Health Status and the Great Recession. Evidence from Italian Electronic Clinical Records.

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Abstract

We investigate the health impacts of unemployment during the Great Recession (GR) in Italy employing a unique individual-level longitudinal dataset with health information objectively assessed by physicians. We frame the analysis in an event study setting by exploiting the exogenous shock in unemployment occurred since the starting of the GR in 2008. Our results document a long-lasting effect of unemployment on the insurgence of cardiovascular disease and a temporary effect on depression. The effects increase with age and are strongest at the verge of the retirement age. Women are disproportionally affected by cardiovascular disease, while men by depression. Policy makers should bear in mind that prolonged economic downturns constitute an additional external risk factor for individual health, and not a temporary benefit as suggested by several studies analyzing the effect of economic downturns on mortality.

Keywords: health status, unemployment, economic crisis, Great Recession.

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1 Introduction

In virtually all societies, health status is directly related to socio-economic conditions and those with high incomes are usually healthier and generally live longer. Also people with better employment prospects are likely to enjoy better mental, physical and social health. Nevertheless, a substantial body of research shows how economic expansions can exacerbate mortality rates due to the rise in environmental pollution and behavioral risks (McInerney and Mellor, 2012, Ruhm, 2015, 2016, Stevens et al., 2015, Toffolutti and Suhrcke, 2014, among others). Broadly speaking, the relationship between economic conditions and health is context dependent, can vary over time, and can be different in the short-term vs long-term. The context heterogeneity is related to both the type of the economy and the healthcare system. The depth of recessions and the strength of economic surges play a role too. In particular, however, the effects of economic conditions are likely to differ substantially according to various health measures: insurgence of specific diseases may be a more timely short-run indicator than mortality.

The Great Recession (GR) is considered the deepest global economic downturn since World War II. The GDP fell significantly in most countries, with a dramatic increase in unemployment. The introduction of fiscal austerity to alleviate public debt favored a global slowdown, with important effects on several domains of individual lives, including health (OECD, 2016). A number of studies have examined the effect of the GR on mortality, showing that the GR actually reduced mortality in a large sample of EU countries and in the US (Baker, 2014, Tapia Granados and Ionides, 2017). Yet, from both an economic and a clinical perspective, investigating the impact of economic downturns on disease rather than on mortality is of crucial importance since several health complications may not lead to mortality in the short run. Health technology progress of the recent decades is constantly transforming once deadly diseases into more manageable chronic conditions, which causes substantial increases in life expectancy, but not in disease free life expectancy (Stuckler et al., 2009). Moreover, a timely reflection of changes in individual health status is more accurately represented by disease diagnosis rather than mortality which is likely to occur with a substantial time lag. The analysis of disease insurgence due to changes in economic conditions is particularly important also from a policy perspective, since the medical cost of chronic diseases are often sustained by the healthcare system for long time. Therefore, the empirical evidence could offer relevant policy

advices for the design of targeted prevention interventions.

Surprisingly, while mortality effects in association with economic downturns have been extensively examined, there are only a few studies that focus on other health dimensions. Currie et al. (2016) and Tekin et al. (2013) using, respectively, longitudinal and repeated cross sectional surveys, find that the rise in the US unemployment rate during the GR worsened self-reported health status and behavioral outcomes, with stronger effects on the most fragile population groups, such as disadvantaged mothers and less educated individuals. These findings have been recently reinforced by Wang et al. (2018), who exploit six waves of the Panel Study of Income Dynamics in the US and find an overall health deterioration in terms of alcohol drinking, obesity, own evaluation of health and mental distress. For the European case, Colombo et al. (2018) in a cross-sectional setting analyze the impact of economic fluctuations in Italy during the period 1993-2012, showing that higher unemployment rates are associated with a higher probability of experiencing self-rated chronic disease. The findings are summarized by Thompson et al. (2019) who consider forty-two studies analyzing the health effects of the GR in Europe and find that more than 60% of them point to health declines.

In this paper we estimate the effect of unemployment on the insurgence of chronic disease during the GR in an event study setting, exploiting the heterogeneity in the province level unemployment rise occurred in 2008 and analyzing how the slump in economic conditions affected individual level incidence of disease. We consider incidence rates in cardio-vascular (CVDs), renal, pulmonary and mental disease. In doing so, we improve in several ways over previous contributions. First, we employ a unique longitudinal dataset collected by general practitioners (GPs) between 2004 and 2017 for a large nationally representative sample of the Italian population. These data offer substantial advantages. They allow to observe patient level clinical histories, enabling us to estimate the incidence of specific groups of diseases using within-patient variation by means of individual fixed effects which rule out potentially confounding factors existing in the relationship between individual health and unemployment. Moreover, our data consists in objective diagnoses, which provide more reliable information than self-rated health and do not suffer from measurement error, which is frequently not at random.[1] In addition, our analysis benefits form the universalistic nature of the Italian healthcare system, where GP visits are free of charge for all patients. Unlike other studies

[1]The degree of measurement error is related to age, socio-economc status and income, hence correlated with the treatment variable in this type of studies (Crossley and Kennedy, 2002, Johnston et al., 2009, Zajacova and Dowd, 2011).

framed in other settings, where the differential expected cost of treatment may influence the access to healthcare and the objective assessment of health, our institutional context warrants homogeneous treatment costs and access to health services across all Italian residents. Finally, the large sample at hand (over 16 million observations) allows to explore heterogenous effects by disease type, age classes and gender without loosing statistical power.

Our results point to a sharp and significant impact of unemployment on the incidence of two major disease groups, namely CVDs and depression. We find that these effects are disproportionately distributed in the population, being strongest for individuals close to the retirement age (56–64), which is plausibly driven by worse employment prospects in case of job displacements for this age group. We also find that the effect on CVDs is stronger for women, while the effect on depression is mainly driven by men. We find no effects of the GR on pulmonary and renal diseases incidence. In two additional placebo checks, we show that higher province unemployment during the GR does not produce significant effects on cancer insurgence, as confirmed also by the related literature. Moreover, we show that province unemployment does not significantly affect individuals who are dropped from the labor market because of their age. Our findings thus point to specific channels through which economic downturns might affect health.

A number of studies examine the impact of economically induced stress, pointing to very high stress (cortisol hormone) response, comparable to around 70% of stress induced by a loss of a family member (see the review in Persson and Rossin-Slater, 2018). As the literature shows that the onset of CVDs and mental disorders is strictly related to stress exposure (see the review in Colombo et al., 2018), our findings identify a neat health channel through which economic downturns are likely to affect not only individual health, but also the economic healthcare costs accruing from a higher unemployment. Considering that future improvements in health technology can delay the mortality risk for chronic patients, the monetary toll of future economic downturns is likely to impose even greater burden on health expenditure.

2 Data

2.1 Medical records

All Italian residents are covered by the National Healthcare System (NHS). The system requires all the residents aged 15 and older to be registered with a GP practice, which is free of charge.[2] GPs also act as the so-called "gate keepers" as they are the ones to issue drugs, specialist visits and diagnostic prescriptions. This activity, together with all the diagnosis that the GPs or other specialists make is registered in the electronic records. The database of each GP in every period contains records of all his patients (roughly 1500 for each GP), hence all Italian residents, both sick and healthy, making it representative of health status of the Italian population (Cricelli et al., 2003). These features are of paramount importance for our analysis since they ensure that the estimation sample is not affected by selection issues.

We exploit the Health Search (HS) database, which is a longitudinal observational dataset based on the ECRs collected by 795 GPs and on 1.6 mln individuals representative of the Italian adult population by age, sex and region (Cricelli et al., 2003, Filippi et al., 2005).[3]

The panel of GPs is strictly balanced, while in a limited number of cases the corresponding panel of patients is unbalanced due to mortality, migration or transitions from pediatrician to GP.

The ECRs contain information collected by GPs during each visit. The insurgence of a specific chronic condition is recorded in the HS database as a diagnosis with a binary indicator. The HS maintains strict "up-to-standard" quality criteria in terms of coding levels and consistency in individual medical and clinical history. We focus on diseases that are relevant for both the epidemiological characteristics of the Italian population and for the cause-specific mortality statistics (Istat, 2017). Following the ICD-9 diseases classification, our health outcomes are represented by four chronic disease groups: cardiovascular (CVDs), pulmonary, renal and depression.[4] In addition, we consider two other disease groups, namely cancers

[2]The choice of the GP is based on geographical proximity as individuals are required to register with a GP practice located within their Local Health Authority (LHA) of residence. For individuals under 15 years of age, same rules apply for registering with a pediatrician.

[3]Data have been collected routinely since 2000. More details on the extent to which the database represents the adult Italian population can be found at `https://www.healthsearch.it/` (Official website of the HS database). Data from HS have been used in several publications, both in clinical and social sciences peer reviewed journals (see Atella et al., 2019, 2017, Atella and Conti, 2014, Atella and D'Amico, 2015, Atella and Kopinska, 2014, Mazzaglia et al., 2009, among others).

[4]The Appendix reports the complete list of the included ICD-9 codes, together with their description and aggregation into specific disease groups. In doing so, we follow the aggregation proposed by Cutler et al. (2019).

and arthritis, that are not likely not to respond to economic shocks in the short run, hence represent suitable placebo outcomes (Ruhm, 2000). Overall, our selection of outcomes follows the literature analyzing the relationship between cause-specific mortality and economic cycles (see Gerdtham and Ruhm, 2006, Ruhm, 2000, 2015, among others). Table 1 shows descriptive statistics of the health outcomes examined. The prevalence rates are in line with the official Italian epidemiological statistics by age group (EpiCentro, 2016), with CVDs being the most frequent condition.

For the purpose of this study, for each individual we summarize their visit specific records into annual aggregates. Furthermore, we restrict the sample to individuals *i*) aged between 15 and 64 who represent the working-age population, and *ii*) observed for at least 2 years in order to exploit the longitudinal dimension, and *iii*) managed by their GPs in the years between 2004 and 2017 in order to capture a sufficient pre- and post-crisis period. The sample constructed according to this procedure includes 12,600,294 observations referring to 1,234,750 individuals.

As mentioned in the introduction, the objective nature of the HS data represents one of the strengths of this study, allowing to limit the measurement error often associated with self-rated health indicators. In this respect, Zajacova and Dowd (2011), Crossley and Kennedy (2002) and Dowd and Zajacova (2007) show that when compared with objective measures, measurement error in self-rated health data is substantial and correlated with both socio-economic disadvantage and age. Additionally, Baker et al. (2004) report that the number of false negatives reported in health surveys amounts to around 50% for most of the examined chronic conditions, including diabetes and hypertension. Moreover, Johnston et al. (2009) find that the probability of false negatives reporting is significantly higher for low-income groups. Lastly, Bound (1991) points out that people tend to misreport illnesses. As the extent of measurement error is related to socio-economic dimensions, it is also endogenous to the treatment in this kind of studies, potentially confounding the estimates of the GR on health.

2.2 Unemployment data and contextual controls

As standard in this literature, macroeconomic conditions are captured by the unemployment rate. We use the official Italian Statistical Office (Istat) data on province-level unemployment for individuals aged 15-65 from 2004 to 2017, hence matching the medical records data (Istat, 2016b).

The unemployment rate varied substantially over time and across provinces, from a minimum of 1.9% to a maximum of 31.4%, with an average of 9.7% over the period of the analysis. The national average unemployment rate rose from 6.9% in 2007 to 13.9% in 2014, imposing significant psychological and financial strain on many Italians for several years. Minimum and maximum unemployment rates registered in 2007 were, respectively, 2.2 and 16.9, while in 2014 they increased to 4.4 and 27.2. Figure 1 plots these annual rates. By taking the national average unemployment rate as a reference, we identify three main periods. The pre-GR period, going from 2004 to 2007, was characterized by a slight decline in unemployment. From the onset of the GR in Italy, in 2008, the unemployment rates inverted the trend, starting to increase with a relatively slow pace until 2010. During the third period, from 2011 to 2014, a second impulse of the GR occurred, during which with the unemployment rate increased more rapidly, moving from 18% to more than 25%. The second negative wave was likely to be generated by the sovereign debt crisis which produced additional effects (Neri and Ropele, 2015). In 2015, the Italian economy started to recover as also reported in official reports (Istat, 2016b).

Together with unemployment rate, we also collect data on education attainment at province level as a socio-economic control, measured by the fraction of population with tertiary education (Istat, 2016a).

3 Empirical strategy

Our goal is to estimate the likelihood of developing a chronic condition subject to unemployment changes. Since the GR represents a sudden economic shock, we exploit a plausibly exogenous variation in unemployment to gauge the effect of the GR on the individual health. In particular, to gauge heterogenous effects of unemployment over the crisis period, we estimate an incidence model which conditions the sample to individuals who are not affected by disease j in the previous period[5], interacting the unemployment rate with year dummies as

[5]We adopt an incidence model which conditions the estimate to individuals who are not affected by a specific disease in the previous year. Since this may generate sample selection, we provide alternative estimates by controlling for a dummy coded as one if the individual is affected by the disease considered in the previous year. This alternative estimation strategy provides similar results.

follows:

$$H^j_{ipt} = \alpha_i + \sum_{t=2005}^{2017} \beta_t D_t U_{pt} + AGE'_{it}\delta + \gamma EDU_{pt} + \vartheta_t + \varepsilon_{ipt} \qquad \text{if} \quad H^j_{ipt-1} = 0 \; ; \; t \neq 2008 \quad (1)$$

where H^j_{ipt}, $j = 1, \ldots, 3$ denotes a dummy variable equal to one if individual i in province p suffers from the jth condition in period t, U_{pt} is the annual unemployment rate in province p, AGE_{it} represents a vector of 5 age classes, and EDU_{pt} measures the education attainment at province level as the fraction of population with tertiary education (Istat, 2016a).[6] In order to capture the specific effect of the GR, we also include the interaction between the unemployment rate and a dummy variable D equal to one for the period 2008-2014. Therefore, β_2 represents our parameter of interest. Furthermore, the terms α_i and ϑ_t control, respectively, for individual and year fixed-effects (FEs), while ε_{ipt} represents an idiosyncratic error term.

Individual FEs control for time-invariant patient characteristics that affect individual behavior and may be correlated with both unemployment and health. For instance, individuals may self-select to reside in provinces with specific characteristics, such as lower unemployment rates, or may engage in specific life styles determining their health, such as a healthy diet and sport practices. Although the HS data do not provide information on individual level socio-economic status or life styles preferences, the individual FEs control for them to the extent that these characteristics do not vary over time. Hence, when following the individuals over the study period, the use of individual fixed-effects isolates the sole time variation in individual health status as a response to changes in the unemployment rate in the province of residence.

We estimate the parameters of the model using the within-group estimator. The unemployment rate, together with education, enter the model in levels and the associated coefficients represent an approximation of average marginal effects.[7] In all the estimates, we cluster the standard errors on 84 provinces.

4 Results

This section presents the estimation results on the effect of the GR on diseases incidence (4.1) and its heterogenous impacts by age classes and gender (Section 4.2). Both sets of results

[6] See Appendix Table **??** for details on the ICD-9 codes associated with the selected chronic diseases.

[7] The choice of approximating the conditional probability of developing a chronic condition using a linear probability model is dictated by the sizable computational burden we face due to the large sample of observations at hand (more than 9 million observations).

are presented in an event study setting, while the complete estimation tables can be found in the Appendix (Section 7). In Section 4.3 we provide a back-of-the-envelope which quantifies the number and the economic cost of individuals significantly affected by the insurgence of diseases due to unemployment rise during the GR.

4.1 Effects of the Great Recession on health

Figure 3 provides a graphical representation of the estimated coefficients obtained by interacting the health outcomes with each year dummy, assuming 2008 as a baseline. In Panel A of Figure 3 we show the incidence dynamics for CVDs. During years 2004-2007 before the onset of the GR, the effect is not significant while it increases significantly after 2009, when the crisis takes place and remains positive and significant during the subsequent years. According to Appendix Table A1, the incidence rate of CVDs steadily grows from 0.034% in 2009 to 0.072% in 2017.

Panel B of Figure 3 shows the corresponding effect on renal diseases, for which we do not find any significant response to the crisis upsurge. Panel C of Figure 3 signals a little but significant impact of the GR for pulmonary diseases, even though this figure is characterized by a pre-trend which is significant only in 2005. Noteworthy, Panel D of Figure 3 shows a significant increase in the depression incidence from 2009, with a peak in 2011 when Italy faced an additional negative impulse due to crisis exacerbating (see Section 2.2). Appendix Table A1 reports that the incidence rate changes from a non-significant 0.004% in 2007 to 0.011% in 2009 up to 0.14% in 2011.

4.2 Heterogeneous effects by gender and age groups.

In analyzing the effects of economic cycles on health, the literature has identified some differences across gender, race, education, and age groups (Currie et al., 2016, Haaland and Telle, 2015, Ruhm, 2000, Tekin et al., 2013, Wang et al., 2018). In what follows, we disentangle the impact of the higher unemployment during the GR to identify the most fragile socio-economic groups in terms of observable characteristics such as gender and age.[8] In this heterogeneity analysis, we focus on CVDs and depression.[9]

[8] Apart from age and gender, the HS database does not include other socioeconomic information at individual level. In the HS data, stratified samples by gender and age classes considered are still representative of the Italian population.

[9] Full estimates tables for pulmonary and renal diseases are reported in the Appendix Table A3 and Table A4.

Figure 4 shows estimates of the effects of increasing unemployment on CVDs by gender: females in Panel A and males in Panel B, controlling as in our baseline specification, for age and individual fixed effects. Although the effect is persistent for both sexes, we find that woman are disproportionately affected by CDVs after the GR, with an average magnitude of approximately 0.0045 percentage points, which is about double compared with the effects for men over the period 2009-2017 (see Appendix Table A2). The fact that unemployment exerts a larger effect on Italian women is in line with the literature on socio-economic gradient in health inequalities among Italians. In statistical sense, education and labour force particiaption are stronger predictors of several health related outcomes Italian women with respect to men (**?**). Moreover, also

Panel A and B of Figure 5 show estimates of the effects on depression incidence respectively for females and males. In this case, the impacts are similar in magnitude but significant only for females with an average increase of approximately 0.001 percentage points averaged over the period 2009-2017 (see Appendix Table A5).

The occupational structure has undergone several changes during the GR, with important shares of females being forced to join the labor market in response to male employment loss. National official statistics show that the proportion of families relying on the sole income of male household heads diminished during the GR, with increments of female employment rates also during pregnancy (Istat, 2014). The gender heterogeneous responses to the GR reflected in our estimates are thus supported by actual events occurred on the labor market. These findings are also in line with those obtained for United States by Currie et al. (2016), who nevertheless restrict the analysis to the group of mothers, and by Wang et al. (2018).[10]

We find large heterogeneity also when estimating the effects by different age classes. The GR has increased the need to relocate in the labor market, and younger individuals are more likely to succeed in finding a new job. Moreover, younger individuals are expected to be in better health and more resilient than older generations. Conversely, according to Istat (2014), the proportion of individuals in search of employment without success was the highest among individuals aged 50 and above. The same age group witnessed the most pronounced increments in the proportion of households in which women were the only breadwinners. Our estimates

[10]We also tested if coefficients obtained for females and males were significantly different by running the same model in Equation 1 for the two samples. We reject the null that coefficients do not differ significantly. We repeated the same test when estimating the effect by age class. The tests are not reported here and are part of the Online Appendix.

of the health effect of unemployment by age class are in line with these descriptive evidences.

Panel A-I of Figure 4 and Figure 6 show the effects of unemployment on, respectively, CVDs and depression, for subsamples of 5-year age classes. For CVDs, we find significant coefficients in all age classes with large heterogeneity in the magnitude of the effects. Younger individuals are much less affected by increasing incidence of CVDs. On the contrary, individuals aged 40 and older experienced larger effects. To give an idea of the magnitude of these figures, the coefficients range from less than 0.001 percentage points for age class 21-25 to 0.002 percentage points for age class 61-64.

Regarding the effect for depression, Figure 6 depicts an interesting pattern in which only individuals aged 61 and older are significantly affected as a consequence of unemployment increase, with an average and persistent increase of 0.006 percentage points (see Appendix Table ??). To explain this evidence it is important to mention that older working individuals, especially those near the retirement age, faced lower chance–and consequently longer time–to be reemployed (Farber, 2015). Moreover, it is likely that reemployed job losers were employed part time subsequent to job loss, with lower earnings and less access to fringe benefits.

4.3 The health effects of the GR: a simple back-of-the-envelope calculation.

Based on our results reported in Figure 2 (see also Table A1), we provide in Table 2 back-of-the-envelope calculations of the number of extra incident individuals for a unitary increase in the unemployment rate in each year. The figures reported are obtained by computing the average population at risk in every year (i.e the average number of individual not affected by the disease, $\overline{pop}$) and the average yearly incidence rate ($\overline{inc}$) and then by computing for each disease d and year t for which the coefficient β_{dt} was statistically significant:

$$extra_{dt} = \{\overline{pop_d} \times \left[\overline{inc_{dt}} + (\beta_{dt} D_t U - \beta_d U)\right] - (\overline{pop_{dt}} \times \overline{inc_{dt}})\} \tag{2}$$

The increase in unemployment rate translated into more than 136000 additional individuals affected by CVDs between 2009 and 2017 and more than 5000 additional individuals affected by depression from 2009 to 2011.

5 Robustness checks

In this section we present two tests to strengthen the validity of our main results. First, following the related literature, we change the health outcome by considering cancer as a disease, which is supposed not to respond to economic shocks (Ruhm, 2000, among others). Secondly, we provide an additional test to explain that our results are driven by the effect of province unemployment and not by potential confounders that co-vary with unemployment and health status. We thus restrict our sample to retired individuals and to those at the end of their work career, thus including individuals aged 65 and above. Since we do not directly observe in the data the individuals' experience or when individuals leave the labor market, we exploit information provided by the Italian law, which establishes that individuals can work up to age 65. Therefore, by restricting the sample to individuals with age between 65 and 73 years, we are reasonably capturing retired individuals and, to a minor extent, end-career workers. If macroeconomic conditions proxied by province unemployment represent the main channel affecting individual's health status, we do not expect significant effects in individuals who have already dropped the labor market, even though the latter can suffer, on average, from a poorer health because of their older age, which however we control for by including individual fixed effects.

In Panel A of Figure 6 shows that province unemployment does not produce significant effect on cancer insurgence[11]; this evidence is also consistent with previous similar studies, which do not find any effects of macroeconomic shocks on the progression of this disease (Ruhm, 2000).

Table 3 and Table 4 report the estimates of the effect of province unemployment on six age classes divided by four-year rolling windows. Specifically, working age individuals are included in the age class 60-64, while individuals at the end of their work career or already retired are included in the remaining five age classes (age 65-69, 66-70, 67-71, 68-72 and 69-73). As expected, we do not find any significant effect of province unemployment on the individual health status of individuals who are presumably dropped from the labor market. This test helps explain that the main mechanism causing new insurgence of depression and CDVs during the GR can be reasonably attributed to a higher unemployment rate.

[11] Full estimates are in Appendix Table A10.

6 Conclusions

Since the seminal paper by Ruhm (2000), a wide body of literature has investigated the effects of economic cycles on mortality assuming that the latter is a proxy of the population's health. A consolidated result of this large body of literature is the negative (procyclical) association between unemployment and mortality rate, with the exclusion of most of the external causes of death. Using the same data and methods, these results have been confirmed also in the case of the GR. One important limitation of these studies is the exclusive use of mortality rates for disease-related deaths as a proxy of health status, which is characterized by a relatively slow responsiveness when correlated with unemployment adjustments, in particular for short-run analyses.

Using detailed panel health data, we investigate the effect on unemployment on morbidity, focusing on four major chronic diseases that are supposed to respond to economic shocks. Using an event study setting, our analysis considers the economic downturn experienced since the starting of the GR in 2008, which represents a discontinuity that allows to identify the effect of increasing unemployment on health. Unlike the few previous contributions that explore the morbidity effects, the patient level data employed in this study show several advantages. They are systematically collected by GPs, thus being more likely to be objectively measured. Moreover, our data provide a multidimensional and representative picture of the population health in terms of major chronic diseases.

Our results show clear evidence of the detrimental health effects of higher unemployment experienced during the GR. In particular, we find significant effect of unemployment on the insurgence of cardiovascular diseases and depression. We find no effects on renal diseases, while for pulmonary diseases our event study analysis shows the existence of a pre-trend that does not allow to identify the effects. These results complement the few studies that correlate individual self-rated health proxies with the unemployment dynamics during the GR (Currie et al., 2016, Tekin et al., 2013, among others). Nevertheless, our event study analysis shows that the increased incidence on cardiovascular diseases is long-lasting, while the effect on depression is only temporary. These impacts are characterized by large heterogeneity. Females and the elderly are the most affected by CVDs, while depression concentrated its effects on males and individuals close to the retirement age (56-64).

Based on our significant empirical findings, the increase in the unemployment rate trans-

lated into more than 136,000 additional individuals affected by CVDs and more than 5,000 affected by depression during the period 2009-2017.

An important recommendation emerging from this study is that policy makers should bear in mind that prolonged economic downturns constitute an additional external risk for individual health - and not a temporary benefit. From an economic policy perspective, the social costs of health deterioration in terms of larger diseases incidence due to the GR will be dumped on current younger generations and on those to come. Moreover, the individuals affected by these severe chronic diseases are likely to face an increased risk of mortality in the future.

Tables

Table 1: Descriptive statistics.

Group	**Variable**	**Mean**	**s.d.**	**min**	**max**
Economic indicator	Unempl. rate (age 15-65)	10,42	5.92	1.87	31.45
Controls	University degree (% of pop.)	11.37	2.65	6.32	35.90
	Age	50.23	19.38	15	64
	Sex	0.52	0.49	0	1
Health outcomes	CVDs	0.16	0.37	0	1
	Pulmonary diseases	0.09	0.29	0	1
	Renal diseases	0.01	0.13	0	1
	Depression	0.06	0.24	0	1
	Cancer	0.02	0.16	0	1

Notes: Sample size is 16,986,292.

Table 2: Number of extra incident individuals for a unitary increase in the unemployment rate.

Year	CVDs	Depression
2009	26497*	3984*
2010	29003*	3526*
2011	28976*	5142*
2012	31551*	2726
2013	28570*	1436
2014	30056*	2555
2015	31206*	2501
2016	31105*	2693
2017	32304*	3128

* Indicates whether the year specific marginal effect of unemployment is statistically significant below 5% level.

Table 3: Effects of Unemployment on CDVs on Non-working Age Individuals.

	Aged 61-64	Age 65-69	Age 66-70	Age 67-71	Age 68-72	Age 69-73
Unemp. rate	-0.0008	-0.0015**	-0.0013*	-0.0006	-0.0005	-0.0004
2005 × Unemp. rate	-0.0005	-0.0007	-0.0008	-0.0012	-0.0016	-0.0014
2006 × Unemp. rate	0.0002	-0.0000	0.0000	-0.0001	-0.0003	-0.0004
2007 × Unemp. rate	-0.0001	-0.0001	0.0002	-0.0001	-0.0003	-0.0002
2009 × Unemp. rate	0.0009**	0.0006	0.0005	0.0001	0.0000	0.0003
2010 × Unemp. rate	0.0010**	0.0014***	0.0011**	0.0008*	0.0002	0.0003
2011 × Unemp. rate	0.0013***	0.0013***	0.0013**	0.0010*	0.0010**	0.0005
2012 × Unemp. rate	0.0014***	0.0017***	0.0016**	0.0013**	0.0011*	0.0010*
2013 × Unemp. rate	0.0013***	0.0018***	0.0016**	0.0012*	0.0010*	0.0009
2014 × Unemp. rate	0.0012**	0.0018**	0.0019**	0.0013*	0.0010	0.0009
2015 × Unemp. rate	0.0015**	0.0019**	0.0019**	0.0014*	0.0012	0.0013
2016 × Unemp. rate	0.0016**	0.0022**	0.0022**	0.0015*	0.0014*	0.0014
2017 × Unemp. rate	0.0018**	0.0022**	0.0022**	0.0016*	0.0015	0.0016*
Share of graduated	-0.0360	-0.1630	-0.1359	-0.1142	-0.0861	-0.1345
Intercept	-0.0157	0.0139	0.0087	0.0025	-0.0009	0.0037
N	709,218	794,940	771,320	745,346	716,841	689,556

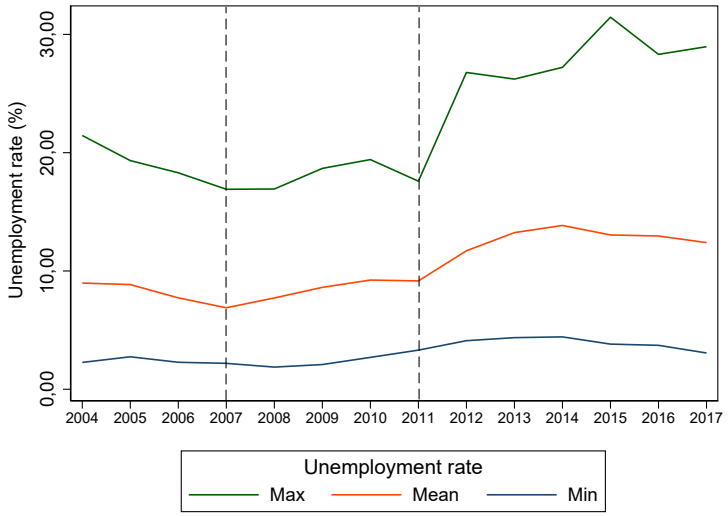
Notes:

Table 4: Effects of Unemployment on Depression on Non-working Age Individuals.

	Age 61-64	Age 65-69	Age 66-70	Age 67-71	Age 68-72	Age 69-73
Unemp. rate	-0.0008***	-0.0003	-0.0000	-0.0001	-0.0001	-0.0000
2005 × Unemp. rate	-0.0001	0.0000	-0.0001	-0.0002	-0.0002	-0.0001
2006 × Unemp. rate	-0.0001	0.0001	0.0001	0.0000	0.0001	0.0001
2007 × Unemp. rate	-0.0001	-0.0001	-0.0003*	-0.0003*	-0.0003	-0.0002
2009 × Unemp. rate	0.0005***	0.0002	-0.0000	0.0001	0.0003*	0.0005**
2010 × Unemp. rate	0.0007***	0.0003	0.0002	0.0001	-0.0000	0.0001
2011 × Unemp. rate	0.0008***	0.0004	0.0002	0.0002	0.0002	0.0002
2012 × Unemp. rate	0.0008***	0.0004*	0.0002	0.0003	0.0003	0.0003
2013 × Unemp. rate	0.0009***	0.0003	0.0001	0.0003	0.0003	0.0003
2014 × Unemp. rate	0.0008***	0.0005	0.0002	0.0003	0.0004	0.0002
2015 × Unemp. rate	0.0009***	0.0005	0.0003	0.0003	0.0004	0.0004
2016 × Unemp. rate	0.0011***	0.0005	0.0003	0.0003	0.0004	0.0003
2017 × Unemp. rate	0.0011***	0.0005	0.0004	0.0004	0.0005	0.0004
Share of graduated	-0.0435	0.0062	0.0247	0.0004	0.0210	-0.0137
Intercept	0.0025	-0.0028	-0.0069	-0.0040	-0.0057	-0.0029
N	801,543	945,491	929,408	909,859	886,839	864,608

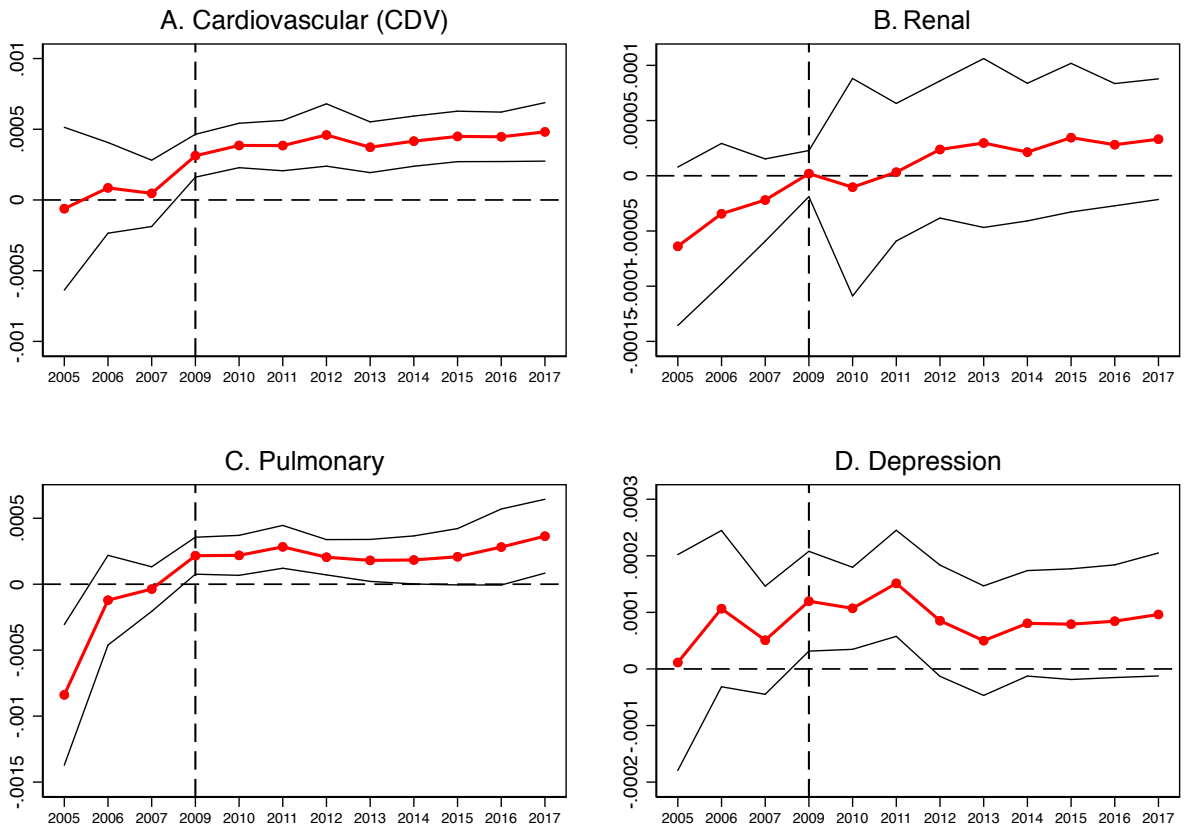
Notes:

Figure 1: Average, Minimum and Maximum Unemployment Rate in Italy.



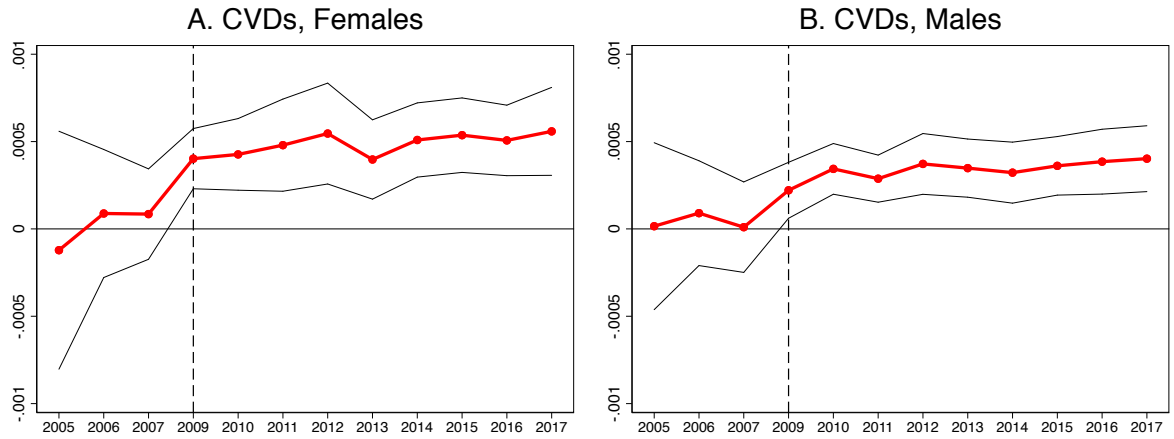
Notes:

Figure 2: Effects of Unemployment on CVDs, Renal, Depression and Pulmonary incidences.



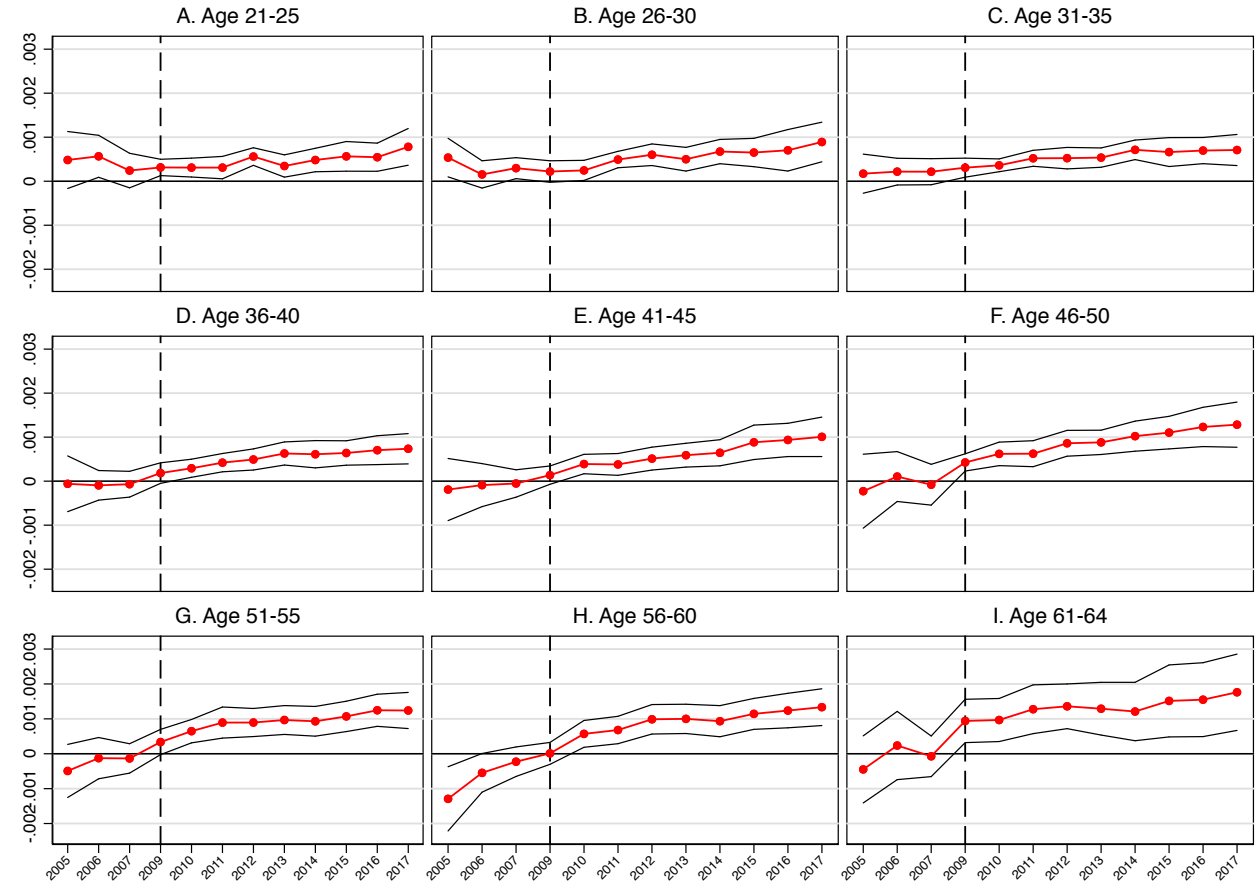
Notes:

Figure 3: Effects of Unemployment on CVD Incidence by Sex.



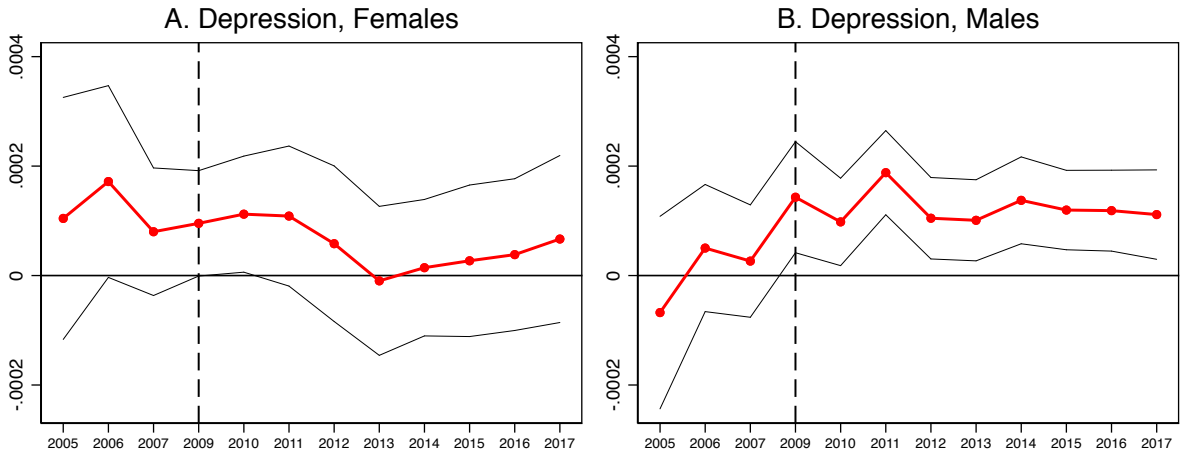
Notes:

Figure 4: Effects of Unemployment on CVD Incidence by Age Class.



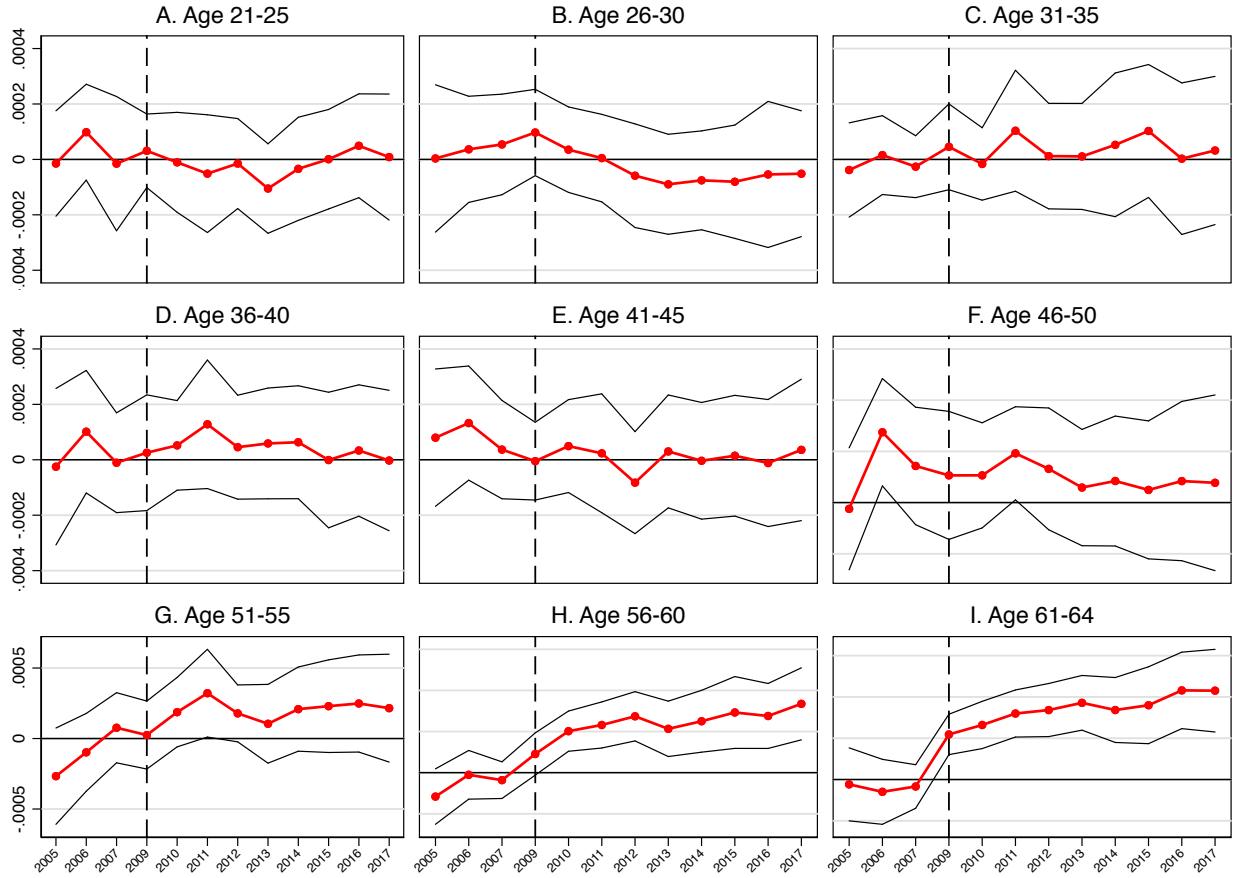
Notes:

Figure 5: Effects of Unemployment on Depression Incidence by Sex.



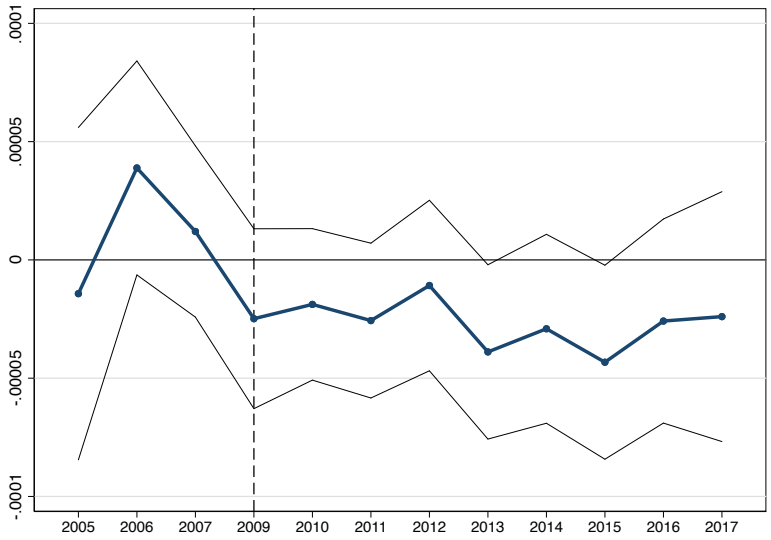
Notes:

Figure 6: Effects of Unemployment on Depression Incidence by Age Class.



Notes:

Figure 7: Effects of Unemployment on Cancer as a Placebo Health Outcome.



Notes:

References

Atella, V., F. Belotti, C. Bojke, A. Castelli, K. Grasic, J. Kopinska, A. P. Mortari, and A. Street (2019). How health policy shapes healthcare sector productivity? evidence from italy and uk. *Health Policy 123*(1), 27–36.

Atella, V., F. Belotti, and D. Depalo (2017). Drug therapy adherence and health outcomes in the presence of physician and patient unobserved heterogeneity. *Health Economics 26*, 106–126.

Atella, V. and V. Conti (2014). The effect of age and time to death on primary care costs: The italian experience. *Social Science & Medicine 114*, 10–17.

Atella, V. and F. D'Amico (2015). Who is responsible for your health: is it you, your doctor or the new technologies? *The European Journal of Health Economics 16*, 835–846.

Atella, V. and J. Kopinska (2014, August). Body Weight, Eating Patterns, and Physical Activity: The Role of Education. *Demography 51*(4), 1225–1249.

Baker, M., M. Stabile, and C. Deri (2004). What do self-reported, objective, measures of health measure? *Journal of human Resources 39*(4), 1067–1093.

Baker, P. A. (2014). Effect of the great recession on us and european health: an econometric analysis. *The Lancet 384*, S14.

Bound, J. (1991). Self-reported versus objective measures of health in retirement models. *The Journal of Human Resources 26*(1), 106–138.

Colombo, E., V. Rotondi, and L. Stanca (2018). Macroeconomic conditions and health: Inspecting the transmission mechanism. *Economics and Human Biology 28*, 29 – 37.

Cricelli, C., G. Mazzaglia, F. Samani, M. Marchi, A. Sabatini, R. Nardi, G. Ventriglia, and A. Caputi (2003). Prevalence estimates for chronic diseases in italy: exploring the differences between self-report and primary care databases. *Journal of Public Health Medicine 25*(3), 254–257.

Crossley, T. F. and S. Kennedy (2002). The reliability of self-assessed health status. *Journal of Health Economics 21*(4), 643 – 658.

Currie, J., V. Duque, and I. Garfinkel (2016). The great recession and mothers' health. *The Economic Journal 125*(588), F311–F346.

Cutler, D. M., K. Ghosh, K. L. Messer, T. E. Raghunathan, S. T. Stewart, and A. B. Rosen (2019). Explaining the slowdown in medical spending growth among the elderly, 1999-2012. *Health Affairs 38*(2), 222–229.

Dowd, J. B. and A. Zajacova (2007). Does the predictive power of self-rated health for subsequent mortality risk vary by socioeconomic status in the us? *International Journal of Epidemiology 36*(6), 1214–1221.

EpiCentro (2016). Epidemiology for public healthcare. Data retrieved from: http://www.epicentro.iss.it/index/MalattieCroniche.asp.

Farber, H. S. (2015, May). Job loss in the great recession and its aftermath: U.s. evidence from the displaced workers survey. Working Paper 21216, National Bureau of Economic Research.

Filippi, A., D. Vanuzzo, A. Bignamini, E. Sessa, O. Brignoli, and G. Mazzaglia (2005). Computerized general practice databases provide quick and cost-effective information on the prevalence of angina pectoris. *Italian Heart Journal 6*(1), 49–51.

Gerdtham, U.-G. and C. J. Ruhm (2006). Deaths rise in good economic times: Evidence from the {OECD}. *Economics and Human Biology 4*(3), 298 – 316.

Haaland, V. F. and K. Telle (2015). Pro-cyclical mortality across socioeconomic groups and health status. *Journal of Health Economics 39*, 248 – 258.

Istat (2014). Il mercato del levoro negli anni della crisi. dinamiche e divari. Data retrieved from: http://www.istat.it/it/files/2014/05/cap3.pdf.

Istat (2016a). Health for All. Istituto Nazionale di Statistica.

Istat (2016b). Rilevazione sulle forze di lavoro. Istituto Nazionale di Statistica. Data retrieved from http://dati.istat.it/Index.aspx.

Istat (2017). L'evoluzione della mortalità per causa: le prime 25 cause di morte. Data retrieved from: http://www.istat.it/it/files/2017/05/Report-cause-di-morte-2003-14.pdf.

Johnston, D. W., C. Propper, and M. A. Shields (2009). Comparing subjective and objective measures of health: Evidence from hypertension for the income/health gradient. *Journal of Health Economics 28*(3), 540 – 552.

Mazzaglia, G., E. Ambrosioni, M. Alacqua, A. Filippi, E. Sessa, V. Immordino, C. Borghi, O. Brignoli, A. P. Caputi, C. Cricelli, and L. G. Mantovani (2009). Adherence to antihypertensive medications and cardiovascular morbidity among newly diagnosed hypertensive patients. *Circulation 120*(16), 1598–1605.

McInerney, M. and J. M. Mellor (2012). Recessions and seniors' health, health behaviors, and healthcare use: Analysis of the medicare current beneficiary survey. *Journal of Health Economics 31*(5), 744 – 751.

Neri, S. and T. Ropele (2015, March). The macroeconomic effects of the sovereign debt crisis in the euro area. (1007).

OECD (2016). Oecd economic outlook, volume 2016 issue 1. *2016*.

Persson, P. and M. Rossin-Slater (2018). Family ruptures, stress, and the mental health of the next generation. *American Economic Review 108*(4-5), 1214–52.

Ruhm, C. J. (2000). Are recessions good for your health? *The Quarterly Journal of Economics 115*(2), 617.

Ruhm, C. J. (2015). Recessions, healthy no more? *Journal of Health Economics 42*, 17 – 28.

Ruhm, C. J. (2016). Health effects of economic crises. *Health Economics 25*, 6–24.

Stevens, A. H., D. L. Miller, M. E. Page, and M. Filipski (2015). The best of times, the worst of times: Understanding pro-cyclical mortality. *American Economic Journal: Economic Policy 7*(4), 279–311.

Stuckler, D., S. Basu, M. Suhrcke, A. Coutts, and M. McKee (2009). The public health effect of economic crises and alternative policy responses in europe: an empirical analysis. *The Lancet 374*(9686), 315 – 323.

Tapia Granados, J. A. and E. L. Ionides (2017). Population health and the economy: Mortality and the great recession in europe. *Health Economics*, in press.

Tekin, E., C. McClellan, and K. J. Minyard (2013). Health and health behaviors during the worst of times: evidence from the great recession. Technical report, National Bureau of Economic Research.

Thompson, K., J. van Ophem, and A. Wagemakers (2019). Studying the impact of the eurozone's great recession on health: Methodological choices and challenges. *Economics and Human Biology 35*, 162–184.

Toffolutti, V. and M. Suhrcke (2014). Assessing the short term health impact of the great recession in the european union: A cross-country panel analysis. *Preventive Medicine 64*, 54 – 62.

Wang, H., C. Wang, and T. J. Halliday (2018). Health and health inequality during the great recession: Evidence from the psid. *Economics and Human Biology 29*, 17 – 30.

Zajacova, A. and J. B. Dowd (2011). Reliability of self-rated health in us adults. *American Journal of Epidemiology 174*(8), 977–983.

7 Appendix

ICD9 codes for Cardiovascular diseases:

Seizure Disorders:

345 3450 34500 34501 3451 34510 34511 3452 3453 3454 34540 34541 3455 34550 34551 3456 34560 34561 3457 34570 34571 3458 34580 34581 3459 34590 34591 7803 78031 78032 78033 78039

Other Vascular Diseases:

443 4430 4431 44381 44382 44389 446 4460 4461 4462 44620 44621 44629 4463 4464 4465 4466 4467 447 4470 4471 4472 4473 4474 4475 4476 4478 4479 448 4480 4481 4489 458 4580 4581 4588 4589 459 4590 45989 4599 7859 7943 79430 79431 79439 7962 V125 V1250 V1253 V1254 V1259 V151 V421 V432 V4321 V4322 V434 V717

Atrial Fibrillation and Flutter, Other Arrhythmias:

427 4270 4271 4272 4273 42731 42732 4276 42760 42761 42769 42781 42789 4279 785 7850 7851

Other Cardiovascular Diseases:

4141 41410 41411 41412 41419 4291 4292 4293 4295 4296 42971 42979 42981 42982 42983 42989 4299

Coronary Atherosclerosis and other heart disease:

411 4110 4111 4118 41181 41189 412 413 4130 4131 4139 414 4140 41400 41401 41406 4142 4143 4144 4148 4149 V4581 V4582

Peripheral Vascular Disease:

440 4400 4400 4401 4402 44020 44021 44022 44023 44029 4404 4408 4409 4439 557 5570 5571 5579 441 4410 44100 44101 44102 44103 4411 4412 4413 4414 4415 4416 4417 4419 442 4420 4421 4422 4423 44281 44282 44283 44284 44289 4429 44321 44322 44323 44324 44329 4477 44770 44771 44772 44773 444 4440 44401 44409 4441 44421 44422 44481 44489 4449 44501 44502 44581 44589

Cerebrovascular disease:

433 4330 43300 4331 43310 4332 43320 4333 43330 4338 43380 4339 43390 437 4370 4371 4373 4374 4375 4376 4377 4378 4379 435 4350 4351 4352 4353 4358 4359 438 4380 4381 43810 43811 43812 43813 43814 43819 4382 43820 43821 43822 4383 43830 43831 43832 4384 43840 43841 43842 4385 43850 43851 43852 43853 4386 4387 43881 43882 43883 43884 43885 43889 4389

Congestive heart failure:

39891 428 4280 4281 4282 42820 42821 42822 42823 4283 42830 42831 42832 42833 4284 42840 42841 42842 42843 4289

Acute myocardial infarction:

410 4100 41000 41001 41002 4101 41010 41011 41012 4102 41020 41021 41022 4103 41030 41031 41032 4104 41040 41041 41042 4105 41050 41051 41052 4106 41060 41061 41062 4107 41070 41071 41072 4108 41080 41081 41082 4109 41090

41091 41092

Acute hemorrhagic stroke, Acute ischemic stroke:

3466 34660 34661 34662 34663 430 431 432 4320 4321 4329 43301 43311 43321 43331 43381 43391 434 4340 43400 43401 4341 43410 43411 4349 43490 43491 436

Deep Vein Thrombosis or DVT:

451 4510 45111 45119 4512 45181 45182 45183 45184 45189 4519 452 453 4530 4531 4532 4533 45340 45341 45342 4535 45350 45351 45352 4536 45371 45372 45373 45374 45375 45376 45377 45379 4538 45381 45382 45383 45384 45385 45386 45387 45389 4539 V1251 V1252

ICD9 codes for Pulmonary diseases:

Chronic Obstructive Pulmonary Disease (aka Emphysema):

490 491 4910 4911 4912 49120 49121 49122 4918 4919 492 4920 4928 494 4940 4941 496

Asthma:

493 4930 49300 49301 49302 4931 49310 49311 49312 4932 49320 49321 49322 49381 49382 4939 49390 49391 49392

ICD9 codes for Depression disease:

Depression:

29383 296 2960 29600 29601 29602 29603 29604 29605 29606 2961 29610 29611 29612 29613 29614 29615 29616 2962 29620 29621 29622 29623 29624 29625 29626 2963 29630 29631 29632 29633 29634 29635 29636 2969 29690 29699 3004 311

ICD9 codes for Renal diseases:

Acute Renal Failure:

5845 5846 5847 5848 5849 586

Chronic Renal Failure, End-stage Renal Disease (ESRD):

585 5851 5852 5853 5854 5855 5856 5859 7925 V420 V451 V4511 V4512 V560 V561 V562 V5631 V5632 V568

ICD9 codes for Cancer diseases:

Cervical Cancer and Other Cancer:

180 1800 1801 1808 1809 2331 7950 79501 79502 79503 79504 79506 V1041 179 181 182 183 184 185 186 187 188 189

Skin Cancer:

172 1720 1721 1722 1723 1724 1725 1726 1727 1728 1729 V1082 173 1730 17300 17301 17302 17309 1731 17310 17311 17312 17319 1732 17320 17321 17322 17329 1733 17330 17331 17332 17339 1734 17340 17341 17342 17349 1735 17350 17351 17352 17359 1736 17360 17361 17362 17369 1737 17370 17371 17372 17379 1738 17380 17381 17382 17389 1739 17390 17391 17392 17399 20931 20932 20933 20934 20935 20936 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329

V1083

Breast Cancer:

174 1740 1741 1742 1743 1744 1745 1746 1748 1749 175 1750 1759 2330 V103

Prostate Cancer:

185 2334 V1046

Colon Cancer:

153 1530 1531 1532 1533 1534 1535 1536 1537 1538 1539 159 1590 20910 20911 20912 20913 20914 20915 20916 2303 V1005

Lung Cancer:

1622 1623 1624 1625 1628 1629 20921 2312 V1011

Table A1: Estimates of the Health Effect of Unemployment During the GR.

	(1) CDVs	(2) Liver	(3) Pulmonary	(4) Depression
2005 × Unemp.	-0.0001	-0.0001	-0.0008**	0.0000
2006 × Unemp.	0.0001	-0.0000	-0.0001	0.0001
2007 × Unemp.	0.0000	-0.0000	-0.0000	0.0001
2009 × Unemp.	0.0003***	0.0000	0.0002**	0.0001**
2010 × Unemp.	0.0004***	-0.0000	0.0002**	0.0001**
2011 × Unemp.	0.0004***	0.0000	0.0003***	0.0002**
2012 × Unemp.	0.0005***	0.0000	0.0002**	0.0001
2013 × Unemp.	0.0004***	0.0000	0.0002*	0.0001
2014 × Unemp.	0.0004***	0.0000	0.0002*	0.0001
2015 × Unemp.	0.0004***	0.0000	0.0002	0.0001
2016 × Unemp.	0.0004***	0.0000	0.0003	0.0001
2017 × Unemp.	0.0005***	0.0000	0.0004*	0.0001
Unemp. rate	-0.0005***	-0.0000	-0.0000	0.0000
Share of graduated	-0.0729*	-0.0091	0.0249	0.0090
Aged 21-25	-0.0025***	-0.0007***	-0.0010**	-0.0019***
Aged 26-30	-0.0107***	-0.0015***	-0.0058***	-0.0045***
Aged 31-35	-0.0182***	-0.0023***	-0.0093***	-0.0064***
Aged 36-40	-0.0246***	-0.0029***	-0.0118***	-0.0074***
Aged 41-45	-0.0289***	-0.0034***	-0.0139***	-0.0079***
Aged 46-50	-0.0307***	-0.0038***	-0.0154***	-0.0077***
Aged 51-55	-0.0295***	-0.0036***	-0.0149***	-0.0065***
Aged 56-60	-0.0224***	-0.0029***	-0.0121***	-0.0046***
Aged 61-64	-0.0061***	-0.0006**	-0.0056***	-0.0023***
Intercept	0.0470***	0.0039***	0.0150***	0.0100***

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR assuming 2008 as a reference year. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A2: Estimates of the Effect of Unemployment During the GR on CVDs by Sex.

	Male	Female
2005 × Unemp.	-0.0001	0.0000
2006 × Unemp.	0.0001	0.0001
2007 × Unemp.	0.0001	0.0000
2009 × Unemp.	0.0004***	0.0002**
2010 × Unemp.	0.0004***	0.0003***
2011 × Unemp.	0.0005***	0.0003***
2012 × Unemp.	0.0005***	0.0004***
2013 × Unemp.	0.0004***	0.0003***
2014 × Unemp.	0.0005***	0.0003***
2015 × Unemp.	0.0005***	0.0004***
2016 × Unemp.	0.0005***	0.0004***
2017 × Unemp.	0.0006***	0.0004***
Unemp. rate	-0.0006***	-0.0004**
Share of graduated	-0.0773	-0.0719*
Aged 21-25	-0.0006	-0.0041***
Aged 26-30	-0.0078***	-0.0131***
Aged 31-35	-0.0143***	-0.0217***
Aged 36-40	-0.0200***	-0.0287***
Aged 41-45	-0.0232***	-0.0340***
Aged 46-50	-0.0248***	-0.0360***
Aged 51-55	-0.0249***	-0.0336***
Aged 56-60	-0.0202***	-0.0242***
Aged 61-64	-0.0077***	-0.0040*
Intercept	0.0476***	0.0463***

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on CVDs separately for males and females. Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A3: Estimates of the Effect of Unemployment During the GR on Liver Diseases by Sex.

	Male	Female
2005 × Unemp.	-0.0001*	-0.0000
2006 × Unemp.	-0.0000	-0.0000
2007 × Unemp.	-0.0000	-0.0000
2009 × Unemp.	-0.0000	0.0000
2010 × Unemp.	-0.0000	-0.0000
2011 × Unemp.	-0.0000	0.0000
2012 × Unemp.	0.0000	0.0000
2013 × Unemp.	0.0000	0.0000
2014 × Unemp.	0.0000	0.0000
2015 × Unemp.	0.0000	0.0000
2016 × Unemp.	0.0000	0.0000
2017 × Unemp.	0.0000	0.0000
Unemp. rate	-0.0000	-0.0000
Share of graduated	-0.0082	-0.0097
Aged 21-25	-0.0005***	-0.0009***
Aged 26-30	-0.0012***	-0.0019***
Aged 31-35	-0.0018***	-0.0028***
Aged 36-40	-0.0023***	-0.0036***
Aged 41-45	-0.0026***	-0.0043***
Aged 46-50	-0.0028***	-0.0048***
Aged 51-55	-0.0027***	-0.0046***
Aged 56-60	-0.0020***	-0.0038***
Aged 61-64	0.0000	-0.0012**
Intercept	0.0032***	0.0045***

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on liver diseases separately for males and females. Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A4: Estimates of the Effect of Unemployment During the GR on Pulmonary Diseases by Sex.

	Male	Female
2005 × Unemp.	-0.0009**	-0.0008**
2006 × Unemp.	-0.0001	-0.0001
2007 × Unemp.	-0.0001	-0.0000
2009 × Unemp.	0.0002*	0.0003***
2010 × Unemp.	0.0002*	0.0002**
2011 × Unemp.	0.0003*	0.0003***
2012 × Unemp.	0.0002*	0.0002**
2013 × Unemp.	0.0002	0.0002*
2014 × Unemp.	0.0002	0.0002*
2015 × Unemp.	0.0002	0.0002*
2016 × Unemp.	0.0003	0.0003*
2017 × Unemp.	0.0004*	0.0004**
Unemp. rate	-0.0000	-0.0001
Share of graduated	0.0332	0.0142
Aged 21-25	-0.0011**	-0.0009*
Aged 26-30	-0.0055***	-0.0060***
Aged 31-35	-0.0087***	-0.0098***
Aged 36-40	-0.0106***	-0.0130***
Aged 41-45	-0.0126***	-0.0153***
Aged 46-50	-0.0137***	-0.0172***
Aged 51-55	-0.0129***	-0.0170***
Aged 56-60	-0.0095***	-0.0147***
Aged 61-64	-0.0033*	-0.0081***
Intercept	0.0132**	0.0171***

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on pulmonary diseases separately for males and females. Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A5: Estimates of the Effect of Unemployment During the GR on Depression by Sex.

	Male	Female
2005 × Unemp.	0.0001	-0.0001
2006 × Unemp.	0.0002	0.0001
2007 × Unemp.	0.0001	0.0000
2009 × Unemp.	0.0001	0.0001**
2010 × Unemp.	0.0001*	0.0001*
2011 × Unemp.	0.0001	0.0002***
2012 × Unemp.	0.0001	0.0001**
2013 × Unemp.	-0.0000	0.0001**
2014 × Unemp.	0.0000	0.0001***
2015 × Unemp.	0.0000	0.0001**
2016 × Unemp.	0.0000	0.0001**
2017 × Unemp.	0.0001	0.0001**
Unemp. rate	0.0001	-0.0000
Share of graduated	0.0051	0.0076
Aged 21-25	-0.0028***	-0.0009***
Aged 26-30	-0.0064***	-0.0025***
Aged 31-35	-0.0087***	-0.0040***
Aged 36-40	-0.0099***	-0.0049***
Aged 41-45	-0.0102***	-0.0056***
Aged 46-50	-0.0096***	-0.0058***
Aged 51-55	-0.0080***	-0.0051***
Aged 56-60	-0.0056***	-0.0035***
Aged 61-64	-0.0026*	-0.0020*
Intercept	0.0140***	0.0064***

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on depression separately for males and females. Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A6: Estimates of the Effect of Unemployment During the GR on Pulmonary Diseases by Age Class.

	Age class								
	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64
2005 × Unemp.	0.0005	0.0005*	0.0002	-0.0001	-0.0002	-0.0002	-0.0005	-0.0013**	-0.0013**
2006 × Unemp.	0.0006*	0.0002	0.0002	-0.0001	-0.0001	0.0001	-0.0001	-0.0005	-0.0005
2007 × Unemp.	0.0002	0.0003*	0.0002	-0.0001	-0.0001	-0.0001	-0.0001	-0.0002	-0.0002
2009 × Unemp.	0.0003**	0.0002	0.0003**	0.0002	0.0001	0.0004***	0.0003	0.0000	0.0000
2010 × Unemp.	0.0003**	0.0002*	0.0004***	0.0003**	0.0004***	0.0006***	0.0006***	0.0006**	0.0006**
2011 × Unemp.	0.0003*	0.0005***	0.0005***	0.0004***	0.0004**	0.0006***	0.0009***	0.0007***	0.0007***
2012 × Unemp.	0.0006***	0.0006***	0.0005***	0.0005***	0.0005***	0.0009***	0.0009***	0.0010***	0.0010***
2013 × Unemp.	0.0003**	0.0005***	0.0005***	0.0006***	0.0006***	0.0009***	0.0010***	0.0010***	0.0010***
2014 × Unemp.	0.0005***	0.0007***	0.0007***	0.0006***	0.0006***	0.0010***	0.0009***	0.0009***	0.0009***
2015 × Unemp.	0.0006**	0.0007***	0.0007***	0.0006***	0.0009***	0.0011***	0.0011***	0.0011***	0.0011***
2016 × Unemp.	0.0005**	0.0007**	0.0007***	0.0007***	0.0009***	0.0012***	0.0012***	0.0012***	0.0012***
2017 × Unemp.	0.0008***	0.0009***	0.0007***	0.0007***	0.0010***	0.0013***	0.0012***	0.0013***	0.0013***
Unemp. rate	-0.0005**	-0.0005**	-0.0005***	-0.0005**	-0.0005**	-0.0007***	-0.0007***	-0.0009***	-0.0009***
Share of graduated	-0.0194	0.0310	-0.0538	-0.0704	-0.0976*	-0.1076*	-0.1292**	-0.1286	-0.1286
Intercept	0.0106*	0.0051	0.0145**	0.0140**	0.0133**	0.0115*	0.0109*	0.0109	0.0109

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on pulmonary diseases separately for different age classes (age class 15-20 is omitted). Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A7: Estimates of the Effect of Unemployment During the GR on Liver Diseases by Age Class.

	Age class								
	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64
2005 × Unemp.	0.0000**	-0.0000	-0.0000	-0.0000	-0.0000	-0.0001	-0.0001	-0.0002	-0.0002
2006 × Unemp.	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0001	-0.0001	-0.0001
2007 × Unemp.	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0001	-0.0001
2009 × Unemp.	0.0000	0.0000	0.0000	0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000
2010 × Unemp.	0.0000	0.0000	0.0000	0.0000	-0.0000	0.0000	-0.0000	0.0002	0.0002
2011 × Unemp.	0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002
2012 × Unemp.	0.0000	-0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0002	0.0002
2013 × Unemp.	0.0000	0.0000	0.0000	-0.0000	0.0000	0.0001	0.0001	0.0002	0.0002
2014 × Unemp.	0.0000	-0.0000	0.0000*	0.0000	0.0000	0.0001	0.0001	0.0003	0.0003
2015 × Unemp.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0003*	0.0003*
2016 × Unemp.	0.0000	0.0000	0.0001**	0.0000	0.0001	0.0001*	0.0001	0.0003	0.0003
2017 × Unemp.	0.0000	0.0000	0.0000*	0.0000	0.0001	0.0001	0.0001	0.0003*	0.0003*
Unemp. rate	-0.0000*	0.0000	-0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0001	-0.0001
Share of graduated	-0.0007	0.0051	0.0011	0.0004	-0.0019	-0.0045	-0.0067	-0.0346	-0.0346
Intercept	0.0003	-0.0006	0.0001	-0.0003	0.0002	0.0001	-0.0002	0.0027	0.0027

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on liver diseases separately for different age classes (age 15-20 is omitted). Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A8: Estimates of the Effect of Unemployment During the GR on Pulmonary Diseases by Age Class.

	Age class								
	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64
2005 × Unemp.	-0.0006*	-0.0004*	-0.0008*	-0.0009**	-0.0009*	-0.0008***	-0.0011***	-0.0013***	-0.0013***
2006 × Unemp.	-0.0001	-0.0001	-0.0003	-0.0004	-0.0002	-0.0002	-0.0004	-0.0001	-0.0001
2007 × Unemp.	-0.0002	-0.0001	-0.0001	-0.0003	-0.0001	-0.0001	-0.0002	0.0001	0.0001
2009 × Unemp.	0.0004*	0.0002	0.0002*	0.0002	0.0003**	0.0004*	0.0002	0.0003	0.0003
2010 × Unemp.	0.0004*	0.0002	0.0003*	0.0002	0.0004***	0.0006***	0.0006**	0.0008***	0.0008***
2011 × Unemp.	0.0005	0.0005*	0.0003	0.0004*	0.0005*	0.0007***	0.0010***	0.0011***	0.0011***
2012 × Unemp.	0.0005*	0.0004*	0.0003	0.0004	0.0006***	0.0008***	0.0009***	0.0012***	0.0012***
2013 × Unemp.	0.0004	0.0006*	0.0003	0.0004	0.0005**	0.0008**	0.0010**	0.0013***	0.0013***
2014 × Unemp.	0.0005	0.0005	0.0004	0.0004	0.0006**	0.0009**	0.0011***	0.0013***	0.0013***
2015 × Unemp.	0.0006	0.0005	0.0005	0.0005	0.0007**	0.0010**	0.0012**	0.0014***	0.0014***
2016 × Unemp.	0.0006	0.0006	0.0006*	0.0005	0.0007**	0.0012**	0.0014***	0.0016***	0.0016***
2017 × Unemp.	0.0008*	0.0007*	0.0007*	0.0006	0.0009**	0.0013**	0.0015**	0.0017**	0.0017**
Unemp. rate	-0.0003	-0.0004	-0.0003	-0.0003	-0.0003*	-0.0006**	-0.0009***	-0.0008**	-0.0008**
Share of graduated	0.0257	-0.0251	0.0036	0.0206	0.0279	0.0240	-0.0102	0.0044	0.0044
Intercept	-0.0034	0.0034	-0.0001	-0.0033	-0.0046	-0.0052	-0.0009	-0.0036	-0.0036

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on pulmonary diseases separately for different age classes (age 15-20 is omitted). Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A9: Estimates of the Effect of Unemployment During the GR on Depression by Age Class.

	Age class								
	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64
2005 × Unemp.	-0.0000	0.0000	-0.0000	-0.0000	0.0001	-0.0000	-0.0003	-0.0003	-0.0003
2006 × Unemp.	0.0001	0.0000	0.0000	0.0001	0.0001	0.0003*	-0.0001	-0.0000	-0.0000
2007 × Unemp.	-0.0000	0.0001	-0.0000	-0.0000	0.0000	0.0001	0.0001	-0.0001	-0.0001
2009 × Unemp.	0.0000	0.0001	0.0000	0.0000	-0.0000	0.0001	0.0000	0.0002	0.0002
2010 × Unemp.	-0.0000	0.0000	-0.0000	0.0001	0.0000	0.0001	0.0002	0.0005***	0.0005***
2011 × Unemp.	-0.0001	0.0000	0.0001	0.0001	0.0000	0.0002*	0.0003*	0.0006***	0.0006***
2012 × Unemp.	-0.0000	-0.0001	0.0000	0.0000	-0.0001	0.0001	0.0002	0.0007***	0.0007***
2013 × Unemp.	-0.0001	-0.0001	0.0000	0.0001	0.0000	0.0001	0.0001	0.0005**	0.0005**
2014 × Unemp.	-0.0000	-0.0001	0.0001	0.0001	-0.0000	0.0001	0.0002	0.0006**	0.0006**
2015 × Unemp.	0.0000	-0.0001	0.0001	-0.0000	0.0000	0.0000	0.0002	0.0007**	0.0007**
2016 × Unemp.	0.0000	-0.0001	0.0000	0.0000	-0.0000	0.0001	0.0002	0.0007***	0.0007***
2017 × Unemp.	0.0000	-0.0001	0.0000	-0.0000	0.0000	0.0001	0.0002	0.0008***	0.0008***
Unemp. rate	0.0001	0.0001	-0.0001	0.0000	-0.0000	0.0000	-0.0001	-0.0003	-0.0003
Share of graduated	0.0263	0.0037	0.0223	0.0047	-0.0083	0.0217	-0.0068	0.0305	0.0305
Intercept	-0.0045	-0.0027	-0.0030	-0.0017	-0.0013	-0.0061	-0.0045	-0.0047	-0.0047

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on depression separately for different age classes (age 15-20 is omitted). Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A10: Estimates of the Effect of Unemployment During the GR on Cancer as a Placebo Outcome.

	(1) Cancer
2005 × Unemp.	-0.0000
2006 × Unemp.	0.0000
2007 × Unemp.	0.0000
2009 × Unemp.	-0.0000
2010 × Unemp.	-0.0000
2011 × Unemp.	-0.0000
2012 × Unemp.	-0.0000
2013 × Unemp.	-0.0000*
2014 × Unemp.	-0.0000
2015 × Unemp.	-0.0000*
2016 × Unemp.	-0.0000
2017 × Unemp.	-0.0000
Unemp. rate	0.0000
Share of graduated	0.0015
Aged 21-25	-0.0017***
Aged 26-30	-0.0035***
Aged 31-35	-0.0053***
Aged 36-40	-0.0068***
Aged 41-45	-0.0076***
Aged 46-50	-0.0077***
Aged 51-55	-0.0072***
Aged 56-60	-0.0054***
Aged 61-64	-0.0014**
Intercept	0.0061***
N	

Notes: The table reports event study estimates of the effect of increasing unemployment during the GR on cancer as a placebo health outcome. Reference year is 2008. The coefficients show the marginal increase in the disease incidence for a one percent increase in provincial unemployment. The unit of observation is the individual. All regressions include individual fixed effects and year fixed effects. Robust standard errors, clustered at the municipality level, are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.