

Economic shocks, resilience, and male suicides in the Great Recession: cross-national analysis of 20 EU countries

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Background: During the 2007–11 recessions in Europe, suicide increases were concentrated in men. Substantial differences across countries and over time remain unexplained. We investigated whether increases in unaffordable housing, household indebtedness or job loss can account for these population differences, as well as potential mitigating effects of alternative forms of social protection. **Methods:** Multivariate statistical models were used to evaluate changes in suicide rates in 20 EU countries from 1981–2011. Models adjusted for pre-existing time trends and country-fixed effects. Interaction terms were used to evaluate modifying effects. **Results:** Changes in levels of unaffordable housing had no effect on suicide rates ($P=0.32$); in contrast, male suicide increases were significantly associated with each percentage point rise in male unemployment, by 0.94% (95% CI: 0.51–1.36%), and indebtedness, by 0.54% (95% CI: 0.02–1.06%). Spending on active labour market programmes (ALMP) (–0.26%, 95% CI: –0.08 to –0.45%) and high levels of social capital (–0.048%, 95% CI: –0.0096 to –0.087) moderated the unemployment–suicide association. There was no interaction of the volume of anti-depressant prescriptions ($P=0.51$), monetary benefits to unemployed persons ($P=0.77$) or total social protection spending per capita ($P=0.37$). Active labour market programmes and social capital were estimated to have prevented ~540 and ~210 male suicides, respectively, arising from unemployment in the countries studied. **Conclusion:** Job losses were a critical determinant of variations in male suicide risks in Europe's recessions. Greater spending on ALMP and levels of social capital appeared to mitigate suicide risks.

Introduction

The link between economic shocks and suicide is well-documented, and history now appears to be repeating itself in the Great Recession.^{1–3} Nearly all European nations have experienced marked increases in suicide rates. Before the onset of recession in 2007, male suicide rates had been falling. However, this downward trend reversed in 2008, when it rose by 9.5%, remaining elevated through 2011 (Supplementary Table S1).^{4,5} While suicide rates have long been about three to four times higher in males than in females, the increase in the suicide rate in the European Union (EU) during the recessionary period was 6-fold greater in men, further widening the gender gap in suicide risk.^{6,7}

Yet, there is also substantial variation in trends in male suicide rates across Europe. Three main patterns can be observed during the Great Recession, from 2007–11:

- (i) acceleration of pre-existing upward trends have been observed in Poland;
- (ii) no significant change has been observed in Austria;
- (iii) reversal of downward trends has been witnessed in most EU countries, albeit to varying degrees. Male suicides rose by >15% in Greece, Ireland and Latvia, whereas in Bulgaria, France, Germany and Hungary, the rate of increase was <3%.^{7,8}

Why are some countries but not others experiencing rises in male suicides? These fluctuations could be artefactual, due to small numbers, few time points or classification biases.^{6,9} However,

statistical testing has found strong evidence that the observed increases are significant departures from past trends.^{7,8} In all, >30 years of data are now available for some countries showing consistent deviations from pre-existing trends.¹⁰ Any change in classification should affect both sexes and all ages simultaneously, which cannot account for the concentration of risks in working-age men.

Suicides would be anticipated to increase most where recessions, and associated economic shocks, were more severe. During recessions, such economic shocks include large, short-term rises in unemployment rates, arrears and housing payment difficulties that are likely to pose substantial suicide risks.^{11,12} Supplementary Table S2 describes relevant previous research; briefly, each is an established independent risk factor for clinical depression,¹³ even after correcting for a previous history of mental illness.^{14,15} One longitudinal record-linkage study in England between 1983 and 1992 found that suicide was 2.6 times more common among the unemployed than the employed.¹⁶ Similar findings were observed in Denmark.¹⁷ British men who became indebted during the early- and mid-1990s were 1.61 times more likely to experience a common mental illness, and potentially higher suicide risks, than those who remained debt free,¹⁵ with findings replicated in different time periods.¹¹ Unaffordable housing also increased risks of poor mental health, particularly among male heads of households, in the UK.^{18,19} In Spain, eviction was associated with a 3-fold increase in the likelihood of presenting with symptoms of major depression.²⁰

Uniquely, the economic crisis had its origins in the housing sector, accompanied by large increases in indebtedness and housing payment problems. Across Europe between 2007 and

2009, the male unemployment rate rose by 9.5 percentage points, self-reported household debt (including mortgage, rent, utility bills and purchases on credit) rose by 20%²¹ and the prevalence of unaffordable housing (people who report housing costs as a 'heavy financial burden') increased by 3.5 percentage points, albeit with increases varying considerably among nations. While previous studies have evaluated the links of unemployment and suicide extensively, to our knowledge no study has looked at the consequences of household debt and unaffordable housing across EU countries and over time.

Additionally, it is unclear how best to mitigate the suicide risks of debt, housing payment problems and job loss, although our previous work has found evidence suggesting that ALMP can mitigate job loss-related risks. Alternative modifying factors have been proposed, including: (i) improved treatment of depression, as a large proportion of suicides occur among persons with a history of depression,²² (ii) cash benefits to replace lost incomes and (iii) high levels of social capital, as previous studies have found that friendship networks, trust and social support can mitigate mental health risks during periods of rapid socioeconomic change.^{1,23}

In this study, we test the impact of unaffordable housing, debt and male unemployment on male suicide risk at the population level across a large set of European nations during the Great Recession. We further investigate whether a series of leading protective factors, antidepressant prescriptions, ALMP, cash benefits to the unemployed, total social protection spending and social capital, as indexed by a measure of social trust, can attenuate the suicide risks of economic change.

Methods

Data sources

Age-standardized male suicide rates covering the years 1981–2011 were obtained for (i) all ages, (ii) those aged 25 to 64 years and (iii) those aged ≥ 65 years. These data were taken from the World Health Organization Human Mortality Database, 2013 edition. Twenty-four EU countries were included in the study. Malta, Luxembourg and Cyprus were excluded because of missing data and small populations. Suicide rates are based on the International Classification of Diseases, 10th revision (ICD-10) classification codes X60–84 and ICD-9 classification E950–959, which include intentional injuries via poisoning, hanging, drowning, firearms and explosives, jumping from a height or other methods.¹⁰ Over the study period, countries changed at various years from ICD-9 to ICD-10 to code deaths. Studies comparing categorization procedures for ICD-9 and ICD-10, so-called 'bridging studies', have found a virtually complete match in suicide numbers (comparability ratio 0.996).²⁴

To measure economic shocks, we examined short-term rises in unemployment, indebtedness and unaffordable housing (Supplementary Table S3). We used age-specific male unemployment data (male unemployed as a percentage of the male workforce) from the OECD's labour force statistics database (2013 edition), based on national labour market surveys.²⁵ Age-specific (25–64 years) male unemployment rates were available only for 20 countries. Self-reported prevalence rates of unaffordable housing ('heavy financial burden due to housing costs') and the rate of indebtedness ('arrear on housing or other bills') are from EuroStat (2013 edition). Measures of unaffordable housing and indebtedness were available only between 2002 and 2011, and, to achieve comparability, we restricted our measure of unemployment in the first instance to these years. Measures of male unemployment are age specific (all, 25–64 and 65+ years), whereas measures of unaffordable housing and indebtedness were not age or sex specific.

Statistical models

First, we separately (and then jointly) quantified associations between each economic shock (indebtedness, unaffordable housing and male unemployment) and changes in age-standardized male suicide rates for each age category (all, 25–64 and 65+ years). We then investigated potential effect modifiers, yielding the following equation:

$$\Delta \text{Suicide}_{ijt} = \beta_0 + \beta_1 \Delta \text{ECON}_{ijt} + \beta_2 \Delta \text{MOD}_{it} + \beta_3 \Delta \text{ECON} \times \text{MOD}_{ijt} + \text{year}_{ij} + \text{country}_i \times \text{year} + \varepsilon_{ijt} \quad (1)$$

Here i is country, j is age category (25–64 years, 65+ years and total) and t is the year. *Suicide* is the annual percentage change in the suicide rate (Δ denotes yearly change), *ECON* is a vector of indicators measuring the percentage point change in each economic shock (i.e. unemployment, indebtedness and unaffordable housing) and estimated in three separate models. *MOD* are the modifying effects of protective factors preventing depression and suicide or promoting resilience, including the current volume of antidepressant prescriptions in defined daily dosage per 1000 populations, the level of government expenditure per unemployed person on income replacement, investment in ALMP and total social protection spending from the OECD Social Expenditure Database. Social capital is measured by the proportion of the population who report high levels of trust in others ('Most people can be trusted or you can't be too careful'), taken from the European Social Survey, collected biannually between 2002 and 2012 (Supplementary Table S3). All models include year and country-specific time trends.

The coefficient of interest in these models is the interaction term that captures the protective effect of these modifying factors. Coefficients were transformed as semi-elasticities, which describe percentage change in suicide rates associated with a percentage point change with economic exposures, to facilitate interpretation. We use first-differenced data to reduce the risk of bias because potentially omitted variables are more likely to correlate with trends in the dependent variable than with annualized changes.²⁶ As a robustness check, we used dynamic fixed-effects regression to disaggregate long-term trends from impacts of short-term economic shocks.²⁷ Further, we compare the effect of GDP, as a 'leading indicator' of the recession, on male suicides with the 'lagging' economic shock variables examined here. Finally, because implementing national suicide prevention programmes reduces overall suicide rates, we test whether the introduction of these programmes alters our findings.²⁸ All models were estimated using STATA version 12.

Results

Association of economic shocks with suicide incidence

Figure 1 shows the results of the cross-national models for each economic shock. Each percentage point rise in the male unemployment rate is associated with a 0.94% rise (95% CI: 0.51 to 1.36; $P < 0.001$) in male suicide rates. Additionally, we found that a one percentage point increase in the rate of indebtedness was associated with a 0.54% rise (95% CI: 0.02 to 1.06; $P = 0.043$) in male suicide rates. Including all three measures, transformed to standardized values as z-scores, within a composite model leaves only the association with unemployment statistically significant at $\alpha = 0.05$ (Supplementary Table S4) even though rising debt has a stronger association with changes in the male suicide rate. These economic shocks are jointly significant at the $\alpha = 0.05$ level ($F(3, 19) = 21.56$, $P < 0.001$).

Investigating age differences, we found that unemployment-suicide associations were primarily concentrated in working-age men. Each percentage point rise in unemployment among those aged 25–64 years was associated with a 1.39% rise (95% CI: 0.53 to 2.24). Neither increases in male unemployment among those aged 65 years or older ($P = 0.95$), as expected, nor the rate of indebtedness for those aged ≥ 16 years ($P = 0.67$) was significantly associated

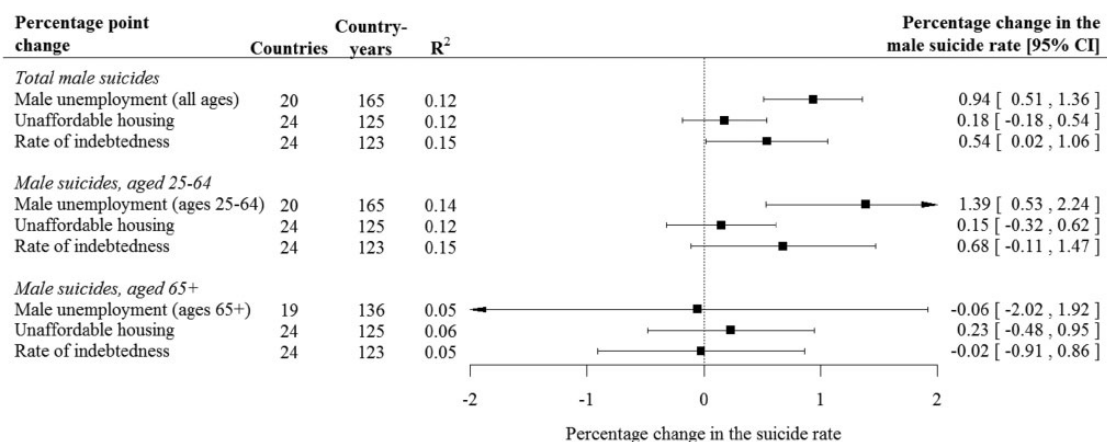


Figure 1 Unadjusted association of economic shocks and the male suicide rate across 24 EU countries, 2002–11. Notes: Luxembourg, Malta, and Cyprus are excluded. Source: WHO Health for All European Mortality database 2013 edition; OECD 2013 edition. Male unemployment, unaffordable housing, and rate of indebtedness all measure a 1% point increase. All models correct for year and country-specific time trends. Confidence intervals are based on standard errors corrected for repeated observations.

Table 1 Effect modifiers of the male unemployment–suicide association, all ages, 1981–2011

| Modifiers | Percentage change in the male suicide rate Effect size (95% CI) | P-value |
|--|--|---------|
| 1 unit increase in the defined daily dosage prescribed to each inhabitant per day (per 1000) | −0.013% (−0.50 to 0.017) | 0.372 |
| \$10 increase per person unemployed on income replacement for the unemployed | −0.00029% (−0.0023 to 0.0018) | 0.772 |
| \$10 per capita increase in ALMP | −0.026%** (−0.045 to −0.0076) | 0.008 |
| \$10 increase per person in social protection spending | −0.00083% (−0.0034 to 0.0018) | 0.51 |
| Percentage point increase in proportion of population with high social trust | −0.048%* (−0.0096 to −0.087) | 0.017 |

Notes: Confidence intervals are based on robust standard errors clustered by country. All models control for year and country-specific time trends. Effect sizes are based on modeling the interaction between changes in unemployment and the level of one of the following moderators: government spending on active labour market programmes, and the defined daily dosage of antidepressants. $\beta_1 \times \text{Unemployment} + \beta_2 \text{Unemployment} \times \text{Moderator} + \beta_3 \times \text{Moderator}$. ALMP: countries=20, country-years=394; Income replacement: countries=20, country-years=199; Antidepressants: countries=16, country-years=203; Social protection: countries=20, country-years=303. Social trust: countries=20, country-years=428. A one-unit increase in the defined daily dosage per 1000 is the equivalent of an additional person being prescribed antidepressants for every 1000 members of the population.

* $P < 0.05$; ** $P < 0.01$.

with the male suicide rate in both the 25–64 and 65+ age groups. Rising working-age unemployment (25–64 years of age) was also not associated with the suicide rate among those aged 65+ years ($P = 0.61$).

Role of effect modifiers

We tested four potential modifiers of the unemployment–suicide association, including one element of secondary suicide prevention, antidepressant prescription (table 1). Per capita antidepressant prescriptions ($P = 0.37$), the level of social protection per person ($P = 0.51$) and the level of income replacement per unemployed person (i.e. unemployment benefit) ($P = 0.77$) had no modifying effect on the unemployment–suicide association. Alternatively, we found that each US \$10 increase in government spending on ALMP reduced the effect of a percentage point rise in male unemployment on the male suicide rate by -0.026% (95% CI: -0.0076 to -0.045). Additionally, a percentage point rise in the proportion of people with high social capital, measured by trust in others, reduced the association of male unemployment with male suicide by 0.048% (95% CI: -0.0096 to -0.087).

Although suicide is a rare event, the number of excess deaths attributable to unemployment is substantial. Table 2 reports the difference between the observed number of suicide deaths and the expected number of suicides based on a pre-recession country-specific linear time trend (1995–2007). Between 2007 and 2009, there have been 6998 excess suicides. Of these, 1077 (15%) were attributable to the rise in unemployment. After adjusting for their modifying effect, we estimate that ALMP have prevented an

additional ~ 540 (50%) male suicides associated with job loss (rounded to the nearest 10). We also found that high levels of social capital in a population prevented an additional ~ 210 (19%) male suicides linked with job loss (rounded to the nearest 10) (Supplementary Table S5).

Robustness checks

We conducted a series of checks to the model specification and outliers. First, we included per capita GDP adjusted for inflation and purchasing-power parity in our models, finding the main coefficients remain strong, although somewhat attenuated (Supplementary Table S6). The unemployment–suicide association may be greater in countries with lower wealth. To test this, we included an interaction term between unemployment and GDP, but our results did not qualitatively change (Supplementary Table S7). Consistent with previous studies, non-linearity between unemployment and male suicide did not influence our results.¹ We examined whether our results were influenced by missing suicide data in Belgium (from 2006 onwards) and found no significant differences in any of our models at the $\alpha = 0.05$ level using a Hausman specification test. Additionally, all variance inflation factors from our joint model of economic shocks were < 2 , and the mean value was 1.6. Excluding outliers from our model (cases with standardized residuals > 2) also did not change our results (see Supplementary Table S8). To include Latvia, Lithuania and Romania in the sample, we re-estimated our models using EuroStat data on unemployment (only available for ages 25–75 years) (Supplementary Tables S9 and S10). None of our results

Table 2 Observed and expected number of male suicide deaths between in 2008 and 2009 and the number of male suicides attributable to the rise in male unemployment and the impact of ALMP across 24 countries

| Country | 2008 | | | | | | | | | | 2009 | | | | | | | | | |
|-----------------|------|------|----------------|----------------------|--------------|--------------------------|-----------------------------------|----------------------------|------|------|----------------|----------------------|--------------|--------------------------|-----------------------------------|----------------------------|--|--|--|--|
| | Exp | Obs | Diff (Obs-Exp) | Rise in job loss (%) | ALMP (USD\$) | Suicides due to job loss | Suicides due to job loss and ALMP | Suicides prevented by ALMP | Exp | Obs | Diff (Obs-Exp) | Rise in job loss (%) | ALMP (USD\$) | Suicides due to job loss | Suicides due to job loss and ALMP | Suicides prevented by ALMP | | | | |
| Austria | 964 | 962 | -2 | -0.3 | 253 | 0 | 0 | - | 924 | 968 | 44 | 1.4 | 306 | 16 (10 to 22) | 5 (-1 to 10) | 11 | | | | |
| Belgium | - | - | - | -0.2 | 441 | - | - | - | - | - | - | 1.3 | 473 | - | - | - | | | | |
| Bulgaria | 613 | 694 | 81 | -1 | - | - | - | - | 578 | 662 | 84 | 1.4 | - | - | - | - | | | | |
| Czech Republic | 1142 | 1123 | -19 | -0.7 | 56 | 0 | 0 | - | 1125 | 1230 | 105 | 2.4 | 66 | 32 (20 to 43) | 27 (17 to 37) | 5 | | | | |
| Denmark | - | - | - | -0.2 | 488 | - | - | - | - | - | - | 3.4 | 564 | - | - | - | | | | |
| Estonia | 186 | 189 | 3 | 0.3 | 12 | 1 (1 to 1) | 1 (0 to 1) | - | 161 | 220 | 59 | 11.2 | 37 | 27 (17 to 37) | 25 (16-33) | 2 | | | | |
| Finland | 715 | 800 | 85 | -0.4 | 291 | 0 | 0 | - | 683 | 760 | 77 | 2.8 | 301 | 26 (17 to 36) | 8 (-1 to 17) | 18 | | | | |
| France | 7326 | 7615 | 289 | -0.5 | 268 | 0 | 0 | - | 7207 | 7759 | 552 | 2 | 307 | 173 (109 to 236) | 51 (-9 to 111) | 121 | | | | |
| Germany | 6797 | 7039 | 242 | -1.2 | 290 | 0 | 0 | - | 6556 | 7199 | 643 | 0.7 | 345 | 55 (35 to 75) | 12 (-10 to 33) | 44 | | | | |
| Greece | 275 | 308 | 33 | -0.1 | 38 | 0 | 0 | - | 271 | 333 | 62 | 1.8 | 56 | 6 (4 to 8) | 5 (3 to 7) | 1 | | | | |
| Hungary | 1823 | 1910 | 87 | 0.5 | 49 | 11 (7 to 15) | 10 (6 to 14) | 1 | 1757 | 1902 | 145 | 2.7 | 77 | 57 (36 to 78) | 47 (30 to 64) | 10 | | | | |
| Ireland | 355 | 386 | 31 | 2.6 | 300 | 8 (5 to 10) | 2 (0 to 5) | 5 | 347 | 422 | 75 | 7.4 | 353 | 36 (23 to 49) | 7 (-7 to 21) | 29 | | | | |
| Italy | 2825 | 2997 | 172 | 0.6 | 142 | 20 (13 to 28) | 14 (8 to 19) | 7 | 2733 | 3091 | 358 | 1.3 | 131 | 42 (27 to 57) | 29 (19 to 41) | 13 | | | | |
| Latvia | 327 | 427 | 100 | 1.7 | - | - | - | - | 291 | 416 | 125 | 13.1 | - | - | - | - | | | | |
| Lithuania | 815 | 918 | 103 | 1.8 | - | - | - | - | 770 | 952 | 182 | 11.6 | - | - | - | - | | | | |
| Netherlands | 939 | 988 | 49 | -0.3 | 430 | 0 | 0 | - | 931 | 1064 | 133 | 0.9 | 468 | 10 (6 to 13) | -1 (-6 to 4) | 10 | | | | |
| Poland | 4486 | 4869 | 383 | -2.6 | 92 | 0 | 0 | - | 4477 | 5530 | 1053 | 1.4 | 104 | 69 (44 to 94) | 53 (33 to 72) | 16 | | | | |
| Portugal | 782 | 794 | 12 | -0.1 | 129 | 0 | 0 | - | 814 | 803 | -11 | 2.8 | 177 | 20 (13 to 28) | 12 (7 to 18) | 8 | | | | |
| Romania | 1976 | 2026 | 50 | -0.5 | - | - | - | - | 1956 | 2197 | 241 | 1 | - | - | - | - | | | | |
| Slovak Republic | - | - | - | -1.6 | 51 | - | - | - | - | - | - | 3.1 | 43 | - | - | - | | | | |
| Slovenia | 325 | 324 | -1 | 0 | 56 | 0 | 0 | - | 310 | 350 | 40 | 1.9 | 97 | 7 (5 to -10) | 6 (6 to 8) | 2 | | | | |
| Spain | 2425 | 2676 | 251 | 3.7 | 244 | 105 (67 to 143) | 46 (13 to 80) | 59 | 2379 | 2666 | 287 | 7.6 | 251 | 218 (138 to 298) | 93 (27 to 159) | 125 | | | | |
| Sweden | 802 | 855 | 53 | 0 | 357 | 0 | 0 (0 to 0) | - | 789 | 887 | 98 | 2.7 | 380 | 26 (17 to 36) | 3 (-8 to 15) | 23 | | | | |
| United Kingdom | 3006 | 3300 | 294 | 0.5 | 88 | 6 (4 to 8) | 6 (3 to 7) | 1 | 2963 | 3313 | 350 | 3.0 | 104 | 106 (67 to 145) | 81 (51 to 111) | 25 | | | | |

Source: WHO Health for All European Mortality database 2013 edition; OECD 2013 edition, EuroStat 2013 edition.

Luxembourg, Malta, and Cyprus are excluded. Missing data for these specific years: Belgium, Bulgaria, Czech Republic, Latvia, Lithuania, and Slovak Republic 2008; deals with 2007-08 change; 2009; deals with 2008-09 change. Expected number of suicide deaths is based on the country-specific linear trend between 1995-2007: $\beta_1 \times \text{Year}$. Here we use a start date which follows the transition from communism among eastern European countries and also a number of large recessions in Western Europe. Observed number of suicide deaths: actual number of suicide deaths in 2008 and then 2009. Rise in male job loss is the percentage point increase in male unemployment. Using our ALMP modifier model (see table 2 and equation 1: $\beta_1 \times \text{Unemployment} + \beta_2 \text{Unemployment} \times \text{ALMP} + \beta_3 \times \text{Moderator}$) we estimated the linear prediction for each country using only $\beta_1 \times \text{Unemployment}$ ($\beta_1 = 1.15\%$). For example, between 2008 and 2009, unemployment rose by 3.02% points from which we predict a 3.5% rise in the suicide rate. We then calculate the rise using the 2007 suicide rate as our baseline. Therefore, $\{[9.71 \text{ (SMR for suicide in 2007)/100} \times 3.5] \times (\text{Male Population}/100\,000) = 106$ suicide deaths. This conservative approach may well be an under-estimate of the impact of unemployment on the rise in suicide. ALMP spending is the per capita level of government spending on active labour market programmes adjusted for inflation and purchasing power (USD\$). Male suicides attributable to job loss is the country-specific linear prediction from the model: $\beta_1 \times \text{Unemployment} + \beta_2 \text{Unemployment} \times \text{ALMP} + \beta_3 \times \text{Moderator}$. Models also correct for both year and country-specific time-trends. If change in unemployment is negative we do not anticipate a rise in suicide due to unemployment, and therefore we report that zero in these cases.

were affected by including these additional countries. We also estimated the association between the male suicide rate for those aged 25–75 years and the change in the unemployment rate for the same age category using EuroStat data (Supplementary Table S11). The results were slightly attenuated, partly reflecting a lower risk in persons over age 65 years, as expected. We also re-estimated our models weighting by the number of deaths, finding that both the ALMP and the social trust interaction do no qualitative change. Examining the change in, rather than level of, antidepressant prescription rates also did not alter our findings (Supplementary Table S12). Results from dynamic fixed-effects regression, which model both the long-term trend and the impact of a short-term shock on that trend (i.e. a rise in male unemployment) while estimating the impact of ALMP and social trust, were consistent with our previous models (Supplementary Tables S13 and S14). The introduction of national suicide prevention programs also did not alter these modifying effects (Supplementary Table S15).²⁸ We also estimated the joint effect of each economic shock on the male suicide rate (Supplementary Table S16). Finally, suicides may be underreported in some countries with some deaths categorized as being due to ‘unknown causes’. We re-estimated our models combining these two causes of death and found that the direction and magnitude of the coefficients did not qualitatively change even though the sample size is reduced (Supplementary Table S17). Finally, although fewer observations, we found that neither unaffordable housing nor the rate of indebtedness moderated the unemployment–suicide association (Supplementary Table S18).

Discussion

Our findings show that rises in male unemployment have contributed to the recent recession-related increases in suicide rates in Europe, although the association varies across European nations, and is significantly reduced in the presence of greater investment in ALMP and higher levels of social capital. Further, the risks of suicide associated with job loss are concentrated in working-age men, and were not significantly mitigated by higher rates of antidepressant prescription, unemployment cash benefits or the total per capita investment in social protections. Household arrears have also contributed to rising male suicides, although again there is wide variation across Europe.

With ecological data it is not clear whether suicides are rising among those directly experiencing job loss. The employed also experience increased anxiety regarding economic prospects, a possible suicide risk factor, during recessions.^{29,30} Yet, this increased anxiety is frequently short-lived and may be linked with other economic factors, such as stock market volatility, rather than unemployment.³¹ Hence these short-term fluctuations may explain suicidality shortly after a crash but not sustained rises in suicide like those observed in Europe since 2007.

The study has several important limitations. First, we were unable to disaggregate rates of unaffordable housing or the prevalence of indebtedness by gender or age. Wide confidence intervals may reflect an inability to identify specific vulnerable groups exposed to these economic shocks across countries, thereby diluting any observable association. Second, other labour market risk factors for suicide, such as under- or precarious employment, have not been examined here because of inadequate data.³² Third, our measure of treatment, antidepressant use, does not capture the full range of treatments for mental illness, including various psychotherapies. Fourth, in the absence of reliable measures of the prevalence of depression, there may be residual confounding between changes in prescription rates and unemployment. Fifth, aggregate level measures of suicide and economic shocks restrict our ability to draw causal inference at the individual level. Nonetheless, to understand population-level risks, it is necessary to evaluate population-level risk factors; failing to do so creates potential for an individualistic

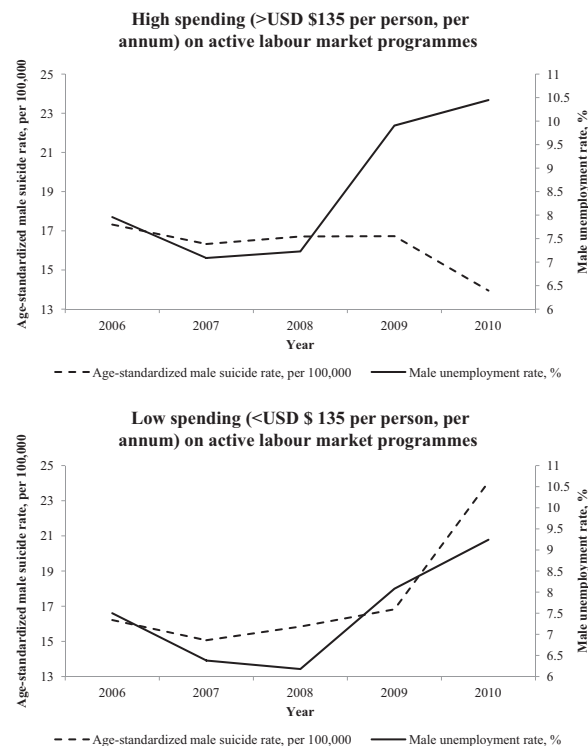


Figure 2 Trends in male suicide and the unemployment rate, by ALMP, 2006–10. Notes: Luxembourg, Malta, and Cyprus are excluded due to small sample size. High/Low is measured as above or below the median level between countries of the within-country means (i.e., US\$135 per person per annum) of spending on active labour market programmes. Source: WHO Health for All European Mortality database 2013 edition; OECD 2013 edition

fallacy.³³ Multilevel data, which nest individual experience within wider economic changes, would have been preferable, yet unfortunately do not exist covering many EU countries over time.

Our findings are consistent with other data.¹ Virtually all EU countries have witnessed rising unemployment, but those nations that have above-mean (US\$135 per capita) investment in ALMP had much smaller rises in suicide rates than those with below-mean levels of investment (figure 2).

Future research is needed to evaluate alternative protective factors, such as religiosity and gender equality, which may prevent suicide and promote resilience, buffering mental health against economic shocks.³⁴ Additionally, our models indicate a residual burden of suicides associated with the events involved in the Great Recession, which are not fully accounted for by the economic indicators investigated in our analysis (e.g. relationship strain or breakdown and increased costs of treatment through co-payments). A significant portion of the initial suicide rise in 2008 cannot be accounted for by the economic indicators used in this study alone. Germany, for example, experienced a significant rise in suicides in 2008, but unemployment fell. Poland has experienced an acceleration in suicides, pre-dating the recession, potentially reflecting the role of rapid economic change, irrespective of its direction. Further work is needed to better measure and assess the fear of job loss and unstable employment, as well as underemployment, associated with economic volatility preceding the rises in unemployment.^{31,35} Indicators of economic shocks other than GDP, such as insolvency, housing foreclosures or the stock market, might be better predictors, pointing to the need for further research.^{36,37}

Notwithstanding potential ecological fallacies, our research has important implications for policy. First, increases in suicide do not appear to be inevitable during recessions. Greater funding of effective labour market programmes and higher levels of social

capital appear to enhance resilience among vulnerable groups, buffering the impacts of job loss and fear of job loss, and its resulting social consequences, on mental health. Second, there is a pressing need to respond to the suicide risks faced by newly unemployed groups in Europe, particularly, as austerity programmes continue to increase public-sector unemployment in Greece, Ireland, Portugal, Spain and Italy.³⁸

Supplementary data

Supplementary data are available at *EURPUB* online.

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A.R. & D.S. conceived the study, conducted the analysis and wrote the draft: M.M., S.B., D.G. and S.S.C. helped revise the draft and oversaw the analysis.

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Conflicts of interest: None declared.

Key points

- Suicide increases in Europe during the great recession have been concentrated in men, but large variations exist across nations and over time.
- Unaffordable housing was not significantly associated with suicides; in contrast, additional job losses and household indebtedness were stronger determinants of population suicide rises.
- Economic risk factors significantly increase suicide rates among men of working age but not among those >65 years of age.
- Where active labour market programmes (ALMP) and social capital were relatively high, there was no elevated risk of suicide during the recent recession.

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