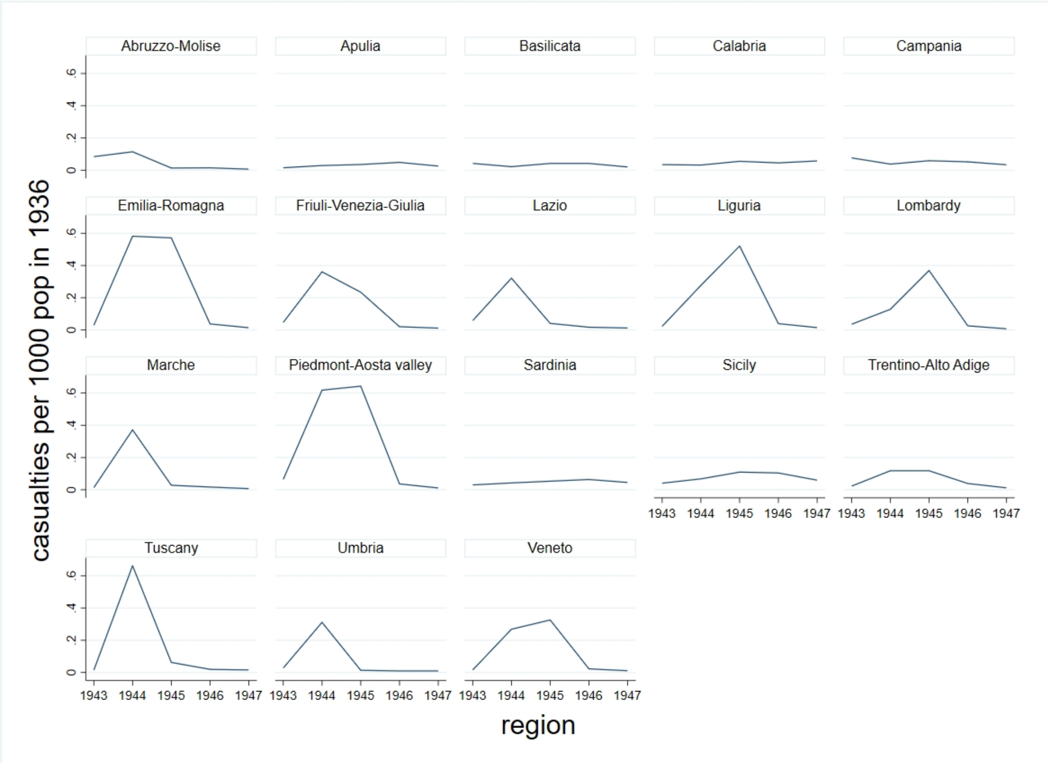
Segue : TAV. 46 — Censimento del bestiame al 20 luglio 1942

Segue : *a*) PER SPECIE (*capi*)

CIRCOSCRIZIONI	EQUINI			BOVINI		BUFALI	SUINI		OVINI		CAPRINI
	Cavalli	Asini	Muli e bardotti	Totale	di cui vacche		Totale	di cui scrofe	Totale	di cui pecore	
Piemonte	61.747	9.343	13.502	1.116.504	529.190	—	219.372	19.705	256.994	164.507	98.239
Liguria	5.786	5.327	6.033	98.375	57.450	—	8.959	317	74.317	55.694	27.608
Lombardia	160.473	34.616	8.606	1.509.005	739.612	—	477.304	38.800	143.569	89.180	63.038
Venezia Tridentina	10.574	1.978	1.024	188.531	103.403	—	48.163	4.193	96.874	55.008	41.893
Veneto	64.899	33.441	5.995	1.293.347	573.694	—	428.962	36.550	190.887	129.007	56.712
Venezia Giulia e Zara	6.746	12.771	1.124	159.521	75.952	—	93.285	10.445	140.560	105.781	30.995
Emilia	64.916	28.300	4.524	1.367.525	641.188	—	451.296	59.400	266.519	193.166	11.657
Toscana	31.512	39.590	4.554	482.278	188.075	—	312.001	51.457	846.007	696.179	20.713
Marche	11.107	7.304	2.343	473.093	207.349	—	242.286	28.121	356.961	274.242	6.206
Umbria	9.040	17.277	3.421	205.554	71.057	—	212.341	39.751	371.240	286.990	4.953
Lazio	35.299	69.390	14.050	296.716	142.965	1.870	240.312	27.918	1.199.662	941.916	69.533
Abruzzi e Molise	28.233	64.879	18.140	210.354	114.471	—	206.943	15.199	910.415	724.802	84.627
Campania	53.902	70.978	10.404	218.327	112.190	9.389	263.311	36.165	388.997	303.539	119.167
Puglie	89.771	39.136	50.270	84.145	43.079	1.507	54.633	9.323	735.614	572.841	100.565
Lucania	13.380	28.167	18.273	62.266	24.934	293	105.070	17.193	448.361	328.372	129.917
Calabrie	10.305	61.577	5.445	134.850	61.308	—	196.598	22.733	417.999	336.180	241.114
Sicilia	75.679	121.256	144.341	244.270	105.157	—	48.270	9.624	574.013	485.731	245.639
Sardegna	36.215	36.484	633	226.841	73.831	—	116.110	33.700	2.003.066	1.632.602	374.035

Note: An extract of the 1942 livestock census that we digitized. We consider the sum of cattle, pigs, poultry, goats and sheep to measure the availability of meat in each region. Source: Census of Agriculture 1942 (Istat, 1948).

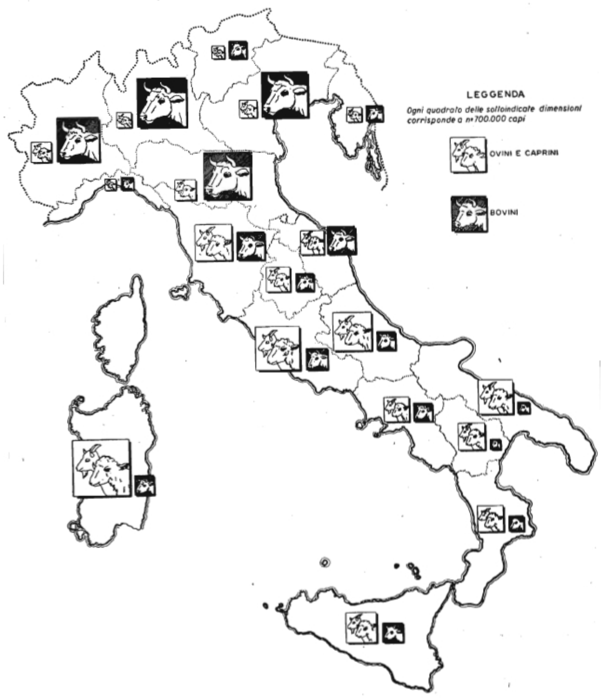
Figure B2. Casualties by explosives or firearms/1000 population in 1936



Notes: Number of casualties by explosives or firearms per 1000 population in 1936. They peak in 1944 in the Central regions and in 1945 in the Northern regions.

Source: Morti e Dispersi per Cause Belliche negli Anni 1940-1945, Istat (1957).

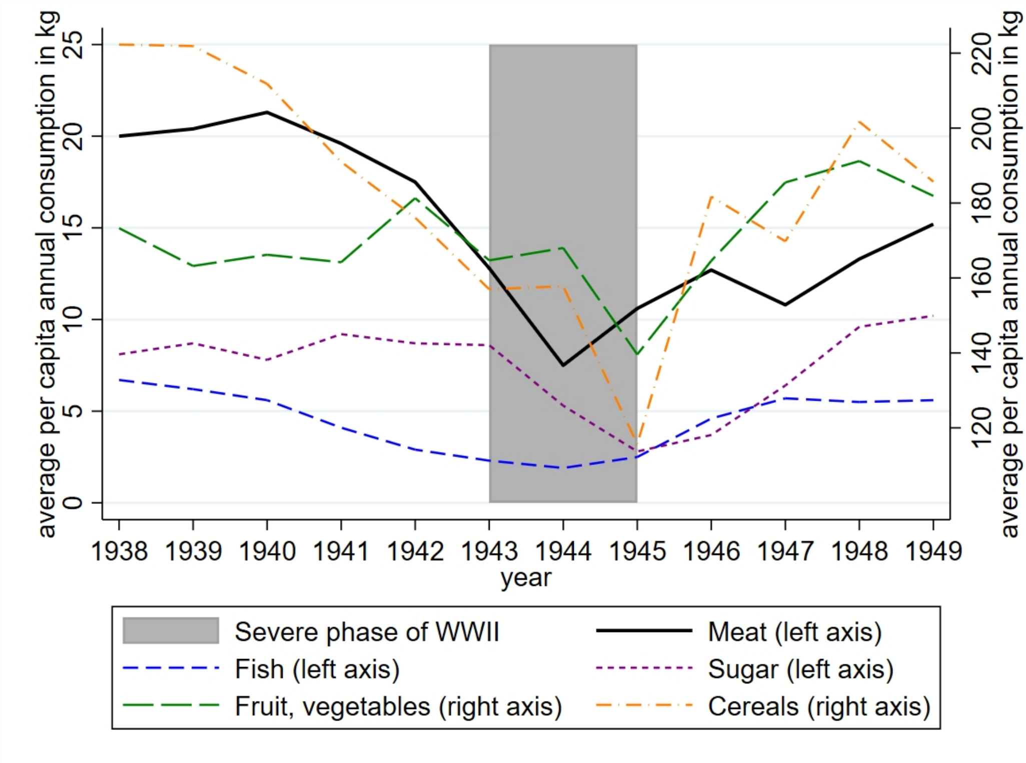
Figure B3. Distribution of livestock across regions in 1942



Notes: The figure shows that livestock was widespread all over the Italian territory. Cattle was more common in the North while goats and sheep were more common in the Center-South.

Sources: Statistical Summary of the Italian Regions (Istat, 1947).

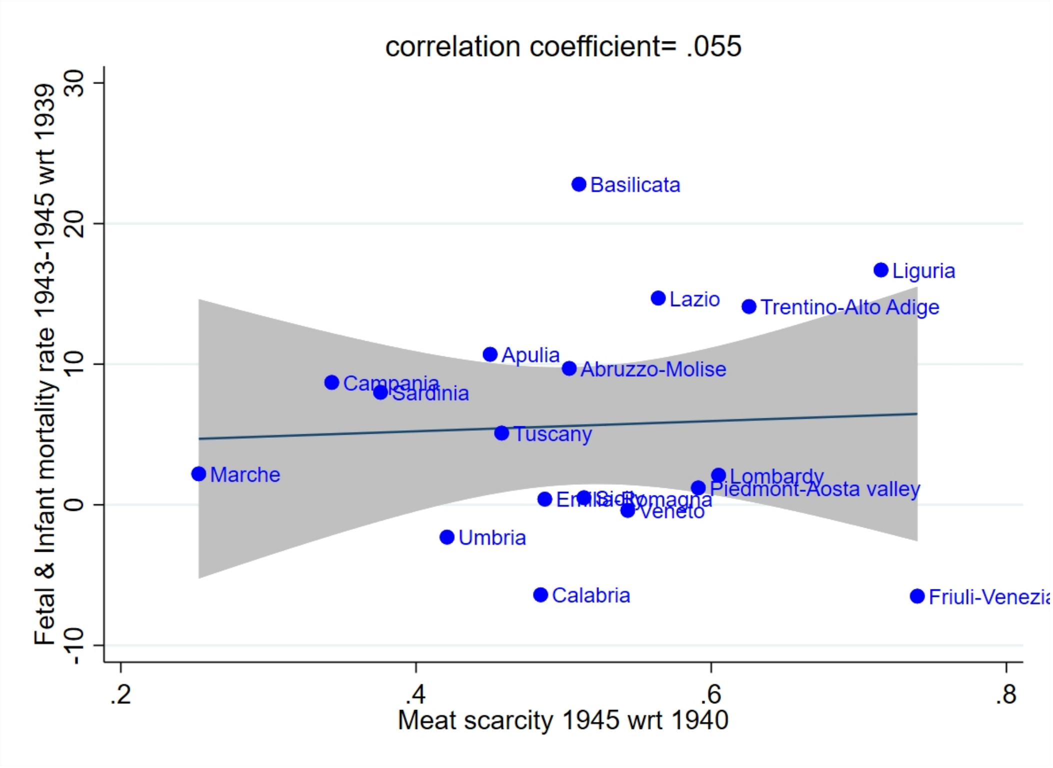
Figure B4. Average per capita annual consumption of various food products



Notes: The figure shows the average consumption of various food products per inhabitant in the period 1938-1949. Average consumption of meat fell sharply in 1943 and 1944. The consumption of other food products also dropped but mostly in 1945. Average consumption per inhabitant is the ratio of total quantities consumed of each food product over the mid-year resident population.

Sources: Summary of Historical Statistics of Italy 1861-1975, (Istat, 1976).

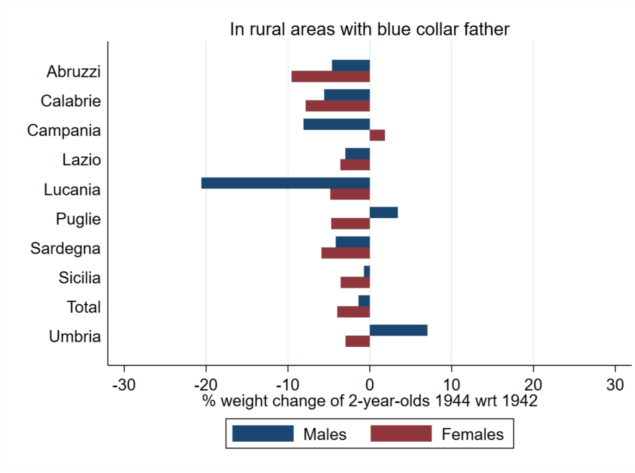
Figure B5. Correlation between fetal-infant mortality and meat scarcity



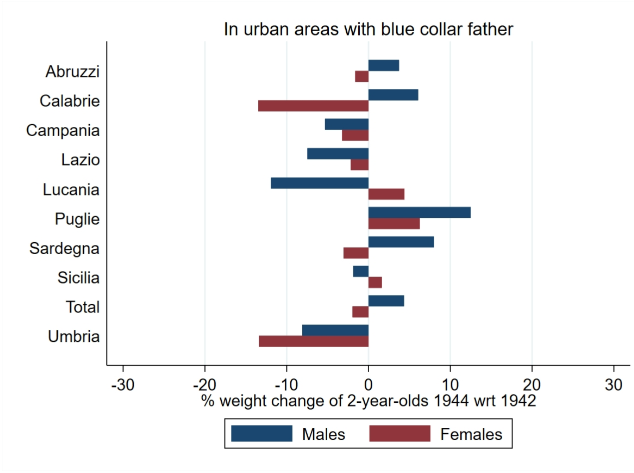
Notes: The figure shows that there is no correlation between the change in fetal-infant mortality rate between 1939 and 1943-45 and the % change in the number of animals slaughtered for meat between 1940 and 1945 at the regional level. Sources: Causes of Death in Italy in the Decade 1939-1948 (Istat, 1950b) and Annual Agricultural Statistics 1940 (Istat, 1948) and 1945 (Istat, 1950a).

Figure B6. Change in average weight of 2-year-olds (%) by gender and paternal occupation in rural and urban areas, 1942-1944

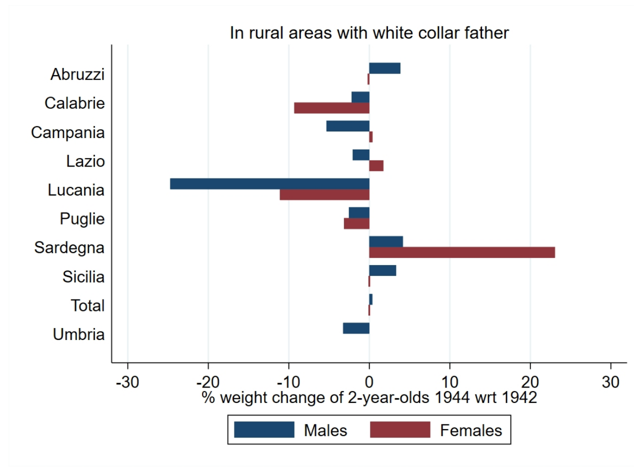
(a)



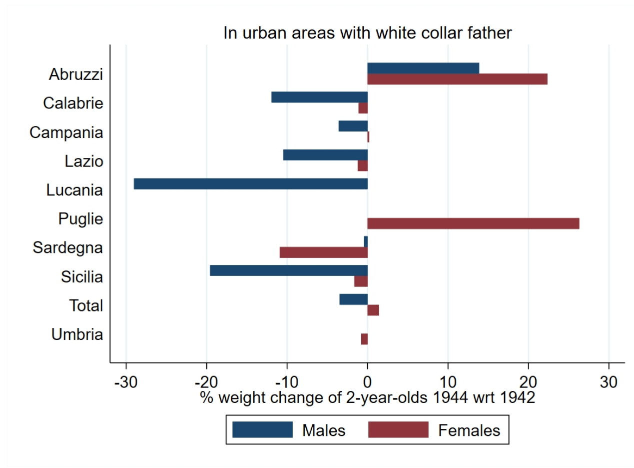
(b)



(c)



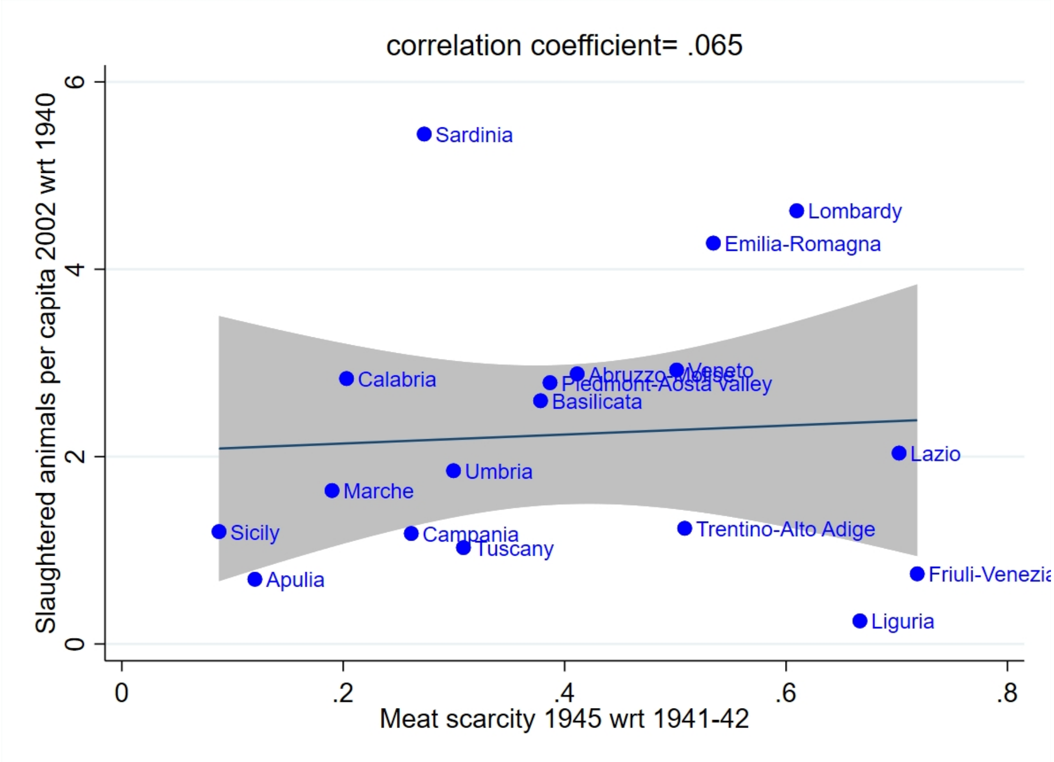
(d)



Notes: The figure shows the percentage change in average weight of 2-year-olds by gender and paternal occupation between 1942 and 1944 in rural and urban areas of a set of regions with available data (liberated territory). Females fared worse than males if their father was a manual worker (blue collar). (a) Among the children of blue collars in rural areas, the average weight loss in the period 1942-1944 was 4.0 per cent for females and only 1.4 per cent for males in total. This gender gap was evident in seven out of nine regions. (b) Among the children of blue collars in urban areas, the average weight of 2-year-old females in 1944 was 2.0 per cent lower compared to 1942 while the average weight of 2-year-old males in the same period increased by 4.3 per cent. (c) Among children of white collars in rural areas, there is no gender gap in total. (d) Among children of white collars in urban areas, males fared worse than females.

Sources: Census and Surveys for the National Reconstruction 1944, Survey on Living Conditions-Public Health, Istat (1945).

Figure B7. Correlation between the evolution over time of the number of slaughtered animals per capita (2002 vs 1940) and meat scarcity between 1941-42 and 1945



Notes: The figure shows that the number of slaughtered animals per capita increased significantly over time (2002 wrt 1940) in all regions. However, this increase is not correlated with the regional meat scarcity during WWII.

Sources: Annual Agricultural Statistics 1940, 1941, 1942 (Istat, 1948), 1945 (Istat, 1950a), 2002 (http://dati.istat.it/Index.aspx?DataSetCode=DCSP_MACELLAZIONI).