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The Great Recession, unemployment and suicide

Thor Norström, Hans Grönqvist

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Swedish Institute for Social Research, Stockholm University, Stockholm, Sweden

Correspondence to
Professor Thor Norström, Swedish Institute for Social Research, Stockholm University, Stockholm S-106 91, Sweden; totto@sofi.su.se

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ABSTRACT

Background How have suicide rates responded to the marked increase in unemployment spurred by the Great Recession? Our paper puts this issue into a wider perspective by assessing (1) whether the unemployment-suicide link is modified by the degree of unemployment protection, and (2) whether the effect on suicide of the present crisis differs from the effects of previous economic downturns.

Methods We analysed the unemployment-suicide link using time-series data for 30 countries spanning the period 1960–2012. Separate fixed-effects models were estimated for each of five welfare state regimes with different levels of unemployment protection (Eastern, Southern, Anglo-Saxon, Bismarckian and Scandinavian). We included an interaction term to capture the possible excess effect of unemployment during the Great Recession.

Results The largest unemployment increases occurred in the welfare state regimes with the least generous unemployment protection. The unemployment effect on male suicides was statistically significant in all welfare regimes, except the Scandinavian one. The effect on female suicides was significant only in the eastern European country group. There was a significant gradient in the effects, being stronger the less generous the unemployment protection. The interaction term capturing the possible excess effect of unemployment during the financial crisis was not significant.

Conclusions Our findings suggest that the more generous the unemployment protection the weaker the detrimental impact on suicide of the increasing unemployment during the Great Recession.

INTRODUCTION

Unemployment is a well-established risk factor of suicide, as indicated by studies at micro, as well as macro level.[1] An urgent research question is thus to assess how suicide rates have responded to the marked increase in unemployment spurred by the Great Recession, considered to be the deepest global economic downturn since World War II. Marked suicide increases that seem to be linked to increasing unemployment have been reported for a large number of countries.[2–5] However, the fragmentary character of these findings hampers any more general conclusions. To put the current crisis into a wider perspective, it seems feasible to consider a time period that is long enough to include previous economic downturns. Further, it can be expected that the impact of unemployment on population mental health is modified by the degree of unemployment protection offered by the social welfare system. The aim of the present paper is thus to address the topic at issue in a more encompassing manner by analysing time-series data spanning the period 1960–2012 for 30 countries which represent a wide spectrum of welfare regimes.

UNEMPLOYMENT AND SUICIDE

Job loss has several tangible and negative consequences that may adversely affect mental health. For instance, to lose one's job means that steady routines structuring everyday life dissipate, that social workplace relations vanish, and that the private economy becomes strained. It is therefore not surprising that unemployment is a well-established risk factor of suicide. Several prospective studies have thus documented an increased risk of suicide among those who become unemployed.[6 7] The reported relative risk is typically in the range 2–3[8–10] However, these estimates are probably inflated as unemployed people are likely to be selected on factors conducive to suicide; for example, depression increases the risk of both suicide and to become unemployed.[11–13] An alternative strategy that should alleviate this problem is to analyse time-series data on the population level, that is, to look at how changes in the unemployment rate affect the suicide rate. Depression may increase the risk of unemployment at the individual level, but is less likely to do so at the aggregate level. It is worthy to note that analyses at the population level capture also the possible detrimental impact of unemployment on those who remain in employment, but fear losing their jobs (see[1] and[14] for more detailed discussions of differences between using micro and macro data in this context). Several aggregate level time-series studies report a significant relation between unemployment and suicide. The early studies in this tradition mostly rely on trend analyses (for reviews, see Platt[6] and Stack[7]) which compromises the validity of the findings. However, positive findings are also reported by researchers applying fixed-effects modelling of time-series data pertaining to a set of European countries,[15] and to the US states.[16 17]

IS THE EFFECT OF UNEMPLOYMENT ON SUICIDE UNIFORM ACROSS TIME AND SPACE?

Welfare state regimes

In her review of the literature, Bartley[18] identifies poverty and financial anxiety as especially important mechanisms linking unemployment to increased suicide risk (similar conclusions are drawn by Hamermesh and Soss[19]). This suggests a potentially modifying effect of a generous welfare system that can provide a safety net in precarious situations and mitigate the adverse effect of a job loss. The hypothesis that the health effect of economic downturns is contingent on the generosity of the social welfare system receives support from the few

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studies that have addressed this topic. Thus Stuckler *et al*,[15] on the basis of time-series data for 26 European Union (EU) countries between 1970 and 2007, found that the unemployment effect on suicide was lower in countries with high labour market security, proxied by government spending on labour market programmes. Similar findings are reported on the basis of US state data.[20] Further, in their analyses of time-series data for 23 Organisation for Economic Co-operation and Development (OECD) countries for the period 1960–1997, Gerdtham and Ruhm[21] found a modifying impact of social insurance spending on the association between unemployment and total mortality. However, the approach of using data on government expenditure on welfare provisions has some well-known limitations; social spending is in itself heavily influenced by structural changes reflecting business cycles, demographic trends or labour market transformation.[22] We will instead rely on an alternative approach that classifies welfare states on the basis of the content and nature of social citizenship rights, as indicated by legislated social insurance replacement rates. More specifically, we will apply a scheme that has been developed within comparative population health research,[23–25] and that has been used in comparative analyses of the association between unemployment and health.[23] In this scheme the countries are classified into five welfare state regimes, ranked from low (1) to high (5) levels of social and financial protection during unemployment: (1) Eastern European countries; (2) Southern European countries; (3) Anglo-Saxon countries; (4) Bismarckian; and (5) Scandinavian countries (see table 1). The ranking is based on the generosity of the unemployment protection system as indicated by four indicators: 'the generosity of benefits paid to the unemployed (replacement rates), the qualifying period and conditions, duration of benefit payments and the waiting period before entitlement is activated'.[23] The highest replacement rates (the most important indicator)[26] are thus found in the Scandinavian and Bismarckian countries, the lowest in the eastern and southern European countries, with the Anglo-Saxon countries in between (table 1).

Is the Great Recession worse than previous economic downturns?

An interesting research question is whether or not the effect on mental health of the present crisis differs from the effects of previous economic downturns. One hypothesis is that losing one's job would be particularly harmful when the national economy is seriously weakened. First, the poor prospects of finding a new job should bolster the feelings of hopelessness. Second, the austerities that have been implemented in several countries due to the recession have limited the access to social services and medical treatment.[27] As an alternative hypothesis it can be argued that a job loss be felt as less stigmatising when this situation is shared by many others in society.

DATA AND METHODS

The study comprises 30 countries, and the longest observation period is 1960–2012, though it is appreciably shorter for some countries (see table 1). Data on unemployment (% unemployed in the work force) were sourced from Eurostat. Age-specific mortality data for females and males were obtained from the WHO Mortality Data Base (Geneva). Gender specific age-standardised mortality rates (number of deaths per 100 000 population) were constructed (following WHO World Standard[28]) for the age-groups 20–64 years, and 65 years and above. Previous studies suggest that male suicide rates respond stronger than female suicide rates to economic downturns, which has been interpreted as a consequence of men's stronger work commitment and responsibility to be the main breadwinner.[7] However, some studies report social contagion effects from the job loser, particularly affecting the mental health of the spouse.[29 30] We expect any impact of unemployment on suicide to be confined to the age-group of the working population (20–64 years). We used the age-group 65 years and above as a placebo outcome where no or a minuscule effect is expected.

The association between unemployment and suicide was assessed by applying two different methodological techniques. The rationale for this is that triangulating findings from different methods should reduce the risk of obtaining method-bound results. The first method was fixed-effects modelling. To test the hypothesis that the unemployment effect may differ across welfare state regimes, the countries were sorted into five country groups ranging from low to high levels of unemployment protection, as described above and detailed in table 1. The other approach was to obtain country-specific estimates of the association at issue by means of time-series analyses of data for the individual countries; these estimates were then pooled into the five welfare state regimes. A brief description of the two methods follows below.

The first method involves analyses of pooled cross-sectional time-series data. When such data are used for estimating the relationship between two variables, there are two obvious sources of bias that may distort the outcome. One is the possible presence of unobserved country differences that are linked to the dependent as well as the independent variables. The other threat to validity of results is the possibility that X and Y variables have converging (or diverging) time trends that do not reflect a causal relationship, but rather the impact of other factors. We thus chose to analyse the differenced data because the differencing not only eliminated all trends in our data, but also means that only the intracountry covariation over time is explored (fixed-effects models), thus eliminating the first-mentioned source of bias as well. Further, the more conservative panel corrected SEs were used.[31] Finally, the models included panel-specific estimation of residual autocorrelation.

The time-series analysis was performed by applying the technique developed by Box and Jenkins,[32] often referred to as ARIMA-modelling (autoregressive integrated moving average). As noted above, a simple differencing was sufficient to remove trends to achieve the stationarity required for ARIMA-modelling. Further, the noise (error) term, which includes explanatory variables not considered in the model, is allowed to have a temporal structure that was modelled and estimated in terms of autoregressive and/or moving average parameters. All estimated ARIMA-models were satisfactory with respect to residual structure (which should not differ from white noise) according to the Box–Ljung Q statistics.[31] The country-specific estimates of the unemployment effect were pooled within each of the five country groups (see Norström and Skog[33] for a more detailed description of this approach.)

We included an interaction term to capture the possible excess effect of unemployment during the years of the financial crisis. The interaction term was constructed as follows:

$$\text{Uncrisis}_{it} = \text{LnUnemployment}_{it} \times \text{Crisis}_{it} \quad (1)$$

where Unemployment is the unemployment rate (%) and *Crisis* is a country specific variable that takes the value 0 in years with no recession, 0.25 in years with a 1-quarter recession, and so

Table 1 Descriptive statistics (period averages) for unemployment replacement rate, unemployment, male suicide rate per 100 000 (20–64 years), and female suicide rate per 100 000 (20–64 years)

	Observation period	Unemployment replacement rate* (%)	Unemployment (%)	Suicide rate per 100 000 (20–64 years)†	
				Females	Males
Eastern European countries					
Bulgaria	1990–2012		11.61	6.42	19.26
Croatia	1991–2012		12.93	9.31	32.73
Czech Republic	1993–2012		6.46	9.54	35.11
Estonia	1990–2012		8.86	11.00	61.80
Hungary	1992–2012		8.53	17.70	60.59
Latvia	1992–2012		11.68	11.31	64.02
Lithuania	1994–2010		12.91	14.08	88.94
Poland	1992–2011		13.36	5.25	31.14
Romania	1990–2011		7.45	4.62	25.60
Slovakia	1994–2010		14.49	4.06	27.78
Slovenia	1996–2010		6.61	12.62	51.61
Period average		56.10	10.45	9.92	44.64
Southern European countries					
Greece	1983–2010		9.83	1.95	6.01
Italy	1960–2010		8.31	3.76	10.35
Portugal	1974–2011		6.62	4.23	14.92
Spain	1972–2011		14.30	3.11	10.21
Period average		55.11	9.69	3.27	10.39
Anglo-Saxon countries					
Australia	1960–2011		5.45	9.01	25.16
Canada	1960–2009		7.53	7.99	25.1
Ireland	1960–2010		9.15	4.76	16.81
UK	1960–2010		5.79	6.17	14.84
USA	1960–2010		6.08	7.49	23.63
Period average		61.32	6.80	7.09	21.11
Bismarckian					
Austria	1960–2011		3.07	12.49	37.92
Belgium	1960–2009		7.40	12.31	29.46
France	1960–2010		6.51	10.67	30.87
Germany	1960–2012		5.30	11.13	28.22
Switzerland	1960–2010		1.64	13.05	34.61
The Netherlands	1960–2011		4.80	8.14	14.50
Period average		71.00	4.78	11.29	29.24
Scandinavian countries					
Denmark	1960–2011		5.38	16.25	32.79
Finland	1960–2011		6.25	13.27	50.89
Norway	1960–2012		2.81	7.86	21.92
Sweden	1960–2010		4.32	12.32	30.27
Period average		72.10	4.69	12.4	33.93

*The fraction of current wages which the social unemployment benefit system provides to a wage earner in the case of unemployment. Average for the period 1992–2009 for Eastern European countries, and 1971–2009 for other country groups.[26]
†Suicide data are missing 1997–1998 for Poland, 2004–2005 for Italy and 2000–2002 for Belgium.

forth, and 1 in years with 4 quarters of recession. The common recession definition was used, that is, that a recession occurred when GDP has contracted at least two consecutive quarters. Data were obtained from Eurostat and OECD. Different International Classification of Diseases (ICD)-classifications have been used during the study period, from ICD-7 to ICD-10. Possible influences of revisions of ICD-classification were captured by dummy variables. Missing mortality data (table 1) were imputed through linear interpolation; dummy variables were created for these years.

One issue concerns the functional form of the relation between unemployment and suicide. Most previous studies have applied a semilog model, that is, with logged output. This assumes an accelerating risk function (convex downwards) which is far from obvious. As noted above, people who become unemployed tend to be selected on suicidogenic characteristics. The selection effect should be especially strong in periods of low unemployment, while the fraction of ordinary people among the unemployed is expected to increase with increasing unemployment rate. This should dampen the suicide response, suggesting a risk function that is concave downwards. This notion is supported by the study by Crawford, Kuforiji and Ghosh[34] which on the basis of 54 published case–control studies found a strong inverse relation between the prevalence

of unemployment on the one hand, and the odds-ratio for suicide among the unemployed, on the other. A study based on data for Ireland[35] reports findings consistent with this pattern. To test this empirically, we used the data for all study countries to estimate a fixed-effects model as described above, including unemployment and unemployment squared as predictors, and suicide (males 20–64 years) as output. The estimate obtained for unemployment was 1.181 (SE=0.214, p<0.001), and for unemployment squared −0.045 (SE=.010, p<0.001), which indicates a risk function that is concave downwards. However, this model specification would make comparisons across country groups awkward, and we thus chose a log–log model that can accommodate the suggested non-linear relationship, and that yields a single effect estimate in the form of an elasticity.

The following fixed-effects model was thus estimated for each of the five country groups (and for all countries together):

$$\nabla \mathrm{LnS}_{it} = e_1 \nabla \mathrm{LnUnemployment}_{it} + e_2 \nabla \mathrm{Uncrisis}_{it} + \beta \nabla \mathrm{X}_{it} + \varepsilon_{it} \quad (2)$$

where S is the suicide rate, Unemployment the unemployment rate (%), Uncrisis the interaction term as defined above, and X a vector of dummy variables capturing ICD-revisions and imputations of missing mortality data. The key parameters to be estimated are the elasticities denoted e_1 and e_2. Corresponding ARIMA-models were estimated for each of the 30 countries. For each of the five country groups we thus obtained two estimates of the unemployment effect on suicide, that is, one from the fixed-effects modelling and another from pooling the country specific ARIMA-estimates into country groups. We used F-tests to assess whether the estimated unemployment effects differed across country groups. We also used F-tests to assess whether the country specific ARIMA-estimates were homogenous within country groups.

We considered the option of controlling for GDP/capita. However, the obvious relation between unemployment and GDP (Okun's law) is best understood as a result of reduced labour input (increased unemployment) leading to decreased output (GDP).[36] Controlling for GDP would thus potentially imply controlling for an intermediary variable, which is not recommended as this induces a bias towards the null.[37] Thus, although controlling for GDP is not our preferred model we will investigate how such a specification affects the unemployment estimate because this gives a hint of how much of a possible unemployment effect on suicide that is mediated by reduced material resources.

All statistical analyses were performed with Stata, V.13 (StataCorp).

RESULTS

Table 1 displays descriptive statistics for the key variables. As shown in figure 1, unemployment increased after 2007 in all country groups except the Bismarckian; the increase was especially marked in the eastern and southern European country groups. (Although there is certainly a considerable heterogeneity within the country groups, unemployment increased in every single country, except Germany, where it decreased somewhat). It can also be seen that in some country groups (especially the Anglo-Saxon and the Scandinavian), unemployment increased at least as much during the 1990-crisis as during the current crisis.

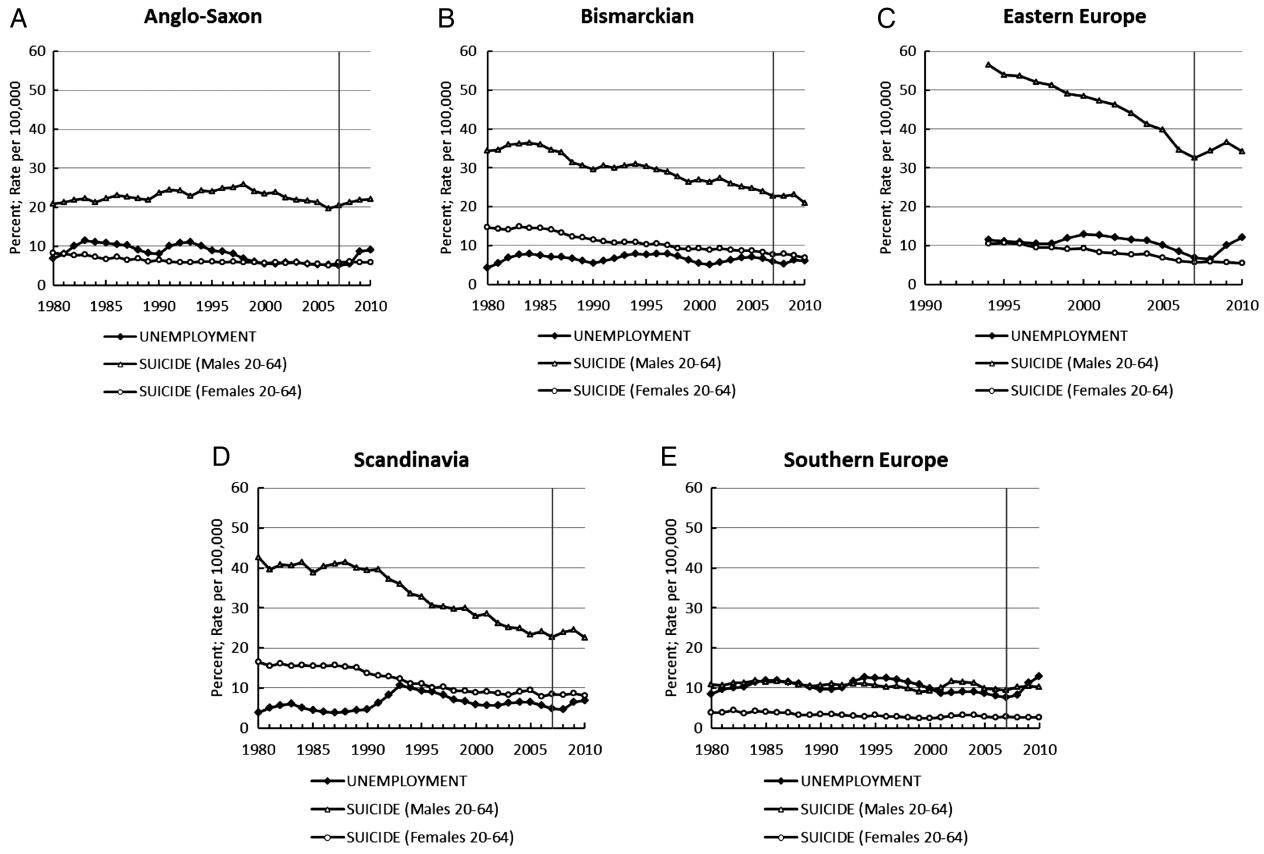

Figure 1 (A–E) Trends in unemployment (%), female suicide rate (20–64 years) and male suicide rate (20–64 years) in five country groups.

Table 2 Estimated effects (elasticities) of unemployment and Uncrisis on male suicide rate (20–64 years)

		Fixed-effects estimates						Pooled ARIMA-estimates							
		Unemployment			Uncrisis			Unemployment				Uncrisis			
Country group	N	Est	SE	p Value	Est	SE	p Value	Est	SE	p Value	F test†	Est	SE	p Value	F test†
1. Eastern European countries	210	0.128	0.028	<0.001	0.068	0.085	0.421	0.149	0.022	<0.001	1.658^{NS}	−0.041	0.062	0.509	0.403^{NS}
2. Southern European countries	153	0.166	0.065	0.010	0.000	0.062	0.997	0.133	0.053	0.013	0.071^{NS}	0.009	0.047	0.842	0.012^{NS}
3. Anglo-Saxon countries	250	0.085	0.034	0.013	−0.012	0.155	0.939	0.065	0.015	<0.001	0.169^{NS}	−0.162	0.105	0.125	0.007^{NS}
4. Bismarckian	303	0.038	0.009	<0.001	0.000	0.045	0.997	0.043	0.009	<0.001	0.957^{NS}	−0.068	0.059	0.250	0.354^{NS}
5. Scandinavian countries	204	0.030	0.020	0.136	−0.173	0.084	0.039	0.023	0.021	0.262	0.234^{NS}	−0.114	0.108	0.294	0.391^{NS}
F test for heterogeneity‡		2.535*			0.904^{NS}			3.808*				0.672^{NS}			
All countries	1120	0.062	0.011	<0.001	0.012	0.038	0.746								

Estimates from fixed-effects models, and pooled estimates from country-specific ARIMA-models.
*p<0.05; NS p≥0.05.
†F test for heterogeneity of estimates within country groups.
‡F test for heterogeneity of estimates between country groups.

The male suicide rate increased markedly in the eastern European country group, but little or not at all in the other country groups. The female suicide rate was generally stable, or decreased. (2011 and 2012 are excluded in figure 1 due to missing suicide data for many countries, see table 1.) Generally, it seems clear that unemployment has a limited explanatory power with respect to trends in suicide. For instance, in three of the country groups (eastern Europe, Bismarckian and Scandinavia) there was a dramatic decline (35–40%) in male suicides during the study period that is obviously due to other factors than unemployment. This, of course, does not preclude that changes in the unemployment rate may impact on suicide, but we should not expect this impact to be very large. This expectation was borne out by the model estimations (table 2); a 1% increase in unemployment was associated with an increase in male suicides by 0.06% (p<0.001). However, this average effect for all countries conceals a great deal of heterogeneity. The estimated effect was thus strongest in the two country groups with the weakest unemployment protection, that is, eastern Europe (elasticity=0.128, p<0.001), and southern Europe (elasticity=0.166, p=0.010). In contrast, the weakest unemployment effect was found in the two groups with the strongest protection, that is, the Bismarckian (elasticity=0.038, p<0.001), and the Scandinavian countries (elasticity=0.030, p=0.136). This apparent gradient (figure 2) in the estimated effects on male suicides was statistically significant as suggested by the F-test that rejects the hypothesis that the five estimates are equal.

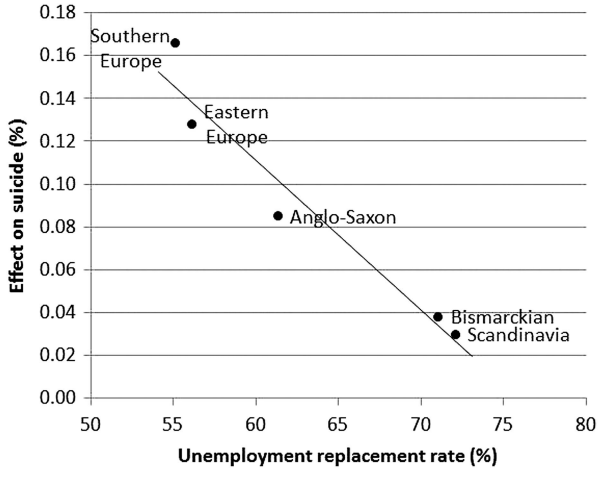

Figure 2 Estimated unemployment effects (FE-models shown in table 2) on suicide (males 20–64) plotted against unemployment replacement rates. See table 1 for definition of unemployment replacement rates and country groups.

The estimates from the fixed-effects models and the pooled ARIMA-estimates were fairly consistent with each other. Further, the F-tests indicate homogeneity of the ARIMA-estimates within each of the country groups. The estimated effect on female suicides (20–64 years) was significant only in the eastern European country group (table 3).

The interaction term (Uncrisis) capturing the possible excess effect of unemployment during the years of the financial crisis was clearly insignificant for all of the country groups. The dummy variables for changes in ICD-classifications were statistically insignificant (estimates not shown). The estimates on the placebo outcomes (female and male suicides 65 years and above) were also statistically insignificant (see online supplementary tables A1 and A2 in Web appendix). Including GDP/capita as control variable resulted in a lowering of the estimate and significance of the unemployment effect in the eastern and southern European country groups, while the estimates in the remaining country groups were unaffected (see online supplementary table A3 in Web appendix). This suggests that the unemployment effect on suicide in these country groups partly was mediated by reduced material resources.

DISCUSSION

As noted in a recent *Lancet* article,[38] remarkably little research has been devoted to the health effects of the economic crisis that bursted in the fall of 2007, and considered to be the deepest recession since the Great Depression. Suicide rates can be seen as a summary proxy for population mental health.[39] From this perspective, it is of interest to analyse how this form of mortality is affected by the current crisis, and more specifically the ensuing surge in unemployment. This is an indicator that lies close to people's experience of economic turmoil, and which has proved to be the one that is most closely related to population health.[40] In this paper we have put this issue into perspective by analysing time-series data that span a long period of time and cover countries representing welfare regimes with quite different degrees of unemployment protection. The data were analysed by two different methods that supplement each other.

Table 3 Estimated effects (elasticities) of unemployment and Uncrisis on female suicide rate (20–64 years)

		Fixed-effects estimates						Pooled ARIMA-estimates							
		Unemployment			Uncrisis			Unemployment				Uncrisis			
Country group	N	Est	SE	p Value	Est	SE	p Value	Est	SE	p Value	F test*	Est	SE	p Value	F test*
1. Eastern European countries	210	0.121	0.048	0.012	0.051	0.162	0.752	0.142	0.037	<0.001	0.338^{NS}	0.172	0.117	0.144	0.083^{NS}
2. Southern European countries	153	0.042	0.101	0.679	−0.109	0.109	0.315	0.024	0.066	0.719	3.940^{NS}	0.030	0.125	0.810	0.191^{NS}
3. Anglo-Saxon countries	250	0.084	0.059	0.151	−0.372	0.242	0.124	0.007	0.029	0.806	0.291^{NS}	−0.290	0.121	0.018	0.002^{NS}
4. Bismarckian	303	0.011	0.014	0.435	−0.055	0.066	0.404	0.023	0.019	0.228	0.888^{NS}	−0.033	0.097	0.734	0.001^{NS}
5. Scandinavian countries	204	0.017	0.030	0.570	−0.185	0.125	0.139	0.012	0.042	0.771	0.203^{NS}	−0.217	0.203	0.286	0.732^{NS}
F test for heterogeneity†		0.640^{NS}			1.079^{NS}			1.843^{NS}				1.847^{NS}			
All countries	1120	0.040	0.016	0.015	−0.097	0.056	0.081								

Estimates from fixed-effects models, and pooled estimates from country-specific ARIMA-models.
NS p≥0.05.
*F test for heterogeneity of estimates within country groups.
†F test for heterogeneity of estimates between country groups.

The division of countries into the five welfare regimes unfolded a great deal of heterogeneity. First, our data show that some country groups are worse struck than others by the current crisis. Second, this uneven distribution of hardship is compounded by the marked gradient in the unemployment effect on suicide. Hence, the less generous the unemployment protection, the sharper the increase in unemployment, and, additionally, the stronger the unemployment effect on suicide. However, not to lose the perspective, it should be pointed out that in most country groups unemployment was at least as high during the crisis of the 1990s, and that the unemployment effect on suicide does not seem to be stronger during the Great Recession than during previous economic downturns during the study period. Our expectation, based on previous research, that the unemployment effect would be confined to males, was by and large borne out by our findings. The one exception from this pattern was the statistically significant effect on the female suicide rate that we obtained for the eastern European country group. However, some studies suggested contagion effects to spouses.[29 30] Such effects may be particularly salient when the unemployment effect to a marked degree is mediated by material deprivation, affecting the whole household, which our analyses controlling for GDP suggested was the case for the eastern European country group.

There are some limitations of the study that deserve to be discussed. A potential concern is the quality of official suicide data. It is widely recognised that suicides are undercounted, and that this bias may vary across countries due to cultural and procedural differences. However, systematic examinations of the accuracy of suicide data at the national level suggest that they are reliable enough to be used in comparative research.[41 42] Further, when the focus is on the temporal dimension, as in the present study, the evidence suggests that the variability in the quality of suicide statistics is less compelling than when the spatial dimension is in focus.[43] The division of countries into the five welfare regimes seems to have been a fruitful approach, as it appeared that there was a substantial variation between, but not within the country groups with respect to the unemployment effect on suicide. However, it is clear that the scheme that we have applied conceals some heterogeneity within country groups, and in addition reflects the level of unemployment protection averaged over a long time period during which some countries have experienced marked changes in their social security systems. Our approach may thus be seen a compromise between two predominant approaches: (1) to analyse a shorter time period for a single country, which tends to yield low statistical power, and (2) to analyse data for all countries jointly, which is likely to conceal a good deal of heterogeneity. Another limitation is that there are no gender specific time-series data on unemployment covering our study period. This lowers the precision of our exposure measure which is likely to yield a downward bias of its estimated effect. Lastly, the risk of omitted variable bias can never be dismissed in the present kind of research. However, it should be noted that although there are numerous factors that affect the suicide rate, only omitted factors that also are synchronised with *changes* in suicide as well as unemployment would bias our outcomes.

To conclude, contextualising the unemployment increase spurred by the Great Recession, our findings suggest that its impact on suicide is not stronger than that of previous economic downturns, and that its impact is strongly modified by the level of unemployment protection.

What is already known on this subject?

The Great Recession is considered to be the deepest economic downturn since World War II, but conspicuously little is known about its impact on population health. Previous research indicates that suicide rates tend to increase in economic downturns, the question is whether the current crisis is extra detrimental, and whether its impact might be buffered by welfare state provisions.

What this study adds?

Our data indicate that unemployment rates increased most in country groups with the least developed unemployment protection (eastern and southern Europe). Our findings suggest that it was also in these country groups that increasing unemployment had the most detrimental impact on suicide. In contrast, the increase in unemployment in Scandinavia, with the highest level of unemployment protection had no noticeable effect on suicides. Our findings also suggest that the current crisis is not more harmful than previous economic downturns in the recent past.

Correction notice This article has been corrected since it was published Online First. The sentence 'It is worthy to note that analyses at the population level capture also the possible detrimental impact of unemployment on those who remain in unemployment...' has been corrected.

Contributors TN and HG conceived the design and drafted the paper. TN conducted the analyses. Both authors approved the final draft.

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REFERENCES

1 Goldman-Mellor SJ, Saxton KB, Catalano RC. Economic contraction and mental health. *Int J Ment Health Nurs* 2010;39:6–31.
2 Barr B, Taylor-Robinson D, Scott-Samuel A, *et al*. Suicides associated with the 2008–10 economic recession in England: time trend analysis. *BMJ* 2012;345:e5142.
3 Reeves A, Stuckler D, McKee M, *et al*. Increase in state suicide rates in the USA during economic recession. *Lancet* 2012;380:1813–14.
4 De Vogli R, Marmot M, Stuckler D. Excess suicides and attempted suicides in Italy attributable to the great recession. *J Epidemiol Community Health* 2013;67:378–9.
5 Reeves A, McKee M, Stuckler D. Economic suicides in the Great Recession in Europe and North America. *Br J Psychiatry* 2014;205:246–7.
6 Platt S. Unemployment and suicidal behaviour: a review of the literature. *Soc Sci Med* 1984;19:93–115.
7 Stack S. Suicide: a 15-year review of the sociological literature part I: cultural and economic factors. *Suicide Life Threat Behav* 2000;30:145–62.
8 Blakely TA, Collings SCD, Atkinson J. Unemployment and suicide. Evidence for a causal association? *J Epidemiol Community Health* 2003;57:594–600.
9 Kposowa AJ. Unemployment and suicide: a cohort analysis of social factors predicting suicide in the US National Longitudinal Mortality Study. *Psychol Med* 2001;31:127–38.
10 Lewis G, Sloggett A. Suicide, deprivation, and unemployment: record linkage study. *BMJ* 1998;317:1283–86.
11 Thielen K, Nygaard E, Andersen I, *et al*. Employment consequences of depressive symptoms and work demands individually and combined. *Eur J Public Health* 2014;24:34–9.
12 Whooley MA, Kiefe CI, Chesney MA, *et al*. Depressive symptoms, unemployment, and loss of income: the CARDIA Study. *Arch Intern Med* 2002;162:2614–20.
13 van Rijn RM, Robroek SJW, Brouwer S, *et al*. Influence of poor health on exit from paid employment: a systematic review. *Occup Environ Med* 2014;71:295–301.
14 Norström T. Deriving relative risks from aggregate data. 1. Theory. *J Epidemiol Community Health* 1988;42:333–35.
15 Stuckler D, Basu S, Suhrcke M, *et al*. The public health effect of economic crises and alternative policy responses in Europe: an empirical analysis. *Lancet* 2009;374:315–23.
16 Mohseni-Cheraghlou A. Labor markets and mental wellbeing: labor market conditions and suicides in the United States (1979–2004). *J Socio-Economics* 2013;45:175–86.
17 Ruhm CJ. Are recessions good for your health? *Q J Econ* 2000;115:617–50.
18 Bartley M. Unemployment and ill health: understanding the relationship. *J Epidemiol Community Health* 1994;48:333–37.
19 Hamermesh DS, Soss NM. An economic theory of suicide. *J Polit Econ* 1974;82:83–98.
20 Cylus J, Glymour MM, Avendano M. Do generous unemployment benefit programs reduce suicide rates? A state fixed-effect analysis covering 1968–2008. *Am J Epidemiol* 2014;180:45–52.
21 Gerdtham U-G, Ruhm CJ. Deaths rise in good economic times: Evidence from the OECD. *Econ Hum Biol* 2006;4:298–316.
22 Korpi W. Power, politics, and state autonomy in the development of social citizenship: social rights during sickness in eighteen OECD Countries since 1930. *Am Sociol Rev* 1989;54:309–28.
23 Bambra C, Eikemo TA. Welfare state regimes, unemployment and health: a comparative study of the relationship between unemployment and self-reported health in 23 European countries. *J Epidemiol Community Health* 2009;63:92–8.
24 Ferrera M. The 'Southern Model' of welfare in social Europe. *J Eur Soc Policy* 1996;6:17–37.
25 Bonoli G. Classifying welfare states: a two-dimension approach. *J Soc Policy* 1997;26:351–72.
26 Van Vliet O, Caminada K. Unemployment Replacement Rates Dataset Among 34 Welfare States, 1971–2009: An Update, Extension and Modification of the Scruggs' Welfare State Entitlements Data Set. NEUJOBS Special Report No 2, Leiden University, 2012.
27 Stuckler D, Basu S. *The body economic: why austerity kills*. UK: Penguin, 2013.
28 Ahmad OB, Boschi-Pinto C, Lopez AD, *et al*. *Age standardization of rates: a new WHO standard*. Geneva: World Health Organization, 2001.
29 Liem R, Liem JH. Psychological effects of unemployment on workers and their families. *J Soc Issues* 1988;44:87–105.
30 Rook K, Dooley D, Catalano R. Stress transmission: the effects of husbands' job stressors on the emotional health of their wives. *J Marriage Fam* 1991;53:165–77.
31 Beck N, Katz JN. What to do (and not to do) with time-series cross-section data. *Am Polit Sci Rev* 1995;89:634–47.
32 Box GEP, Jenkins GM, Reinsel GC. *Time series analysis: forecasting and control*. New York: Wiley, 2008.
33 Norström T, Skog OJ. Alcohol and mortality: methodological and analytical issues in aggregate analyses. *Addiction* 2001;96:5–17.
34 Crawford MJ, Kuforiji B, Ghosh P. The impact of social context on socio-demographic risk factors for suicide: a synthesis of data from case—control studies. *J Epidemiol Community Health* 2010;64:530–34.
35 Corcoran P, Arensman E. Suicide and employment status during Ireland's Celtic Tiger economy. *Eur J Public Health* 2010;21:209–14.
36 Prachowny MFJ. Okun's Law: theoretical foundations and revised estimates. *Rev Econ Stat* 1993;75:331–36.
37 Schisterman EF, Cole SR, Platt RW. Overadjustment bias and unnecessary adjustment in epidemiologic studies. *Epidemiology* 2009;20:488–95.
38 Karanikolos M, Mladovsky P, Cylus J, *et al*. Financial crisis, austerity, and health in Europe. *Lancet* 2013;381:1323–31.
39 Bray I, Gunnell D. Suicide rates, life satisfaction and happiness as markers for population mental health. *Soc Psychiatry Psychiatr Epidemiol* 2006;41:333–37.
40 Tapia Granados JA. Increasing mortality during the expansions of the US economy, 1900–1996. *Int J Epidemiol* 2005;34:1194–202.
41 Rockett IR, Thomas BM. Reliability and sensitivity of suicide certification in higher-income countries. *Suicide Life Threat Behav* 1999;29:141–49.
42 Sainsbury P, Jenkins JS. The accuracy of officially reported suicide statistics for purposes of epidemiological research. *J Epidemiol Community Health* 1982;36:43–8.
43 O'Carroll PW. A consideration of the validity and reliability of suicide mortality data. *Suicide Life Threat Behav* 1989;19:1–16.