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Abstract

Our study examines the relationship between business cycles and mortality rates in Italy over the period 2004–2019. Using the unemployment rate as a proxy for macroeconomic conditions, we investigate how economic fluctuations affect mortality rates across causes of death, age groups, genders, and educational levels. The analysis relies on data from the National Institute of Statistics (ISTAT) and applies panel data methods to control for province-specific heterogeneity and time effects. The findings reveal a procyclical pattern, with higher unemployment rates associated with lower mortality. Substantial heterogeneity emerges across demographic groups and causes of death. To test robustness, the analysis is extended to include the COVID-19 pandemic years (2020–2021), thereby assessing its impact on the previously identified relationships. Results suggest that the pandemic disrupted established unemployment–mortality dynamics, particularly for transport accidents and respiratory diseases. Overall, the findings highlight the importance of targeted public policies to mitigate health risks during economic expansions and provide insights into how macroeconomic conditions shape public health outcomes in Italy.

Keywords: Business Cycles • Mortality Rates • Unemployment • Public Health • Italy • Regional Disparities • COVID-19 Impact

JEL Classification: E32 • I10 • I12 • I14 • J14 • J16

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1 Introduction

The association between macroeconomic conditions and health outcomes has received considerable research attention, as it encompasses critical socio-economic and psychological dimensions. In Italy, a country characterized by pronounced regional economic disparities and a rapidly aging population, this relation remains relatively underexplored. This study investigates the link between business cycles—particularly fluctuations in unemployment—and mortality rates in Italy over the period 2004–2019, thereby addressing a notable gap in the existing literature.

Traditionally, economic downturns have been considered particularly detrimental, especially for individuals with limited economic resources. The conventional paradigm regarding the health effects of macroeconomic fluctuations posits that recessions exert disproportionately adverse impacts on the most vulnerable segments of the population (Brenner, 1971, 1975, 1979). Nevertheless, an expanding body of evidence has challenged this view, particularly in developed countries with functional social safety nets. Several studies have documented a procyclical pattern, whereby mortality increases during periods of economic expansion, notably in the United States (Brenner, 1979; Ruhm, 2000) and Spain (Cervini-Plá and Vall-Castelló, 2021). Subsequent research suggests that, although mortality has historically followed a procyclical trajectory, the strength of this association has attenuated over time in certain contexts, likely reflecting changes in health behaviors and public policy interventions (Ruhm, 2015).

Stuckler et al. (2009), in their analysis of European countries, emphasized that economic crises may induce substantial deterioration in public health, particularly in contexts characterized by reductions in healthcare expenditure. Collectively, these findings underscore the complexity and heterogeneity inherent in the macroeconomic–health association across diverse demographic and geographic contexts.

Moreover, unemployment has been identified as a critical determinant of health outcomes. Sullivan and Von Wachter (2009) demonstrated that job loss is associated with elevated mortality rates in both the short and long term, highlighting the substantial health risks faced by affected individuals. These findings reinforce the importance of robust social safety nets and targeted public health interventions during periods of economic contraction. Complementary evidence from Browning and Heinesen (2012) revealed that job displacement resulting from plant closures in Denmark led to significant increases in both mortality and hospitalizations, with effects persisting over several years.

Expanding the scope to early-life outcomes, Dehejia and Lleras-Muney (2004) investigated the influence of business cycles on neonatal health in the United States. The study found that children born during recessions exhibited improved health outcomes, including lower rates of low birth weight and infant mortality. This evidence introduces a new dimension to the literature, indicating that the effects of macroeconomic fluctuations on health may commence as early as birth.

Furthermore, prior research has demonstrated that economic downturns may differentially affect specific causes of death, with transport accidents and respiratory diseases showing the most pronounced sensitivity to unemployment fluctuations (Ruhm, 2000; Gerdtham and Ruhm, 2006). Collectively, these studies highlight the nuanced and multifaceted nature of the macroeconomic–health nexus, suggesting that the effects of business cycles are contingent upon age, cause of death, and socio-economic context.

This paper addresses the research gap by providing a comprehensive analysis of the Italian context, exploring variations in mortality across causes of death, demographic groups, and regions. Using provincial-level data and panel methodologies, we examine the association between business cycles and mortality in Italy over the period 2004–2019.

Compared to the extensive literature on other countries, studies focusing specifically on Italy remain scarce, particularly at the regional level (one exception is Cavicchioli and Pistoresi, 2020). Italy's unique demographic and economic characteristics—such as its pronounced North–South economic divide, historically high unemployment rates, and aging population—render it an especially compelling case for examining the interplay between economic conditions and public health. These structural disparities create a distinctive context in which to analyze how economic cycles influence mortality. Moreover, Italy has experienced several major economic crises, including the sovereign debt crisis of 2011–2013, which significantly affected the labor market and may have had substantial implications for public health. Investigating these periods provides valuable insights into the ways economic downturns affect mortality in a country characterized by a robust welfare system yet marked by persistent structural inequalities.

Consistent with prior studies, the analysis is disaggregated by age, gender, and education level, as well as by cause of death, using national vital statistics at the provincial level. To assess robustness, the analysis is extended to include 2020 and 2021, thereby evaluating the impact of COVID-19 on the unemployment–mortality association.

In this study, the unemployment rate serves as a key indicator of macroeconomic conditions, reflecting both the state of the labor market and broader economic performance. This variable typically fluctuates with economic cycles, rising during recessions and declining during periods of recovery and expansion. Beyond functioning as a marker of economic performance, unemployment has profound implications for both physical and mental health. Understanding the mechanisms through which unemployment affects health is essential for designing effective policies to mitigate its adverse impacts.

Figure 4 in the appendix illustrates trends in unemployment and mortality rates from 2004 to 2019. The unemployment rate is depicted by the blue line, while the mortality rate is represented by the orange line. From 2004 to 2011, both rates remain relatively stable. However, beginning around 2011–2012, the unemployment rate rises sharply, coinciding with the sovereign debt crisis. This increase peaks between 2013 and 2014 before gradually declining. In contrast, the mortality rate remains largely flat for most of the period, showing a slight upward trend from approximately 2015 onward. Notably, during the peak unemployment years (2013–2014), the mortality rate does not exhibit a corresponding spike, suggesting a potential decoupling between economic downturns and immediate changes in mortality.

Similarly, Table 7 in the appendix supports the analysis of potential relationships between unemployment and mortality. During periods of elevated unemployment (2008–2011), no immediate or clear increase in mortality is observed, indicating that the unemployment–mortality relationship is complex and not straightforward.

In line with prior studies, we observe a procyclical pattern: increases in unemployment correlate with decreases in mortality. The effect is more pronounced for men than for women, for whom the relationship is not statistically significant. Moreover, the impact varies across causes of death. Across age groups, effects are generally not statistically significant, except for the 16–24 cohort, which shows statistically significant procyclical coefficients. By education level, individuals with higher attainment—high school and university graduates—also exhibit a significant procyclical pattern. Incorporating data from the COVID-19 pandemic (2020–2021) indicates that this global health crisis has altered established unemployment–mortality dynamics, attenuating the previously observed negative association. Notably, deaths from respiratory diseases exhibit a countercyclical pattern over this period, whereas all other causes with statistically significant coefficients remain procyclical.

The findings of this study carry important implications for economic and health policy formulation in Italy, both during periods of recession and expansion. By identifying the dynamics between unemployment and mortality, the study can guide policymakers in implementing effective preventive measures to protect vulnerable populations.

It is important to emphasize that this paper does not aim to establish causal relationships; rather, it provides a descriptive analysis intended to facilitate cross-country comparisons. While certain causes of death, such as transport accidents, are well-established in the literature as directly influenced by unemployment fluctuations, others, such as cancer-related mortality, may be affected by additional factors and prior conditions. This distinction highlights the complexity of the unemployment–mortality association across different causes of death.

The paper is structured as follows: Section 2 introduces the data and descriptive statistics, detailing the dataset and sample selection process. Section 3 outlines the methodology employed. Section 4 presents the main results, highlighting key findings. Section 5 examines heterogeneous effects, analyzing variations across gender and age groups. Section 6 provides robustness checks, incorporating data from 2020 and 2021 to assess the impact of COVID-19. Finally, Section 7 concludes by summarizing the main insights and contributions of the study.

2 Data and Descriptive Statistics

We use data from the National Institute of Statistics (ISTAT), Italy's official agency for collecting and disseminating economic, demographic, social, and health statistics. The dataset contains detailed information on mortality and unemployment rates.

The dependent variable is the mortality rate between 2004 and 2019 at the provincial level. Individual-level records include causes of death and demographic characteristics such as sex, age, and education, which we aggregated by province and year. The sample covers 103 of Italy's 107 provinces, excluding four created after 2009.[1]

The analysis focuses on individuals aged 15–74, the only age group for which consistent provincial-level data are available. This range encompasses most of the working-age population and is therefore suitable for studying the interaction between labor market conditions and health outcomes.

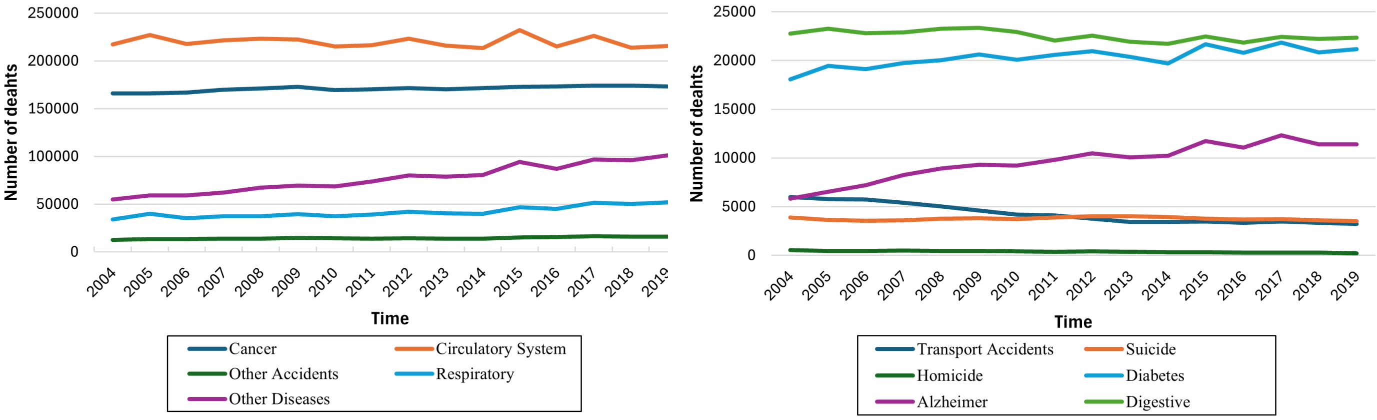
As mentioned earlier, we aggregated individual-level data by province and year to calculate the number of deaths in each province during the study period. Additionally, we collapse the data by cause of death. The selection of these causes was based on their significance as primary statistical indicators for assessing a population's health status and addressing the healthcare planning needs of the country. Specifically, we included the following categories: *Transport accidents*, *Suicide*, *Homicide*, *Cancer*, *Diabetes*, *Alzheimer's disease*, *Circulatory system diseases*, *Digestive diseases*, *Respiratory diseases*, and *Other accidents* (including drowning, poisoning, events of undetermined intent, and other external causes of trauma and poisoning). We also included *Other diseases*, encompassing certain infectious and parasitic diseases, diseases of the blood and hematopoietic organs, immune system disorders, endocrine, nutritional, and metabolic diseases, mental and behavioral disorders, diseases of the nervous system and sense organs, among others.

Figure 1 shows mortality trends by cause between 2004 and 2019. The left panel shows a relatively stable trend in cancer-related deaths, a slight increase in respiratory disease mortality, and a consistent number of deaths from other accidents. There is also a modest upward trend in deaths from circulatory system diseases and a notable rise in deaths from other diseases, particularly after 2015. In the right panel, a continuous decline in deaths from transport accidents is evident throughout the period. Suicide-related deaths show a slight decrease over time, while homicide-related deaths remain relatively low and stable. Mortality from digestive diseases remains constant, whereas deaths from Alzheimer's disease exhibit an increasing trend, particularly after 2010, reflecting the impact of an aging population. Lastly, deaths due to diabetes show a slight upward trend.

The unemployment rate is used as a macroeconomic indicator to capture business cycle fluctuations. This choice is based on evidence that other economic indicators, as highlighted by Granados (2005), are highly correlated. Such correlations can lead to unreliable

[1] Barletta-Andria-Trani, Fermo, and Monza and Brianza were established in 2009, and South Sardinia in 2016.

Figure 1: Evolution of mortality by cause in the period 2004-2019. Source: ISTAT



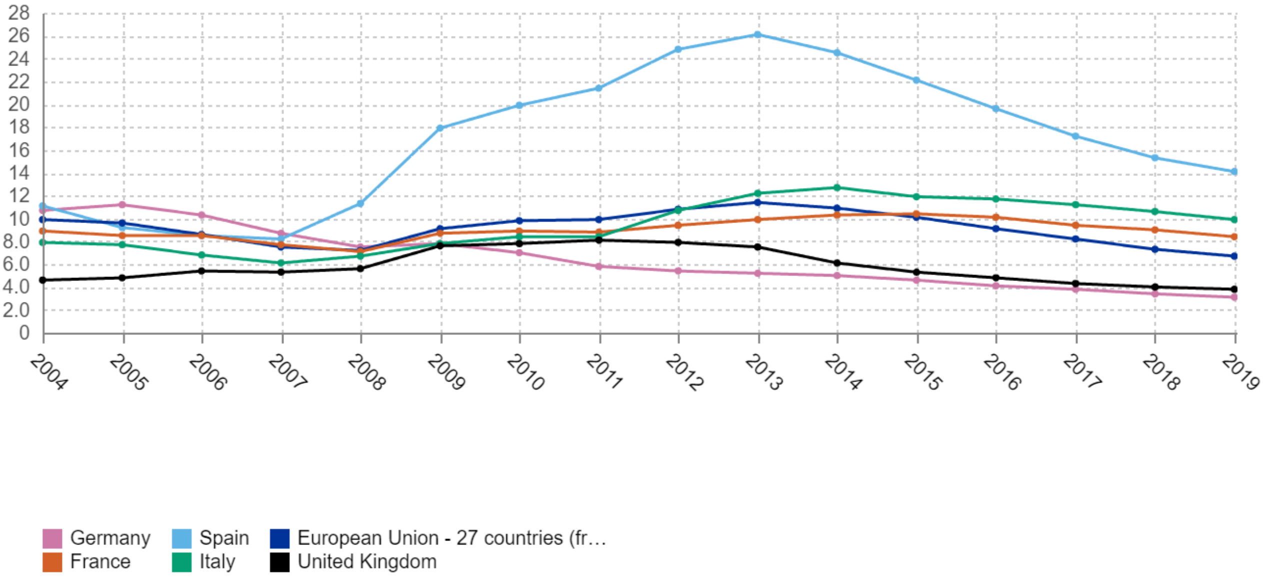
results in multiple regressions when modeling mortality using two or more economic indicators simultaneously. Notably, when mortality is regressed on multiple economic variables, unemployment is the only variable that consistently remains statistically significant. Furthermore, previous research has shown that the effects of regional GDP or income are more sensitive to model specifications compared to the effects of regional unemployment, reinforcing the robustness of unemployment as an indicator of health fluctuations (Ruhm (2000); Granados (2005)). Finally, the choice of the unemployment rate is also motivated by its practicality for provincial-level analysis, given the challenges associated with obtaining GDP data at such a granular level.

Figure 2 illustrates unemployment trends in Italy relative to the EU average. Until 2013, Italy's unemployment rate remained below the European average. The sovereign debt crisis of 2011–2012 triggered a sharp increase, from 8.4% in 2011 to 10.7% in 2012, peaking at 12.7% in 2014. As noted by Petrelli (2013), the rise was most pronounced in southern Italy, where unemployment reached 20.7% in 2014.

To capture heterogeneity in the relationship between economic conditions and mortality, we disaggregate by gender, age, cause of death, and education. Table 8 reports descriptive statistics. Men accounted for 48.54% of deaths (4,657,266) and women for 51.46% (4,937,313). Circulatory diseases were the leading cause of death (37.45%; 3,596,104), followed by cancer (29.19%; 2,800,617) and respiratory diseases (12.45%; 1,195,677).

By age, 72.84% of deaths (6,933,782) occurred among individuals aged 75 and older, and 14.74% (1,407,276) among those aged 65–74. Regarding education, 73.92% (7,050,636) of the deceased had only an elementary school certificate, 12.34% (1,176,601) a high school diploma, 11.68% (1,114,512) a middle school diploma, and just 2.64% (252,293) held a university degree.

Figure 2: Unemployment Rate (2004-2021) - Eurostat



3 Methodology

To examine the relationship between mortality and unemployment, we estimate the following specification, adapted from Cervini-Plá and Vall-Castelló (2021) and Ruhm (2015):

$$ln(M_{kjt}) = \alpha_{kj} + U_{kjt}\gamma + \lambda_{kt} + H_j * T + A15\delta + A65\theta + \epsilon_{kjt} \quad (1)$$

where M_{kjt} denotes the mortality rate from cause k in province j at time t, and U_{kjt} is the provincial unemployment rate at that time, used as a proxy for macroeconomic conditions. Mortality is defined as the number of deaths from a specific cause (or from all causes) relative to the provincial population, expressed per 1,000 inhabitants. In other words, the mortality rate measures the frequency of deaths within a population, adjusted for population size, and is calculated using the following formula:

$$M_{kjt} = \frac{Number\ of\ deaths_{kjt}}{Population_{kjt}/1000}$$

The term α captures province fixed effects, λ accounts for year effects, and ϵ is the error term. The parameter of interest, γ, measures the association between unemployment and mortality.

A log-linear form is employed so that coefficients can be interpreted as elasticities, i.e., the percentage change in mortality associated with a one percent change in unemployment. Year effects (λ_{kt}) absorb factors evolving uniformly across provinces, such as medical advances or changes in social behavior, while province fixed effects (α_{kj}) capture time-invariant local characteristics, such as lifestyle or environmental conditions. Thus, identification comes from within-province variation in unemployment relative to other provinces.

The specification also includes province-specific linear trends (H_jT), where T is normalized between zero (2004) and one (2019), following Ruhm (2015). This generates 103 province-specific time trends.

Demographic structure is controlled for using the share of the population aged under 15 (A_{15}) and over 65 (A_{65}), which account for variations in age composition and its potential effect on labor supply and health outcomes.

Equation 1 is estimated for overall mortality as well as by cause of death, using annual provincial data. We also explore heterogeneous effects by sex, five age groups (0–24, 25–44, 45–64, 65–74, 75+), and four educational levels (primary, secondary, high school, and university).

Finally, to quantify effect sizes, we follow Ruhm (2015) and Cervini-Plá and Vall-Castelló (2021). The relative effect of a one percentage point increase in unemployment on mortality from cause k is:

$$(e^{\gamma_k} - 1) * 100\%$$

This formula provides the expected percentage change in mortality from cause k resulting from a one percentage point increase in the unemployment rate. These relative effects are then translated into absolute numbers using the formula:

$$(e^{\gamma_k} - 1) * \pi_k D$$

where π_k represents the share of deaths attributable to cause k and D is the average annual number of deaths (599,661).

4 Results

We begin by analyzing the relationship between unemployment and total mortality, with attention to differences across causes of death.

The first row of Table 1 shows that overall mortality ("All Causes") is procyclical. The coefficient (-0.00161) is negative and statistically significant, indicating that a one–percentage point increase in the local unemployment rate is associated with a modest decline (-0.16%) in mortality. This finding supports the view that overall mortality follows a procyclical pattern, consistent with Ruhm (2015), who reported a weakening of this relationship over time.

Focusing on the statistically significant coefficients, the analysis reveals a nuanced pattern across causes of death. Specifically, a one percentage point increase in the unemployment rate is associated with a 0.853% decrease in the mortality rate from transport accidents, which is statistically significant at the 90% confidence level. Similarly, a one percentage point increase in the unemployment rate corresponds to a 0.916% decrease in the suicide

Table 1: Association between unemployment rate increase and mortality rate by cause of death

Mortality Rate	Unemployment Rate
All Causes	-0.00161*
	(0.000923)
Transport Accidents	-0.00853*
	(0.00471)
Suicide	-0.00916*
	(0.00503)
Homicide	0.00282
	(0.0116)
Cancer	-0.00139
	(0.00102)
Diabetes	-0.000960
	(0.00227)
Alzheimer	-0.00258
	(0.00335)
Circulatory System Diseases	-0.00192*
	(0.00111)
Digestive	-0.000923
	(0.00192)
Other Accidents	-0.000761
	(0.00264)
Respiratory	-0.00270
	(0.00169)
Other Diseases	-0.00122
	(0.00147)
Observations	1,648
Year fixed effects	YES
Province fixed effects	YES
Province specific linear trends	YES

All estimations include Year FE, Province FE,
Linear trends and Demographic control.
Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

rate, also significant at the 90% confidence level. In the same vein, a one–percentage-point increase in the unemployment rate is associated with a 0.192% decrease in mortality from circulatory system diseases, significant at the 90% confidence level.

The decline in mortality from transport accidents aligns with the hypothesis that economic downturns reduce mobility and traffic volumes, leading to fewer fatal accidents, consistent with the mechanisms discussed by Ruhm (2000) and further examined by Cervini-Plá and Vall-Castelló (2021) for the Spanish context.

For other causes, coefficients are not statistically different from zero. In particular, cancer and diabetes show negative but insignificant associations, while homicide is positive but insignificant. Remaining categories ("Respiratory," "Digestive," "Other Accidents," "Alzheimer's," and "Other Diseases") also yield negative yet insignificant estimates.

Overall, these results suggest predominantly procyclical dynamics for certain external and cardiovascular causes. Mortality from transport accidents declines notably during downturns, consistent with reduced exposure to mobility-related risks. The suicide effect is modest (10% significance) and should be interpreted with caution, but it contributes to the procyclical pattern observed in the data.

While the findings partially align with Cervini-Plá and Vall-Castelló (2021) for Spain, indicating procyclical patterns in mortality for certain causes, the lack of procyclicality every causes of mortality mirrors the trends identified by Ruhm (2015). Specifically, Ruhm documented a decline in the procyclicality of overall mortality over time. His analysis highlighted a substantial shift in the relationship between macroeconomic conditions and mortality: total deaths transitioned from being strongly procyclical in the 1970s and 1980s to largely uncorrelated with macroeconomic fluctuations in the early 21st century.

It is important to emphasize that the absence of a clear aggregate relationship does not imply that job loss leads to improved health outcomes. On the contrary, our results align with the evidence presented by Sullivan and Von Wachter (2009), who demonstrate that unemployment significantly increases mortality risk, both in the medium and long term, due to acute and chronic stress, reduced financial resources, and employment instability.

This apparent paradox is further discussed by Tapia Granados et al. (2014), who reveal that while individual unemployment increases mortality risk, higher contextual (state-level) unemployment rates are associated with reduced mortality at the aggregate level. Given that our analysis is conducted at the macro level using provincial data rather than individual-level observations, our findings are more consistent with the contextual component of this paradox. Specifically, although individual job loss remains profoundly detrimental to health, higher unemployment at the aggregate level may coincide with reductions in specific types of mortality due to lower exposure to certain risks during recessions, while leaving overall mortality largely unaffected.

5 Heterogeneous Analysis

In this section, we explore heterogeneities by examining the association between unemployment and mortality across age groups, gender, and educational levels. All specifications include year and province fixed effects as well as demographic controls, thereby accounting for unobserved variations specific to a given year or province and reducing the risk of omitted-variable bias.

Table 2 reports the relationship between fluctuations in unemployment and mortality across different age groups. The results highlight substantial heterogeneity by age.

Only the 16–24 age group exhibits a statistically significant association: a 1% increase in the unemployment rate corresponds to a 0.194% decline in mortality. This procyclical pattern appears specific to younger cohorts; for the other age groups, coefficients remain negative (procyclical) but are not statistically significant. A plausible explanation lies in age-specific causes of death. Among young individuals, traffic accidents represent a leading cause of mortality, and prior research shows that road fatalities are highly procyclical. For example, Stevens et al. (2015) document that increases in unemployment are associated with marked declines in traffic-related deaths among young adults, while He (2016) find that each percentage-point increase in unemployment reduced motor vehicle fatalities by 2.9% in the U.S. during the Great Recession. These reductions are not primarily driven by fewer miles traveled but by lower risk per mile, particularly in crashes involving heavy trucks, multi-vehicle collisions, and speeding. During downturns, reduced commercial activity lowers truck circulation and congestion, while risky behaviors such as speeding or alcohol-impaired driving decline due to reduced disposable income. Taken together, this evidence suggests that the significant mortality decline observed among the 16–24 age group during recessions is largely explained by reductions in road traffic fatalities, a cause to which young people are disproportionately exposed.

Table 2: Changes in age-specific mortality rates relative to unemployment rate fluctuations

Mortality Rate	16-24	25-44	45-64	65-74	75+
Unemployment rate	-0.194***	-0.022	-0.020	-0.009	-0.005
	(0.022)	(0.016)	(0.016)	(0.016)	(0.016)
Observations	1646	1648	1648	1648	1648
R^2	0.987	0.987	0.987	0.987	0.987
Year fixed effects	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES
Province specific linear trends	YES	YES	YES	YES	YES

All estimations include Year FE and Province FE.

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Previous studies have shown that macroeconomic conditions, including unemployment, can influence mortality, but effects often differ substantially between men and women (Gerdtham and Johannesson, 2005). As a second dimension of heterogeneity, we examine the association by gender. Table 3 presents the results, highlighting important differences across causes of death.

For men, the coefficient for "All Causes" is negative and marginally significant ($\rho < 0.10$), suggesting modest procyclicality: a one–percentage-point increase in unemployment is associated with a 0.17% decline in overall mortality. Cause-specific estimates reveal further procyclical effects. Mortality from suicide, other accidents, and respiratory diseases falls significantly when unemployment rises: a one–percentage-point increase in unemployment is associated with 0.97% fewer suicide deaths (significant at the 10% level), 0.68% fewer deaths from other accidents (significant at the 5% level), and 0.39% fewer respiratory deaths (significant at the 10% level). While the suicide result may appear counterintuitive, these patterns are consistent with reduced work- and traffic-related exposures during downturns and with more time available for health maintenance. In contrast, estimates for homicide, circulatory diseases, digestive diseases, Alzheimer's, transport accidents, cancer, and other causes are not statistically significant. Overall, men's mortality displays modest procyclicality, driven mainly by reductions in external and respiratory causes, while most other outcomes show no systematic association with unemployment.

For women, the coefficient for "All Causes" is negative but not statistically significant, indicating no aggregate relationship between unemployment and mortality. At the cause-specific level, however, distinct patterns emerge. Transport accidents decline as unemployment rises (1.33% per one–percentage-point increase, 5% level), consistent with lower mobility and reduced exposure to traffic during recessions. Homicide also decreases (2.03% at 5% level), suggesting a procyclical pattern potentially linked to reduced public or contact-intensive activities in weaker labor markets. By contrast, deaths from other accidents increase (0.46% at 5% level), pointing to a countercyclical component that may reflect greater time spent at home and a higher incidence of domestic accidents. For suicide, cancer, diabetes, Alzheimer's, circulatory, digestive, respiratory, and other causes, no statistically significant effects are observed.

Table 4 presents the relationship between unemployment and mortality across education groups. The coefficients for individuals with high school and university education are negative and statistically significant, indicating procyclicality, consistent with the findings of Edwards (2008). For those with a high school degree, a one–percentage-point increase in unemployment is associated with a 0.694% reduction in mortality, while for university graduates the reduction is 0.628%. These effects may reflect better access to healthcare, healthier lifestyles during unemployment, greater adaptability to economic hardship, and more generous unemployment benefits, all of which may mitigate mortality risk during downturns.

These results partly align with Muller (2002), who found that the share of individuals without a high school diploma is positively and linearly associated with age-adjusted

Table 3: Relationship between unemployment rate changes and mortality for different causes of death by gender

Mortality Rate	Men	Women
All Causes	-0.00170*	-0.000357
	(0.00101)	(0.000644)
Transport Accidents	-0.00613	-0.0133**
	(0.00475)	(0.00660)
Suicide	-0.00969*	0.00158
	(0.00523)	(0.00698)
Homicide	-0.00161	-0.0203**
	(0.0123)	(0.00975)
Cancer	-0.00178	-0.000600
	(0.00117)	(0.000867)
Diabetes	0.00200	-0.000153
	(0.00307)	(0.00186)
Alzheimer	-0.00373	-0.0000843
	(0.00536)	(0.00267)
Circulatory System Diseases	-0.00110	-0.000531
	(0.00130)	(0.000768)
Digestive	-0.00170	0.00144
	(0.00240)	(0.00191)
Other Accidents	-0.00678**	0.00459**
	(0.00337)	(0.00225)
Respiratory	-0.00387*	-0.00101
	(0.00202)	(0.00160)
Other Diseases	-0.00230	-0.000141
	(0.00176)	(0.00114)
Observations	1,648	1,648
Year fixed effects	YES	YES
Province fixed effects	YES	YES
Province specific linear trends	YES	YES

All estimations include Year FE, Province FE
and demographic control.
Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Relationship between unemployment rate changes and mortality for different cause of death by education level

Mortality Rate	Primary	Secondary	High School	University
Unemployment Rate	-0.00174	0.000380	-0.00694**	-0.00628**
	(0.00116)	(0.00287)	(0.00267)	(0.00299)
Observations	1648	1648	1648	1648
R^2	0.9175	0.8920	0.9162	0.8363
Year fixed effects	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES
Province specific linear trends	YES	YES	YES	YES

All estimations include Year FE, Province FE and Demographic control.

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

mortality. In our case, having at least a high school diploma appears protective against mortality during economic downturns.

Table 5: Predictions of the number of deaths and confidence intervals at 95% for various causes of death.

Causes	Number of deaths	95% Conf.	Interval
Total Causes	-965	-2407	119
Transport accidents	-39	-81	3
Suicide	-36	-74	3
Circulatory System Diseases	-431	-919	57
Men	-494	-1069	81
Women	-110	-499	279

Note: In order to calculate the predicted number of death we use $(e^{\hat{\gamma}k} - 1)x\pi_k D$ where π_k is the share of deaths due to source k and D is the average annual number of deaths (599,661). 95% confidence intervals are estimated as $(e^{\hat{\gamma}k \pm 1.96xs_k} - 1)x\pi_k D$ for s_k standard error. *** p<0.01, ** p<0.05.

Finally, we conclude this section by calculating the impact of these coefficients in terms of the number of deaths. Table 5 shows that a one percentage point increase in the unemployment rate leads to an average reduction of 965 deaths per year, with a 95% confidence interval ranging from -2407 to 119 deaths. When broken down by gender, the effect of a one percentage point increase in the unemployment rate is more pronounced for men, reducing deaths by 494, compared to a reduction of 110 deaths for women, the latter of which is not statistically significant.

We calculate death predictions for the causes of death that were statistically significant in the previous analysis, as shown in Table 1. Specifically, cardiovascular deaths show the largest decrease during a recession: a one percentage point increase in the unemployment rate leads to 431 fewer cardiovascular deaths annually. Additionally, a one percentage point rise in the unemployment rate is associated with a reduction of 39 deaths from transport accidents and 36 fewer deaths from suicide.

6 Robustness Check

In this section, we extend the analysis to 2020 and 2021 to examine the impact of the COVID-19 pandemic. Including these years allows us to assess whether the unemployment–mortality relationship changes significantly during this unprecedented crisis. The pandemic affected not only the healthcare system but also individual behaviors and lifestyles, influencing both direct and indirect causes of mortality. This extended timeframe therefore provides a more comprehensive perspective on the interplay between unemployment and mortality under extraordinary circumstances.

In the main analysis, we exclude the pandemic years because the pandemic represents an external factor that influences mortality (particularly by increasing deaths from respiratory causes) while simultaneously driving up unemployment due to the accompanying economic crisis. Consequently, during these years, both unemployment and mortality increase simultaneously, moving in the same direction. Therefore, our hypothesis is that when we include these years in the analysis, the relationship between unemployment and mortality will become less procyclical, as the dynamics observed during the pandemic are countercyclical in nature.

The data analysis in Table 6 indicates that the effect of unemployment on overall mortality is negative for both periods considered, suggesting that an increase in the unemployment rate generally corresponds to a decrease in mortality. However, the effect size is slightly smaller when the COVID-19 years are included, and the coefficient becomes statistically insignificant. This outcome can be explained by the contrasting effects observed across different causes of death. The pandemic caused a sharp rise in respiratory-related deaths, primarily due to COVID-19, as shown by the significant peak in respiratory mortality in 2020 (purple line in Figure 3). This trend is reflected in the positive and significant coefficient for respiratory diseases, highlighting the substantial impact of the pandemic on mortality specifically related to respiratory causes. In particular, with a one percentage point increase in the unemployment rate, respiratory disease mortality will increase by 0.39%. Furthermore, since the coefficient is positive and statistically significant at the 90% confidence level, it also indicates a countercyclical effect of the mortality rate with increasing unemployment.

At the same time, other causes of death remained stable or even declined. For example, deaths from transport accidents and cardiovascular diseases either decreased or did not increase significantly, likely due to mobility restrictions and lockdowns, which reduced incidents associated with external risks. This offset between the rise in respiratory-related deaths and the decline or stability in other causes contributed to maintaining a relatively stable overall mortality rate. Consequently, while unemployment increased and respiratory-related deaths rose during the pandemic, the stability in other causes resulted in no significant change in the total mortality rate.

Table 6: Effect of a one point increase in the unemployment rate on the mortality rate due to different causes of death

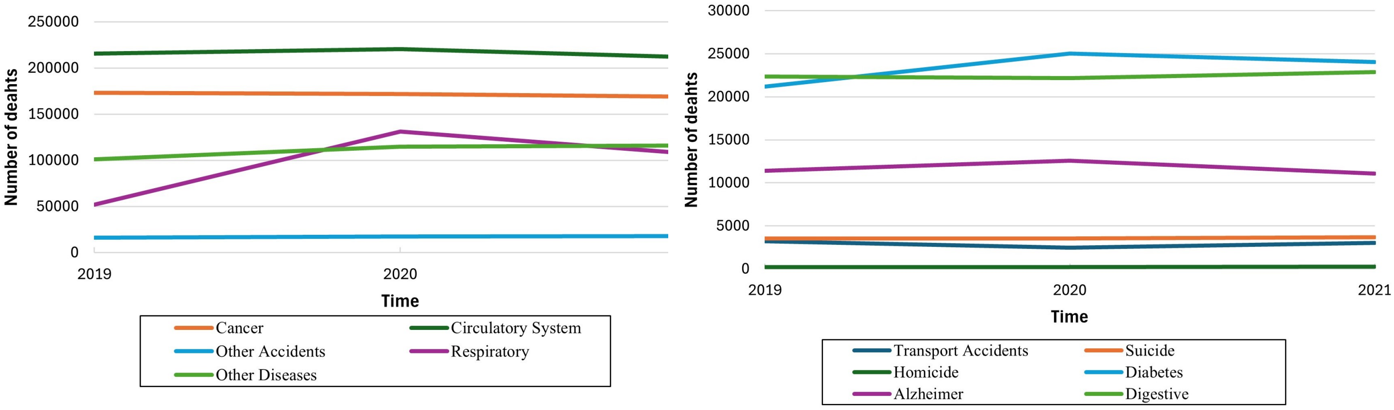
Mortality Rate	2004-2019	2004-2021
All Causes	-0.00161*	-0.000618
	(0.000923)	(0.000854)
Transport Accidents	-0.00853*	-0.0107**
	(0.00471)	(0.00429)
Suicide	-0.00916*	-0.00197
	(0.00503)	(0.00431)
Homicide	0.00282	0.00893
	(0.0116)	(0.0101)
Cancer	-0.00139	-0.00165*
	(0.00102)	(0.000858)
Diabetes	-0.000960	-0.000204
	(0.00227)	(0.00197)
Alzheimer	-0.00258	-0.00442
	(0.00335)	(0.00310)
Circulatory System Diseases	-0.00192*	-0.00140
	(0.00111)	(0.000993)
Digestive	-0.000923	-0.00209
	(0.00192)	(0.00169)
Other Accidents	-0.000761	0.000608
	(0.00264)	(0.00225)
Respiratory	-0.00270	0.00388*
	(0.00169)	(0.00210)
Other Diseases	-0.00122	-0.00282**
	(0.00147)	(0.00130)
Men	-0.00170*	-0.00061
	(0.00101)	(0.00093)
Women	-0.00036	-0.00006
	(0.00064)	(0.00063)
Observations	1,648	1,854
Year fixed effects	YES	YES
Province fixed effects	YES	YES
Province specific linear trends	YES	YES

All estimations include Year FE, Province FE and Demographic control.

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 3: Evolution of mortality by cause in the period 2019-2021 - source: ISTAT



For "other diseases," the coefficient becomes negative and statistically significant at the 95% level once 2020–2021 are included. A one–percentage-point increase in unemployment is associated with a 0.28% reduction in mortality from these causes, consistent with procyclicality.

Overall, incorporating the pandemic years reduces the overall procyclical effect of unemployment on mortality. The most striking change concerns respiratory diseases, where the pandemic reversed the usual relationship, producing a countercyclical pattern. For other causes, procyclical effects persist, but they are overshadowed by the pandemic's direct impact on respiratory mortality.

7 Conclusion

This study analyzes the relationship between economic cycles and mortality in Italy from 2004 to 2019, using unemployment as an indicator of macroeconomic conditions. The results reveal a procyclical pattern: higher unemployment is associated with lower mortality, with notable variations by gender and cause of death. Comparable evidence of procyclical mortality has been documented in Germany Neumayer, 2004, Spain Granados, 2005; Cervini-Plá and Vall-Castelló, 2021, France Buchmueller, Jusot, Grignon, et al., 2007, Mexico Gonzalez and Quast, 2011, Canada Ariizumi and Schirle, 2012, OECD countries Gerdtham and Ruhm, 2006, and Pacific-Asian nations Lin, 2009. When the pandemic years (2020–2021) are included, the relationship weakens, with the effect of unemployment on mortality becoming negative but statistically insignificant.

The gender-specific analysis shows that unemployment significantly reduces mortality among men, but the effect is not significant for women. The impact also differs across causes of death: mortality from road accidents, suicides, and cardiovascular diseases declines when unemployment rises, while respiratory-related deaths increase during the pandemic, reflecting the influence of COVID-19. Across age groups, only the 16–24 cohort exhibits a statistically significant (procyclical) decline in mortality; estimates for other age groups are negative but not significant. Moreover, educational disparities are marked: the procyclical effect is strongest among individuals with higher education, such as high school and university graduates.

This study contributes to the literature by providing a provincial-level analysis for Italy, thereby emphasizing the importance of demographic characteristics in assessing the health effects of economic conditions. This approach complements the national-level time series analysis of Cavicchioli and Pistoresi (2020).

In sum, the evidence confirms a general procyclical relationship between unemployment and mortality, while the pandemic years illustrate how extraordinary crises can alter these dynamics. The findings underscore important policy implications: the health consequences of job loss extend beyond immediate economic hardship. Targeted interventions for unemployed individuals could therefore improve not only economic outcomes but also reduce health risks associated with labor market shocks. At the same time, periods of economic expansion and low unemployment also require careful monitoring, as they are associated with higher risks of traffic accidents and stress-related conditions. Policies aimed at promoting road safety and mitigating work-related stress could thus play a crucial role in reducing preventable mortality during economic upturns.

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A Appendix

Figure 4: Mortality Rate and Unemployment Rate

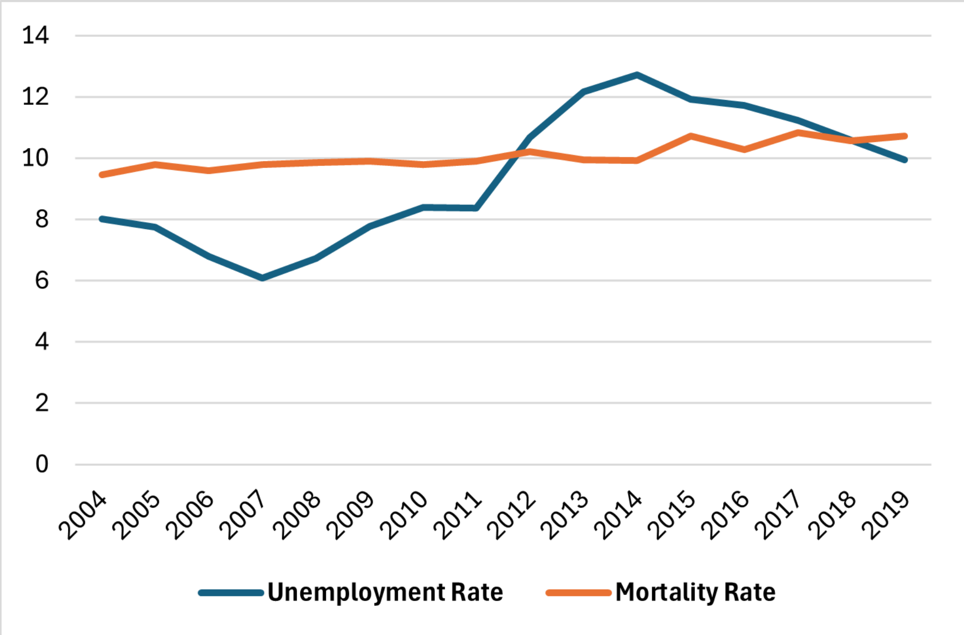

Table 7: Yearly Data on Unemployment Rate, Total Causes (deaths), Population, and Mortality Rate

Year	Unemployment Rate	Deaths	Population	Mortality Rate
2004	8.015	541,908	55,907,407	9.693
2005	7.745	565,149	56,328,280	10.033
2006	6.790	551,597	56,564,801	9.752
2007	6.087	565,638	56,778,738	9.962
2008	6.737	574,313	57,257,169	10.030
2009	7.764	581,159	57,663,165	10.079
2010	8.381	565,654	57,925,411	9.765
2011	8.377	574,990	58,174,169	9.884
2012	10.678	593,664	58,323,892	10.179
2013	12.175	579,937	58,489,728	9.915
2014	12.717	579,004	58,557,238	9.888
2015	11.929	624,875	58,507,343	10.680
2016	11.725	597,577	58,379,655	10.236
2017	11.242	629,469	58,285,332	10.800
2018	10.639	612,186	58,159,212	10.526
2019	9.982	620,018	58,042,345	10.682

Table 8: Total and proportions of deaths in total mortality by cause of death - Source: National Institute of Statistics (ISTAT)

Charachteristics	**Total of deaths**	**Percentage (%)**
Gender		
Men	4,657,266	48.54
Women	4,937,313	51.46
Causes		
Transport accidents	73,832	0.77
Suicide	63,225	0.66
Homicide	7,120	0.07
Cancer	2,800,677	29.19
Diabetes	331,475	3.45
Alzheimer	157,917	1.65
Circulatory system diseases	3,596,104	37.48
Digestive	370,826	3.86
Other accidents	242,148	2.52
Respiratory	685,677	7.15
Other diseases	1,265,578	13.19
Age group		
0-24	67,186	0.70
25-44	168,521	1.77
45-64	948,814	9.95
65-74	1,420,677	14.89
75+	6,933,325	72.69
Education level		
Elementary school certificate, no degree	7,050,636	73.92
Middle school certificate	1,571,212	16.47
High school diploma	664,404	6.97
University degree or diploma	252,293	2.64