Impact of early life stress on long-term labour market outcomes *

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Abstract

This paper analyses the long-term effects of in utero exposure to maternal stress on adult labour market outcomes using an Italian administrative dataset on the universe of workers. We leverage the episodes of Nazi violence during World War II (WWII) and analyze the difference between cohorts of males born in municipalities before and after onsets of Nazi rides, relative to the same cohorts that went through no violence. We find a significant labour market penalty for individuals exposed to Nazi violence, net of the overall WWII events. We find that the magnitude of this penalty is the highest at the age of XXX and most pronounced in terms of lower earnings, lower labour force participation and lower probability of perceiving a pension.

JEL Codes: I1, O1
Keywords: Fetal programming; Stress; Earnings; Labour force; Disability, long-term effects.

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1 Introduction

The “fetal origins” hypothesis developed by Barker (1990) has recently gained extensive attention in the economic literature (Almond and Currie, 2012), Almond et al. (ming). The essential idea is that exposure to an adverse event in the intrauterine period activates in the fetus alert mechanisms which remain programmed later in life, leading to disequilibrium and future disease" (Almond and Currie, 2012). Stress is one of the most pertinent shocks in modern developed countries, ranging from acute time-limited to chronic indefinite stressors. Stress is likely to affect a developing fetus through the production of cortisol (corticotrophin-releasing hormone), which is found to increase the likelihood of pre-term birth and low birth weight (Hobel and Culhane, 2003). Above that, stress is also known to suppress immune function and increase susceptibility to infections in pregnant mothers, being another source of reduced gestational age and birth weight. As low socio-economic status others experience on average higher levels of stress, a causal link between fetal stress exposure and later life outcomes sheds light on one channel trough which disadvantage might be transmitted across generations. From this perspective investments allocating resources in programs supporting fetal health might have relevant rates of return and bring efficiency gains with respect to other traditional childhood investments.

A very narrow group of studies examine the effect of stress exposure of pregnant mothers on long-run labour market outcomes. Aizer et al. (2016) analyze the effects of directly measured stress hormone cortisol levels during pregnancy on educational attainment in a sibling fixed effects setting. They find that in utero exposure to elevated levels of stress negatively affects offspring cognition, health, and educational attainment. While this study relies on a direct measurement of stress, it has a disadvantage of somewhat small sample sizes and the fact that stress levels are correlated with unobserved events that have direct effects on the mother. Additionally, Black et al. (2016) show that stress induced by the death of the mother’s parent during pregnancy has a small negative effect on birth and long-term adult outcomes. Finally, Persson and Rossin-Slater (2018) in a similar framework show that a death of a maternal relative reduces psychological health in the long-run. A limitation of the two works is that the stress observed in the mothers is not randomly assigned, and exposure to its source is likely to be correlated with a number of unobserved events and circumstances, which

might not be controlled for with a mother/sibling fixed effect approach.

In this paper we offer a contribution to the maternal stress literature by studying labour market outcomes of individuals whose pregnant mothers witnessed an episode of Nazi violence during World War II (WWII). In a quasi-experimental setting, we analyze the difference between cohorts of males born in municipalities before and after onsets of Nazi rides, relative to the same cohorts that went through no violence. We thus use both cohort and geographic variation differences in the prenatal exposure to identify the differences in fetal exposure to stress. We exploit three unique datasets, which allow us to trace the in utero exposure to the episodes of Nazi rides, distinguishing them from the evolution of the WWII battlefront events of the universe of Italian workers according to their month and municipality of birth. The labour market outcomes come from a longitudinal administrative dataset collected by the Istituto Nazionale della Previdenza Sociale (INPS), the Italian social security and welfare institute and allow us to observe individual labour outcomes between the ages of 35 and 75. We are thus able to isolate the effects of daily-life difficulties brought around with WWII such as nutritional shortages describing potential physical effects on the pregnant mother, from specific episodes of violence which invaded a number of municipalities and represented psychological stress. In fact, the data on Nazi violence, provides us information on the type of violence (civil or partisan oriented) and on the age and gender composition of victims. We are thus able to isolate to a reasonable extent Nazi rides in which pregnant women were more likely to witness rather than take active part in the events.

In the analysis we account for selective fertility and selective mortality. Individuals who decide to conceive children after the onset of violence might not be a random sample of the population. To downplay the potential issues of endogenous fertility, for each municipality, we consider only the first ride episodes, leaving out repeated massacres. We thus eliminate from the sample individuals conceived after the first Nazi ride, whose parents on the one hand might have a different prior about the pregnancy outcome, and on the other hand, might have differential fertility. Moreover, we conduct several specification checks, by limiting the sample to the sole individuals conceived before the onset of the Armistice when Italy surrendered to the Allied forces. By considering the sole individuals born in the 6-month window around the Armistice, we delimit the analysis to fertility choices made

before the materialization of war events. While selective mortality at birth and in the early childhood might be an issues, we are not able to address it within the data. However, we find no evidence of a differential survival pattern of individuals once they reach the ages of 35 and 75.

Our results point to a significant labour market penalty for individuals exposed to Nazi violence, net of the overall WWII events. We find a 1.2, 1.8 and 3% penalty on earnings at the age of 40, 50 and 60, respectively. We also find that individuals exposed at violence induced stress are more likely to suffer from a disability (x%) and less likely to receive a work pension (y%). Finally, we also find that the first work pension, representative in the cohort examined of individual last work salary, is penalized for the exposed individuals by 1.4%. We find no evidence of heterogeneous selection into different labour markets (public employment, private employment or self-employment).

The paper unfolds in the following way: Section 2 describes specific aspects of WWII in Italy, relevant from the point of view of this study, Section 3 presents the data and the relative sources. Section 4 discusses the empirical strategy, while in Section 5 we review the core results and in Section 6 we discuss the robustness exercises showing the insensitivity of our results to alternative specifications. Finally, Section 7 concludes.

2 WWII in Italy as a natural experiment

The time frame of this analysis and the sample choice infer from the historical events of WWII in Italy, which we exploit as a natural experiment. The incidence of the war events and of the Nazi Massacres in particular varied widely and idiosyncratically across municipalities, where similar pregnant mothers experienced strikingly different physical environment while pregnant.

Italy was a non-belligerent country until June 1940, when Mussolini declared war to Britain and France. From June 1940 until the end of summer 1943, Italy moved her armed troops mostly outside its national territory in order to expand her colonies. This period was marked by a relatively scarce number of casualties, which concentrated in the surroundings of strategic bombing targets, such as military and commercial harbors, significant industrial sites (i.e. metallurgic, transport and heavy machinery industries), or important railways (Baldoli and Knapp, 2011, 2012).

Figure 1: WWII fronts in Italy

On September 3rd the armistice was secretly signed, and made public over the radio on September 8th, following which the Italian prime minister and the Italian royal family fled Rome on the morning of September 9th. Just a few weeks earlier, the Allies had landed in Sicily in order to start an advance in September from the South of Italy towards the mainland and the North of the country, against the resisting German forces (see Figure 1). The time-line of these events allows for an identification of two distinct time periods, pre- and post-armistice, with the latter one representing a spatial and temporal shock in terms of the living conditions of the Italian residents.

The events following September 1943 were difficult to predict, and their harsh nature had non-trivial effects on civilian lives, and ruled out any possibility of strategic reaction. According to Strazza (2010), frequently information about the arrival of military troops did not spread to neighboring villages. Moreover, according to Baldoli and Knapp (2011) there were no national evacuation plans. In addition, from a logistical point of view, moving across provinces was extremely difficult, since

railroads and main transportation networks had been destroyed by the Allies in tactical bombing raid (Baldoli and Knapp, 2012).

Within the post-armistice period we distinguish exposure to the general armed conflicts between the armies, ranging from quick victories and movements of the front line entailing relatively few casualties, to long stalemates associated to a large number of fatalities. The army movements started rapidly in Southern Italy, and then ground to a halt at the Winter Line resulting in a prolonged stalemate and huge civilian losses.

Second, the Armistice gave rise to the outbreak of violent Nazi massacres against the civilians. Although the numbers of casualties involved were not high, these massacres were characterized by intense violence and had a direct impact on the civilian population. The character of the massacres was heterogeneous, with some of them directed at resistance fighters, while others concentrated on the civilian population. In few occasions they were of particular violence for their victims, who involved children and women. Overall, the two sources of adversities were governed by military choices, with battleground affecting heavily the life of civilians.

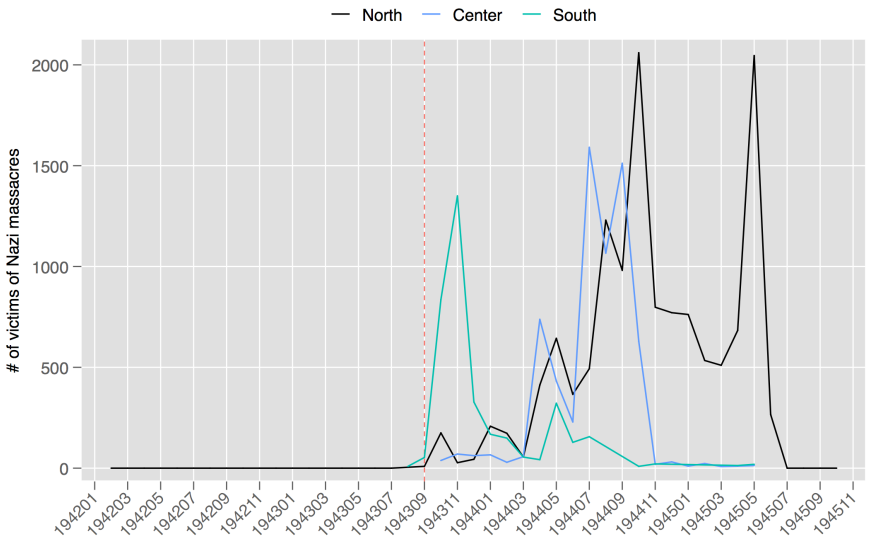
3 Data

We assemble an individual-level dataset, combining individual administrative data on labour outcomes with historical data on the Nazi violence and on the intensity of war faced while in utero. This section introduces the data sources and additional services can be found in Appendix AAA.

3.1 Nazi violence data

Following a joint historical Italian-German commission, a ?German-Italian Fund for the future? was created by the German Foreign Ministry. Under this fund, the INSMLI (National Institute for the History of the Italian Liberation Movement? and the ANPI (National Association of Italian Partisans) promoted a project whose aim was to give a complete picture of the violence perpetrated against civilians by the German army and its allied Fascists in Italy between 1943 and 1945. The project gave rise to the Atlas of Nazi and fascist massacres, including a database and a wide collection of

Figure 2: Average province nazi massacre victims per 100,000



materials (documents, pictures, videos) on all the episodes.

The database lists and analyses all the massacres and the individual murders of civilians and resistance fighters killed in Italy after September 8, 1943 both by German soldiers and soldiers of the Italian Social Republic outside of the armed fights. These range from the first murders in the South to the withdrawal massacres committed in the days after the Liberation in Piedmont, Lombardy and Trentino Alto Adige region.

The chronological and geographical data processing resulted in an accurate reconstruction of the Nazi war in Italy, which finally connects modes, authors, times and places of the violence against the innocents all over the country. The database counts more then 5,000 episodes, describing the precise timing and place (day/municipality), the amount and type of victims (by age and gender), the violence type (type of murder, type of additional violence, such as robbery, property destruction, sexual violence) and the perpetrators type. Nazi violent rides distinguish between those connected to violence on civilians and fight against groups of armed resistance fighters. [1] As before, the treatment is formulated by month/province of death of the victims, and is depicted in Figure **??**.

[1]The information about the project, the database and access possibilities is available at `http://www.straginaziFasciste.it/?page_id=9&lang=en`.

In our preferred specification we concentrate on violence episodes which were aimed at resistance fighters rather than directly on civilians, in order to capture the effect of psychological stress rather than physical direct harms resulting from the rides. Moreover, we only keep municipalities with the first ever occurrence of the massacre so as to wash out the possible bias deriving form a different prior of parents after a violence episode. The spatial and temporal evolution of the massacres is described in figure 2, which followed a similar chronological pattern as the rest of the war events.

3.2 Genral war data

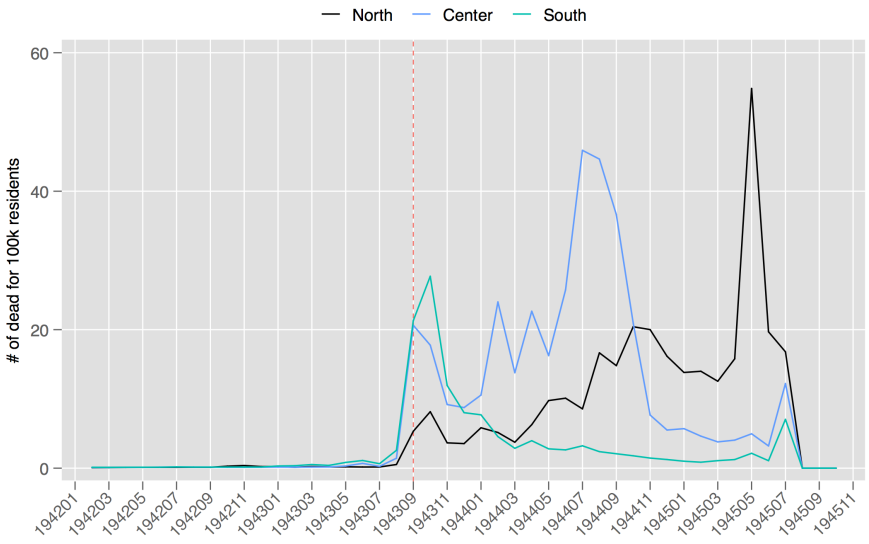
The general WWII intensity in Italy is obtained from the official publication "Morti e dispersi per cause belliche negli anni 1940-45" (The dead and the missing due to war causes between 1940-1945) ISTAT (1957), collected by the Italian National Institute of Statistics (ISTAT).[2] The data refer to the number of war victims, according to province and month of death.[3] Figure 3 provides a detailed description of the heterogeneous distribution of civilian casualties over time and space.

In order to control for living conditions in the Italian provinces we use current data on average gross income from the Italian Ministry of Economics. We also account for the health conditions across Italian regions during war by collecting ISTAT data for two cause specific mortality rates (Mortality rates for pregnancy, delivery and puerperium, and Mortality rate for early childhood diseases). Finally, based on the data on the toll of war victims, for each combination of province and year/month of birth, we construct an indicator of early childhood exposure to war intensity in the first year of life from birth month in each province in order to net out the possible impact of war after the in utero phase.

[2]The publication is available and accessible either at the ISTAT archives, or online at `http://lipari.istat.it/digibib/causedimorte/IST3413mortiedispersipercausebellicheanni1940_45+OCRottimizz.pdf`.

[3]The analysis is framed in the todays administrative province division of the country, while ISTAT data report the intensity of war according to the historical administrative provinces. In the recent decades some provinces changed their structure by incorporating/separating some of their municipalities. We thus account for these changes and adopt a re-weighting procedure which follows the portions of population which change their province reference.

Figure 3: Average province war victims per 100,000



3.3 Longitudinal employer data

Our primary data source on individual outcomes comes from the Istituto Nazionale della Previdenza Sociale (INPS), the largest social security and welfare institute in Italy and one of the most important on a European level. [4] It insures both private sector employees and self-employed workers and all companies operating in Italy are registered with INPS. Additionally, INPS provides both social security and welfare services.

In terms of earnings, INPS records are not comprehensive of public sector workers, which in Italy constitute a roughly XX percent of labour market force. For all other employees, INPS data provide a longitudinal employment and earnings histories for workers from 1974 onward, together with information on their qualifications, types of contract, unemployment spells and a range of additional information. It also provides municipality and exact date of birth which we use as a crosswalk for the WWII in utero exposure data. An important characteristics of the INPS data is its full time and space coverage for genuinely all non-public work contracts. As a result, the dataset allows us to track all the mobility of workers within Italy, independently of the employers. The only caveat of the

[4]The Institute has a budget (of approximately 400 billion Euro between receipts and payments) which is second only to state budget.

data is the impossibility to distinguish individuals who earn zero earnings in any given year because of unemployment or because of their exit from the non-public labour market force. We thus test indirectly if the treatment variable is correlated with out-of-private market labour force mobility, by examining whether individuals exposed at in utero stress are more likely to work in the public sector. We find no evidence in favor of differential mobility across sectors.

3.4 Data selection

Based on the historical events presented in Section 2, the sample selection includes records for male individuals who were born in the war era (years 1943, 1944 and 1945) in all the Italian territory. We focus on males only, since the female labour force representation among the Italian cohorts considered is much less represented (around 30% of the total labour force) and is distributed much more heterogeneously across the Italian territory. In our preferred specifications, we limit the sample to men born between January 1943 and May 1944, referring to individuals all conceived before the onset of the armed conflicts, with some of them exposed while in utero at both the war onset and at Nazi rides. The conception time delimited to the pre-armistice period allows us to compare individuals whose parents had the same prior about the pregnancy evolution, but whose actual pregnancy evolution, due to specific time-space heterogeneity, exposed them at different levels of stressors.

We determine the intrauterine period for each male individual observed in the INPS data by counting 9 months backwards from their month/year of birth. Following the same approach, we additionally single out each of the three gestational trimesters [5] Moreover, for each individual we trace his/her municipality of birth.[6] Within the Nazio violence data we create an indicator dummy variable for the occurrence of at least one Nazi violence episode in the 9 months prior to birth for each

[5]It is well known that the hypothesis of 9-month-pregnancies induces measurement errors in case of premature births, as emphasized by Currie and Rossin-Slater (2013). In case of shorter pregnancies, the actual exposure to treatment is lower, and the resulting estimate of treatment likely to be biased, since the overestimation of exposure period is likely to be correlated with higher probability of negative health outcomes typical of the preterm babies. In general, preterm pregnancies in our historical setting are likely to represent a narrower issue, since premature live births were rare during the WWII times. According to Kopp and Krakow (1983) early follow up studies done between 1920 and 1949 show that child weight at birth is the main parameter to consider for survivorship. In fact, until the WWII neonatology was not able to save pre-term babies weighting less than 1.8 kg, which was usually achieved not before the 31st week of pregnancy.

[6]Italy is currently organised on 8090 municipalities, which represent the third-level administrative sub-division of 110 provinces of 20 regions.

year/month and municipality combination. We thus assign the dummy variable to each individual om the INPS data according to the municipality and birth date combination. We then create a similar variable for the general WWII intensity data, which in this case is a continuous variable describing the amount of war victims accumulated in the 9 months (or in each trimester) prior to the month of birth in each province. In this case the match with the INPS labour data is done on month and province of birth of each individual.

3.5 Outcome variables

The main outcome variables are represented by log annual earnings of each individual at the age of 40, 50 and 60 expressed in 2005 euro, adjusted for inflation using the CPI index. If the earnings record is missing, in our main specification we keep it as missing. [7]. We also construct a measure of the number of months worked at each of the ages.

Additionally, within the data we study work pensions. INPS pays all retirement pensions, to both public and private labour market retirees. Moreover, the Italian pension scheme applicable to cohorts selected in our study is such that our workers retired receiving 80% of their last retribution received before retirement. The first pension allows us thus to analyze a synthetic measure of their working career result. Finally, in order to have a hint on the mechanism through which the labour market penalization operates we also study the disability status.

3.6 Descriptive statistics

Table 1 and Table 2 presents descriptive statistics of the individuals born in 1943-1945 period, separately for the workers outcomes (the private sector ones) and the pensioners or disabled individuals (all Italian beneficiaries of work pensions or formal disability allowance recipients when looked at in 2017, hence on average 73 years after the war events. Table 1 reports the descriptive statistics for the pool of all private sector workers who over the period between 1974 and 2017 have been at least once insured with INPS. The statistics on the workers are computed as of 2017 and refer also

[7] We also replace it with zero. Additionally, we construct log annual earnings averaging out $t-1$, t and $t+1$ earnings in order to minimize variance the earnings distribution.

to individuals who in the period between 1974-2017 deceased or left the non-public labour market. Women represent only a 33% of the sample.

Table 2 describes form a similar perspective the overall pool of individuals born in 1943-1945 period who as seen form birth to 2017 have received a work pension or a disability allowance or any other INPS service. Out of the total of two million individuals seen in 2017, 15% has already died. 57% of them is paid a work pension (20% public sector, 50% private employees and 30% self-employed). The average monthly work pension is of 968 euro. 5% of males has perceived a work-acquired disability, while 9% a civil disability of any rate.

Table 1: Summary statistics - workers

Variable	N	Mean	Std. Dev.	Min.	Max.
age	1,350,151	70.60305	5.346007	34	75
women	1,350,151	.3339545	.4716239	0	1
first year earnings	1,350,151	12164.97	10106.93	706.0314	303961.8
median life earnings	1,350,151	17764.01	13452.41	706.0314	303961.8
average life earnings	1,350,151	17498.84	13324.47	706.0314	303961.8
last year earnings	1,350,151	16036.43	17129.63	706.0314	379860.5
total life earnings	1,350,151	295302.6	326865.4	706.0314	3835600
number of years worked	1,350,151	14.16594	10.00435	1	42

Table 2: Summary statistics - pensioners

Variable	N	Mean	Std. Dev.	Min.	Max.
women	2,087,614	.4842448	.4997518	0	1
age	2,087,614	71.02953	4.971104	25	75
death	2,087,614	.1514995	.3585351	0	1
death year	309,199	2006.516	8.552788	1968	2017
work pension	2,087,614	.5700654	.4950666	0	1
public pensions	1,190,076.51	.2051413	.403805	0	1
private pensions	1,190,076.51	.493259	.4999547	0	1
self employed pensions	1,190,076.51	.301639	.4589695	0	1
first pension	1,190,076.51	968.4216	854.7252	0	62738
median pension	1,190,076.51	1126.396	916.4481	0	51024.5
disability	2,087,614	.1327202	.3392721	0	1
work disability	2,087,614	.0513386	.2206876	0	1
civil disability	2,087,614	.0986712	.2982201	0	1

4 Identification Strategy

Our empirical identification strategy exploits the variation in type, space and time of the adversities of WWII over several months and across Italian municipalities. The conflicts onset struck in

September 1943, implying that cohorts born just months apart experienced markedly different in utero conditions. We employ a generalized difference-in-differences strategy, taking advantage of the unexpected outbreak of violent raids and war events occurred in heterogeneous timing after the Italian armistice from September 8^{th} 1943 onwards. This exogenous source of variation represents an unambiguous discontinuity in the evolution of the prenatal era circumstances that breaks the distribution of WWII intensity over time (months) and across space (municipalities).

We thus build the following baseline reduced form, evaluating whether the war adversities have likely caused maternal stress, which, in turn, can be shown to have affected the long-term health outcomes of the children:

$$y_{icpt} = \beta_0 + \beta_1 Nazi_{ct} + \beta_2 War_{pt} + \beta_3 X_i + \alpha_c + \gamma_t + \epsilon_{icpt} \tag{1}$$

where y_{icpt} represents on hf the individual labour outcomes studied, $Nazi_{ct}$ is defined as an indicator dummy variable for individuals born in municipalities which had an episode of violence in the 9 months prior to the month of birth, War_{pt} is defined as a continuous measure of the number of war deaths in the province of birth per 1k residents in the 9 months prior to the month of birth. We include municipality fixed effects, time (year x month) fixed effects, and individual age. As customary, ϵ_{ipyg} is a province clustered standard error term.

As largely discussed in the previous pages, WWII does not provide randomization in strict causal inference terms, but delivers a setting that can be considered satisfactory for the causal interpretation of the conflict intensity parameter. The war events exploited in this study evolved in an unpredictable way, with the king running away from Rome a day after the armistice proclamation being an important representation of the information asymmetry about the war events that civilians were exposed to. It is thus reasonable to consider local adverse conditions as exogenously assigned to the civilians, after controlling for time invariant heterogeneity at municipality level, and the inclusion of time-characteristics based on month/year fixed effects.

We estimate the model for both the overall pool of all war exposed individuals (born in 1943,

1944 and 1945) as well as for the 9-month window around the conflicts onset (January 1943 - May 1944). In fact, the quintessential caveat in the estimation of exposure to early life shocks on long term outcomes is selective fertility. Individuals are likely to adjust their fertility choices to the underlying uncertainty about the future. Mothers may respond to the shock by deciding not to get pregnant or having difficulties getting pregnant. On the one hand, it is likely that mothers who decide to get pregnant in war times feature on average lower socio-economic status, which is also likely to determine worse childhood conditions, hence poorer health in the long-term and an overestimation of the causal effect. On the other hand, it might be that only families with better socio-economic status decide to have children, being able to buffer the adverse effect of war. It is important to highlight that in our setting socio-economic characteristics, for which we cannot control, affect only the choice of having a baby and not the chance to get treated, which remains exogenous. In such case fertility choices based on the socioeconomic status would entail better long-term health outcomes among the treated, and an underestimation of the causal effect. Our identification strategy tires to downplay the importance of this issue by subsampling individuals born in a 9-month pre/post window, between January 1943 and May 1944, all conceived before the materialization of any sign of upcoming war on the national territories, between April 1942 and August 1943. Moreover, we only keep municipalities with the first ever occurrence of the massacre so as to wash out the possible bias deriving form a different prior of parents after a violence episode. This sample selection allows us to make a reasonable claim that *foetuses* in the two subgroups were conceived in a fairly similar environment as far as the lack of war is concerned, hence the fertility choice concerning their conception was made according to similar uncertainty priors.

As also explained in 2 section, the sudden and unexpected changes in war events and the nature of war described in the historical section rule out, to a reasonable extent, the issue of endogenous maternal mobility, hence also the possible issue of miss-classification in treatment. On the one hand, as discussed in Section 2, movements across provinces during WWII in Italy were very limited due to the military strategies and to lack of consistent evacuation plans (Baldoli and Knapp 2012) Baldoli and Knapp (2012). Moreover, if any, the bias is again expected to underestimate the causal impact, given that the true control group (individuals whose mothers resided in low war

adversity provinces both during pregnancy and at birth) is likely to be contaminated with treated individuals (individuals whose mothers resided in high war adversity provinces and at some point of the pregnancy moved to safer provinces). In fact, assigning individuals erroneously to a treatment according to the birthplace represents a typical case of misclassification in treatment, which leads to an underestimation (attenuation bias) of the treatment effect (Lewbel, 2007). In our setting this bias is likely to increase with the length of the exposure to treatment, which we approximate on the basis of the information about municipality and month of birth.

Finally, our causal claims hinge on the capacity of our empirical analysis to rule out, or control for, the effect of selection of survivors in the treated sample. War events are likely to increment the likelihood of infertility, miscarriages, stillbirths or simply higher overall mortality, which may distort the characteristics of the individuals in the treated sample (those exposed to war stress). Moreover, by analyzing the long-term impacts of war on the elderly, we are likely to be exposed at an even greater amount of survival distortion. Notwithstanding, the direction of this bias leads to an underestimation of health differential, due to the selection process occurring both during early and adult life, where the overall sample, and the treated individuals in particular, are expected to be on average healthier.

Finally, since war may be responsible for the deterioration of living conditions straight after the actual events take place, it is important to disentangle the gestation exposure period form the very early childhood circumstances. In order to address this issue, we include at-birth and infant mortality relative to the birth year/region and for the residual province war intensity that individuals went through in the first 12 months after birth.

5 Results

In this section we present the results obtained from the specification discussed before. The outcomes examined are the disability status, log earnings at the age of 40, 50 and 60, receiving a work pension and the amount of the first work pension received.

Table 3 and Table 4 refer to the full sample (all individuals born in 1943, 1944 and 1945) and to the restricted sample (individuals born in the 9-month-window around the conflicts outbreak),

respectively. Each specification in Table 4 additionally refers to individuals undergoing the in-utero period in the absence of Nazi violence, or during the first Nazi violence episode within the municipality. Conversely, any individual whose prenatal life period witnessed subsequent waves of Nazi violence is excluded from the delimited sample, so as to capture the unprecedented episodes of violence, downplaying the selection issues. Each model specification includes municipality and month/year fixed effects, and controls for the overall WWII victims toll specific to each prenatal period in each province of individual birth. We also control for age. The standard errors are clustered at the municipality level.

Table 3 shows that for all outcomes considered, we find a penalty related to stressful events suffered in the prenatal era. Moreover, the longer the lag from birth to outcomes realization, the stronger the penalty becomes. It is important to highlight that we have run the same model specification on mortality, for which we find no statistically significant results.

Table 4 offers the same set of results obtained on the restricted sample referring to the sole individuals born -/+ 9 months around the event of Armistice in order to wash out possible issues related to selective fertility. In this setting, all individuals are conceived before the war events materialize and one might claim that no endogeneity in fertility choices arises. Moreover, we only keep municipalities with the first ever occurrence of the violence so as to wash out the possible bias deriving form a different prior of parents. For all outcomes considered, we find even greater magnitudes of penalties related to stressful events suffered. The bias direction suggests that a positive selective fertility might have occurred, e.g. individuals conceived during the war era and born alive were on average endowed with better health or economic conditions, which in turn mitigated to a higher extent the adverse effects of in-utero exposure to stress.

Table 3: Results full sample

	Disability	**Log earnings at 40**	**Log earnings at 50**	**Log earnings at 60**	**Receiving work pension**	**First work pension**
nazi massacre	0.00964***	-0.0125**	-0.0183*	-0.0305**	-0.00349*	-14.28811**
(municipality)	(0.00179)	(0.0046)	(0.0077)	(0.0102)	-0.00206	-6.6259
war deaths	0.00006***	-0.0000232	0.0000488	-0.0000727	-0.00003***	-0.00252
(province)	(0.00001)	(0.0000)	(0.0000)	(0.0000)	-0.00001	-0.02118
age	-0.00030***	-0.00252***	-0.0114***	0.00307	0.00181***	1.46122***
	(0.00000)	(0.0004)	(0.0017)	(0.0049)	-0.00001	-0.05408
Observations	1,078,788	302,446	166,955	72,021	1,078,788	645,889
R-squared	0.10082	0.130	0.134	0.151	0.10354	0.05636

Table 4: Results for the 9-months window sample

	Disability	**Log earnings at 40**	**Log earnings at 50**	**Log earnings at 60**	**Receiving work pension**	**First work pension**
nazi massacre	0.00710***	-0.00460	-0.0422***	-0.0461*	-0.00791**	-32.50045***
(municipality)	(0.00224)	(0.0085)	(0.0121)	(0.0191)	-0.00432	-10.28508
war deaths	0.00007***	-0.00000615	-0.000153*	-0.0000669	-0.00006***	-0.06353
(province)	(0.00000)	(0.0000)	(0.0001)	(0.0001)	-0.00002	-0.04573
age	-0.00036***	-0.00220***	-0.0141***	-0.00236	0.00174***	0.99037***
	(0.00001)	(0.0004)	(0.0022)	72021	-0.00001	-0.05033
Observations	855.013	236896	81021	34117	538,103	345,906
R-squared	0.09396	0.130	0.160	0.193	0.10835	0.05141

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