

What does it drive the relationship between suicides and economic conditions? New evidence from Spain

Abstract

In this paper we analyse suicides across the 17 Spanish regions over the period 2002-2013. In doing so, we estimate count panel data models considering gender differences taking into account before and during economic crisis periods. A range of aggregate socioeconomic regional-level factors have been considered. Our empirical results show that: (i) a socioeconomic urban-rural suicide differentials exist, (ii) there exists a Mediterranean suicide pattern; and (iii) unemployment levels have a marked importance during the crisis period. The results of this study may have usefulness for suicide prevention in Spain.

Keywords Suicide; Material Deprivation; Count Panel Data; Economic conditions

1 Introduction

Empirical evidence on the relationship between macroeconomic conditions and health has not yet reached a consensus on how business cycles, and more precisely economic downturns, affect health behaviours and results. Regarding the latest, generally for developed countries, and particularly for Spain, it has been shown that economic crisis intensifies mental illness disorders. Thus, evaluating the mental-health consequences of the latest economic crisis, Gili et al. (2013) report there was a significant increase in the number of patients seeking treatment at primary-care centres for mood, anxiety, somatoform and alcohol-related disorders.

Thus, regardless of theoretical orientation, it is assumed that people behave rationally even when their decisions are based on the present value of future life (Bandyopadhyay and Green, 2013). However, it should be also considered the new standard economic-approach which considers suicide is consequence of an irrational behaviour due to mental illnesses (Hong and Lee, 2015) or social disintegration (Jarosz, 1985) or less social capital (Heliwell, 2007).

Suicide is a significant cause of death in many OECD countries (Chen et al, 2010). There are different reasons which could explain why people choose to attempt or commit suicide. Besides, there exist multiple risk factors that can predispose a person to attempt to take their own life: mental-health disorders, the social context where the individual lives, low income, “bad” lifestyles, and/or unemployment status (OECD, 2013). In this framework, Spain provides a good opportunity to examine deaths from suicide and self-harm because, since the start of the “Great Recession”, it has experienced one of the worst economic scenarios.

Thus, although suicide mortality rates for Spain are up to date well below the average, an important shift has appeared since the start of the latest economic crisis. In fact, according with OECD Health Statistics (2015), rates (defined as the total number of suicides per 100.000 persons) rose from 6.7% to 7.5% between 2007 and 2013, while for the OECD-34 countries they were 12.7% and 11.7%, respectively. Therefore, in spite different studies have analysed suicides for Spain (Granizo et al., 1996; Tapia-Granados, 2005; Bernal et al., 2013; Giner and Guija, 2014), little evidence is still found for the latest economic crisis. Hence, to identify how many, who, and why people are prone to suicide has become crucial.

Our objective is to study the determinants and patterns of suicides using Spanish regional aggregate data for 2002-2013. The analysis is performed, both jointly and separately, for two main marked different business cycles periods of this century for Spain: “Great Expansion” (2002-2007) and “Great Recession” (2008-2013). We use count panel data models and the analysis is stratified by sex. In order to do so, we transmit a distinction on previous contributions and we provide new highlights for suicide prevention in Spain.

The study is structured as follows. The following section contains the data and methodological aspects. The estimation results are presented in Section 3. Finally, Section 4 summarizes and concludes.

2 Data and methods

In order to identify patterns, we analyse the different determinants through which deaths from suicide and self-harm may be affected during this latest century in Spain, two 6-year periods according to two different business cycles scenarios are studied¹: 2002-2007 (“Great Expansion”) and 2008-2013 (“Great Recession”). The units of analysis are all the Spanish regions, small enough to consider there is internal homogeneity so aggregate socioeconomic factors considered in the regressions could correctly reflect the nature of the social environment where people live (Chang et al., 2011; Santana et al., 2015).

Regarding the empirical strategy, as the dependent variable takes non-negative integer values (number of deaths from suicide and self-harm) the suitable framework is based on count data modelling. Poisson and Negative binomial models have been estimated. Then, we try to contrast the relationship between number of suicides and different explanatory socioeconomic variables for the Spanish case.

Assuming that, we consider a range of regional-level characteristics that can be distinguished by three subgroups of indicators: (i) self-regional area characteristics which are fixed throughout the sample period under consideration (for example, if the region is “foral” and so it has the greatest regulatory autonomy possible in indirect as well as direct taxation in Spain, or if the region is located on the coast (north or Mediterranean) as a proxy for climatic characteristics); (ii) material deprivation factors

¹ Nonetheless, the results are compared to the full sample period 2002-2013.

(measured by an unemployment rate and by a ratio regarding the percentage of population that is at risk of poverty²); urbanization/rural indicator (proxied by population density). In any case, the selected variables were based on the literature review as well as restrictions with data availability. Table 1 shows an overview of our key variables and sources of information. Further details on the variables used in the estimates are described in Table 2, where the summary statistics of the series by periods are provided.

Empirical methods are then based on static panel count models. As fixed and random effects models for short panels introduce an individual-specific effect (Cameron and Trivedi, 2013; Jones et al., 2013), our general specification can be described as follows:

$$E(y_{it}|x_{it}, \alpha_{it}) = \alpha_{it} \exp(x'_{it} \beta), i = 1, \dots, 17; t = 1, \dots, 12 \quad (1)$$

where y_{it} indicates number of deaths from suicide and self-harm, and x_{it} contains the aforementioned indicators (*foral*, *north*, *mediterranean*, *unemployment*, *at-risk-of-poverty* and *density*) for each region (i) during the years under consideration (t). Moreover, it should be highlighted that the intercept is merged into α_{it} , and that the estimated coefficients can be interpreted as semi-elasticities.

[Insert Table 1]

[Insert Table 2]

In order to have a better knowledge of the situation and as a first approximation to our econometric estimations, we are going to explore how our dependent variables have been changing, both across regions and time.

Hence, the suicide deaths are described by age group in Table 3, where it can be noticed that it is mainly concentrated in people who are between 15 and 59 years old, mainly working-age population. However, the final estimations are only desegregated by sex (total, males and females). In fact, it is noted that, in this case, there appear larger differences. Specifically, Table 4 shows the distribution of suicides by sex whereas Table 5 focuses on the differences by regions. Also, it must be highlighted that the

² Constructed by Eurostat, it considers persons with an equivalised disposable income below the risk-of-poverty threshold: at 60 % of the national median equivalised disposable income (after social transfers). Important points: (i) persons are only counted once even if they are present in several sub-indicators; (ii) material deprivation covers indicators relating to different economic strain and durables.

number of suicides is higher for men and that there appear not to be too many differences between the business cycles time periods considered. Regarding regions, the largest numbers are found in regions located in Mediterranean (Andalusia, Catalonia and Valencian Community) and north areas (Galicia) for the Spanish case.

[Insert Table 3]

[Insert Table 4]

[Insert Table 5]

Additionally, since these first initials descriptive analyses, it can be pointed that the number of suicides is determined by different factors further away from size of the region (i.e. the case of the Canary Islands and its not climate variability). Besides, our results are reinforced by Figures 1 and 2. So, Figure 1 plots the time evolution of total suicides by region whereas Figure 2 shows the distribution disaggregating by gender. Nonetheless, the following section contains the empirical results when considering the above mentioned indicators for these patterns.

[Insert Figure 1]

[Insert Figure 2]

3 Results

The estimation results for the Poisson/Negative binomial panel model estimations are presented synthetically in Tables 6-8. Thus, in Table 6 results for the total number of suicides are presented whereas Tables 7-8 contain the ones for males and females, respectively. Much more attention should be also paid to exploring how the methodology is employed and the Poisson distribution is the benchmark in count data applications. However, the use of one or the other estimator is determined by the Alpha p -value. In this study, negative binomial appear to fits better in all specifications (we always use random effects). We use 170 observations for 2002-2013 “Full sample”, 68

observations for 2002-2007 “Great Expansion”, and 102 observations for 2008-2013 “Great Recession”.

It is noteworthy from these Tables that coefficients are statistically significant and in most cases have the expected signs according to the priori economic criteria. Furthermore, it could be argued that the estimates are robust and consistent along periods regarding each of the dependent variables (total, males and females). Notwithstanding, it is noticed that there appear differences regarding the sample period under consideration.

[Insert Table 6]

[Insert Table 7]

[Insert Table 8]

If we focus on the three subgroups of indicators we can highlight the following results. On the one hand and as expected, material deprivation factors, when significant, have a clear positive effect on the number of suicides. On the other hand, the density indicator shows negative results. Thus, it would be in accordance with the studies that indicate suicides would be higher in rural areas and against the ones with claim suicides are located in areas of population concentration. So, the overall urban-rural suicide differential well known in other countries, like the United States (Singh and Siahpush, 2002), is also presented for the Spanish case.

By way of interpretation, specific regional characteristics in all estimations appear to be only significant regarding Mediterranean regions. Therefore, whereas climatic factors could play a major role on individual lifestyles and behaviours, no significant effects are found for tax autonomy regional differences (*foral*). Similarly, results are in line with those supporting the “bioclimatic theory” which suggests that temperature has a direct influence on the tendency to suicide and also explain suicidal seasonality (Lin et al., 2008; Tsai and Cho, 2012; or Qi et al., 2015). Moreover, despite being shown in other studies that *foral* leads to greater health expenditure (Cantarero and Lago, 2010 and 2012) here results do not support their importance in terms of health results.

Besides, regarding differences between economic business cycles and gender, it can be seen, material deprivation factors tend to raise its importance during recessions and that the magnitude for the variables is higher for women than for men.

4 Conclusion

Our results may have some usefulness for suicide prevention and control in Spain. Specifically, urban-rural disparities in suicides may reflect differential changes over time in key social integration indicators, as shown by the results for deprived indicators/areas. Public health strategies to prevention and allocation of resources should clearly take into account this diversity in order to make an efficient use of resources. Education programmes or improvements in housing conditions could be implemented.

In any case, to the extent that suicides are somehow consequences of macro-level circumstances, it would be also desirable to design specific policy measures countering major events that generate them, for instance massive layoffs, high unemployment rates or low income. Given the positive relationship between health and economic growth (Blázquez-Fernández et al., 2015), regions cannot afford losing (young and working-age) population, particularly when it is avoidable. Furthermore, suicides do not only terminate the lives of individuals in their most productive years, they also produce health, emotional and financial troubles to family and friends left behind (Piérard and Grootendorst, 2014). All this issues should be considered in health policy thereby leading to improve health outcomes.

To summarise, the main aim of this paper is to identify patterns and analyse the different determinants through which deaths from suicide and self-harm may be affected during this latest century 21st in Spain. This topic is particularly relevant for this country given the relationship between mental health problems and economic crisis. The analysis has been done for the 17 Spanish regions during the period 2002-2013, while considering business cycles (Great Expansion 2002-2007 and Great Recession 2008-2013).

Preliminary analysis shows that suicide mortality varied slightly by period of time or age, and that the highest differences are found by gender. Also, empirical results have highlighted that the socioeconomic urban-rural suicide differentials exist and its slope continues over time; Mediterranean regions are more prone to suicides; and variables regarding material deprivation, like unemployment and people at risk of

poverty, are more important during the crisis. In any case, these macroeconomic conditions can use at the same time many pathways to affect commit suicide. Exploring these different pathways is not possible with current Spanish regional available data but it could be interesting to do it in next research.

References

- Bandyopadhyay, S., & Green, E. (2013). Fertility and wealth in early colonial India: Evidence from widow suicides (satis) in Bengal. *Economics Letters*, 120(2), 302-304.
- Bernal, J. A. L., Gasparrini, A., Artundo, C. M., & McKee, M. (2013). The effect of the late 2000s financial crisis on suicides in Spain: an interrupted time-series analysis. *The European Journal of Public Health*, ckt083.
- Blázquez-Fernández, C., Cantarero-Prieto, D., Perez-Gonzalez, P., & Llorca-Díaz, J. (2015). Does early-life health enhance growth? Evidence from Spain. *Applied Economics Letters*, 22(11), 860-864.
- Cameron, A. C., & Trivedi, P. K. (2013). *Regression Analysis of Count Data*. 2nd edition, Econometric Society Monograph, No. 53, Cambridge University Press.
- Cantarero, D., & Lago-Peñas, S. (2010). The determinants of health care expenditure: a reexamination. *Applied Economics Letters*, 17(7), 723-726.
- Cantarero, D., & Lago-Peñas, S. (2012). Decomposing the determinants of health care expenditure: the case of Spain. *The European Journal of Health Economics*, 13(1), 19-27.
- Chang, S. S., Sterne, J. A., Wheeler, B. W., Lu, T. H., Lin, J. J., & Gunnell, D. (2011). Geography of suicide in Taiwan: spatial patterning and socioeconomic correlates. *Health & Place*, 17(2), 641-650.
- Chen, J., Choi, Y. J., & Sawada, Y. (2010). Joint liability borrowing and suicide: The case of Japan. *Economics Letters*, 109(2), 69-71.
- Gili, M., Roca, M., Basu, S., McKee, M., & Stuckler, D. (2013). The mental health risks of economic crisis in Spain: evidence from primary care centres, 2006 and 2010. *The European Journal of Public Health*, 23(1), 103-108.

Giner, L., & Guija, J. A. (2014). Number of suicides in Spain: Differences between data from the Spanish Statistical Office and the Institutes of Legal Medicine. *Revista de Psiquiatría y Salud Mental (English Edition)*, 7(3), 139-146.

Granizo, J.J., Guallar, E., & Rodriguez-Artalejo, F. (1996). Age-Period-Cohort Analysis of Suicide Mortality Rates in Spain 1959-1991. *International Journal of Epidemiology*, 25(4), 814-820.

Heliwell, JF. (2007) Well-Being and social capital: does suicide pose a puzzle?, *Social Indicators Research*, 81(3), 455-496.

Hong, S. C., & Lee, J. (2015). People on the verge of death: evidence from impacts of celebrity suicides. *Applied Economics*, 47(7), 710-724.

Jarosz, M. (1985) Suicides in Poland as an indicator of social disintegration, *Social Indicators Research*, 16(4), 449-464.

Jones, A. M., Rice, N., d'Uva, T.B., & Balia, S. (2013). *Applied health economics*. 2nd Edition, Routledge.

Lin, H. C., Chen, C. S., Xirasagar, S., & Lee, H. C. (2008). Seasonality and climatic associations with violent and nonviolent suicide: a population-based study. *Neuropsychobiology*, 57(1-2), 32-37.

OECD (2013). "Suicide", in *Health at a Glance 2013: OECD Indicators*. OECD Publishing. http://dx.doi.org/10.1787/health_glance-2013-10-en

OECD Health Statistics (2015). *OECD Health Statistics 2015*. OECD, Paris. http://stats.oecd.org/index.aspx?DataSetCode=HEALTH_STAT

Piérard, E., & Grootendorst, P. (2014). Do downturns cause desperation? The effect of economic conditions on suicide rates in Canada. *Applied Economics*, 46(10), 1081-1092.

Qi, X., Hu, W., Page, A., & Tong, S. (2015). Associations between climate variability, unemployment and suicide in Australia: a multicity study. *BMC psychiatry*, 15(1), 114.

Santana, P., Costa, C., Cardoso, G., Loureiro, A., & Ferrão, J. (2015). Suicide in Portugal: spatial determinants in a context of economic crisis. *Health & Place*, 35, 85-94.

Singh, G. K., & Siahpush, M. (2002). Increasing rural-urban gradients in US suicide mortality, 1970-1997. *American Journal of Public Health*, 92(7), 1161-1167.

Tapia-Granados, J.A. (2005). Recessions and mortality in Spain, 1980-1997. *European Journal of Population/Revue européenne de Démographie*, 21(4), 393-422.

Tsai, J.F., & Cho, W. (2012). Temperature change dominates the suicidal seasonality in Taiwan: a time-series analysis. *Journal of Affective Disorders*, 136(3), 412-418.

Tables and Figures

Table 1 Variables and definitions

Variable	Definition	Source
<i>suicides_total</i>	Total number of deaths from suicide and self-harm, total population	Spanish National Institute of Statistics (INE).
<i>suicides_m</i>	Total number of deaths from suicide and self-harm, males	Spanish National Institute of Statistics (INE).
<i>suicides_w</i>	Total number of deaths from suicide and self-harm, females	Spanish National Institute of Statistics (INE).
<i>foral</i>	1 if the region is “foral” (and so has the greatest regulatory autonomy possible in indirect as well as direct taxes in Spain): Basque Country or Navarre Community.	Authors’ elaboration.
<i>north</i>	1 if the region is sited on the north of Spain: Asturias, Cantabria, Galicia and Basque Country.	Authors’ elaboration.
<i>mediterranean</i>	1 if the region is sited on the mediterranean area of Spain: Andalusia, Balearic Islands, Canary Islands, Catalonia, Valencian Community and Murcia.	Authors’ elaboration.
<i>unemployment</i>	Unemployment rates.	Eurostat.
<i>at-risk-of-poverty</i>	At-risk-of-poverty rate (percentage of total population).	Eurostat.
<i>density</i>	Population density.	Eurostat.

Source: Authors’ elaboration.

Table 2 Summary statistics of selected variables used in estimations

Variable	Full sample (2002-2013)					Great Expansion (2002-2007)					Great Recession (2008-2013)				
	Obs.	Mean	S.D.	Min.	Max.	Obs.	Mean	S.D.	Min.	Max.	Obs.	Mean	S.D.	Min.	Max.
<i>suicides_total</i>	204	198.01	178.63	16	823	102	196.32	173.15	16	741	102	199.71	184.79	17	823
<i>suicides_m</i>	204	151.36	136.85	13	658	102	149.12	130.98	13	585	102	153.61	143.10	15	658
<i>suicides_w</i>	204	46.65	42.74	0	188	102	47.21	43.07	0	174	102	46.10	42.61	1	188
<i>foral</i>	204	0.12	0.32	0	1	102	0.12	0.32	0	1	102	0.12	0.32	0	1
<i>north</i>	204	0.24	0.43	0	1	102	0.24	0.43	0	1	102	0.24	0.43	0	1
<i>mediterranean</i>	204	0.35	0.48	0	1	102	0.35	0.48	0	1	102	0.35	0.48	0	1
<i>unemployment</i>	204	14.08	7.26	4.7	36.2	102	9.26	3.21	4.7	18.6	102	18.90	6.97	6.6	36.2
<i>at-risk-of-poverty</i>	170	20.20	7.47	5.3	40.2	68	20.05	7.88	5.3	40.2	102	20.29	7.22	5.9	37.9
<i>density</i>	204	158.94	174.48	22.4	806.4	102	152.40	166.75	22.4	772.6	102	165.49	182.48	26	806.4

Source: Authors' calculations.

Table 3 Total suicides descriptive analysis (2002-2013) by age group (Spain, total regions)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
< 1 years	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1 -14 years	0.2%	0.1%	0.3%	0.2%	0.2%	0.4%	0.1%	0.2%	0.1%	0.1%	0.1%	0.2%
15- 29 years	14.3%	13.4%	13.8%	12.8%	11.5%	10.1%	11.0%	10.8%	7.6%	7.7%	8.6%	7.8%
30-39 years	16.2%	17.9%	16.1%	16.9%	17.2%	16.5%	16.3%	15.1%	15.8%	15.6%	15.5%	13.4%
40-44 years	7.2%	7.7%	8.4%	8.8%	8.5%	9.5%	9.9%	9.3%	10.9%	10.8%	10.3%	9.8%
45-49 years	7.2%	7.2%	8.3%	7.1%	8.6%	8.7%	8.6%	9.9%	9.8%	9.4%	9.6%	10.6%
50-54 years	7.2%	7.4%	7.4%	6.6%	7.0%	7.0%	8.2%	7.7%	9.8%	9.9%	9.6%	11.6%
55-59 years	7.0%	6.6%	6.0%	6.6%	6.8%	7.1%	7.7%	7.4%	7.4%	7.5%	8.1%	8.4%
60-64 years	5.7%	5.8%	5.9%	6.1%	7.0%	6.9%	6.5%	7.4%	7.0%	6.1%	6.5%	7.0%
65-69 years	8.0%	6.6%	6.4%	6.4%	5.6%	5.6%	6.5%	6.1%	6.3%	6.2%	5.5%	6.6%
70-74 years	7.7%	7.6%	7.9%	8.6%	8.1%	7.3%	6.7%	6.6%	5.9%	6.4%	6.0%	6.4%
75-79 years	8.2%	7.9%	7.9%	7.9%	7.4%	7.7%	7.4%	8.2%	7.3%	8.1%	7.6%	6.6%
80-84 years	5.6%	6.5%	6.2%	6.6%	7.1%	7.3%	6.2%	5.9%	5.9%	6.8%	7.0%	6.6%
85-89 years	3.9%	3.7%	3.6%	3.4%	3.5%	4.5%	3.5%	4.0%	4.3%	3.9%	3.9%	3.5%
90-94 years	1.3%	1.1%	1.4%	1.7%	1.2%	1.1%	1.1%	1.2%	1.5%	1.3%	1.4%	1.2%
> 94 years	0.3%	0.5%	0.3%	0.2%	0.3%	0.2%	0.3%	0.2%	0.3%	0.3%	0.3%	0.3%

Source: Authors' calculations from Spanish National Institute of Statistics (INE).

Table 4 Suicide descriptive analysis by periods (Spain, total regions)

2002-2007				2008-2013			
Population	Deaths by suicide			Population	Deaths by suicide		
Total	Total	Males	Females	Total	Total	Males	Females
42,916,920	20,264	15,400	4,864	46,434,685	20,633	15,880	4,753
<i>Crude rate (per 10,000)</i>	<i>4.72</i>	<i>3.59</i>	<i>1.13</i>	<i>Crude rate (per 10,000)</i>	<i>4.44</i>	<i>3.42</i>	<i>1.02</i>

Source: Authors' calculations.

Table 5 Summary statistics for *suicides* by region (sample period)

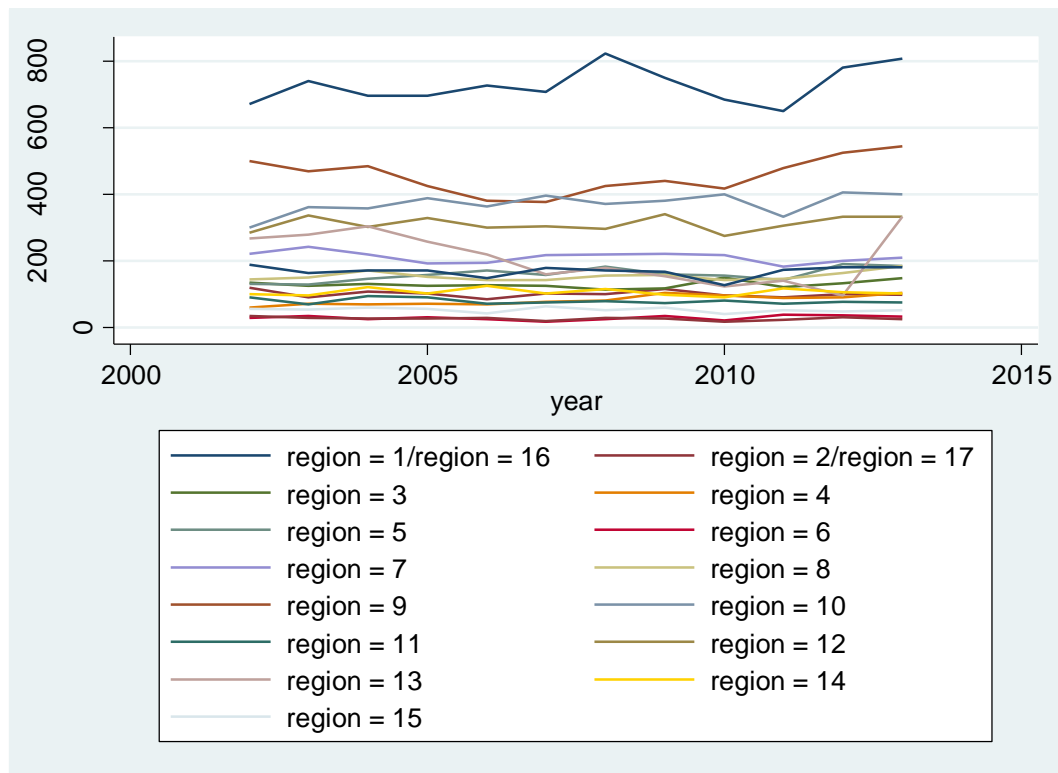
	Full sample (2002-2013)				Great Expansion (2002-2007)				Great Recession (2008-2013)			
	Mean	S.D.	[95% Conf. Interval]		Mean	S.D.	[95% Conf. Interval]		Mean	S.D.	[95% Conf. Interval]	
<i>suicides_total</i>												
Andalusia	728.25	15.63	697.43	759.07	706.83	10.13	686.74	726.92	749.67	28.09	693.93	805.40
Aragon	99.67	2.89	93.97	105.36	100.17	5.02	90.22	110.12	99.17	3.38	92.46	105.87
Asturias	128.83	3.20	122.52	135.14	127.83	1.76	124.34	131.32	129.83	6.45	117.04	142.62
Balearic Islands	81.08	4.36	72.49	89.67	68.67	2.53	63.66	73.68	93.50	3.93	85.70	101.30
Canary Islands	158.67	5.85	147.14	170.20	148.17	6.73	134.82	161.52	169.17	7.81	153.67	184.66
Cantabria	28.42	1.90	24.66	32.17	26.50	2.59	21.36	31.64	30.33	2.79	24.80	35.87
Castile and Leon	210.67	4.68	201.44	219.89	213.50	7.57	198.49	228.51	207.83	5.99	195.95	219.72
Castile-La Mancha	153.50	3.91	145.80	161.20	149.50	4.67	140.23	158.77	157.50	6.24	145.12	169.88
Catalonia	455.75	15.47	425.25	486.25	439.67	21.76	396.51	482.82	471.83	21.82	428.55	515.12
Valencian Community	371.33	9.02	353.55	389.12	361.17	13.77	333.85	388.48	381.50	11.27	359.15	403.85
Extremadura	78.08	2.41	73.32	82.84	80.83	4.48	71.94	89.73	75.33	1.58	72.19	78.48
Galicia	311.42	6.34	298.91	323.92	309.17	8.12	293.06	325.28	313.67	10.44	292.96	334.38
Madrid	208.83	22.54	164.39	253.28	247.50	21.06	205.73	289.27	170.17	34.56	101.61	238.72
Murcia	105.50	3.10	99.38	111.62	106.67	4.96	96.83	116.50	104.33	4.15	96.10	112.57
Navarre Community	52.33	2.02	48.36	56.31	54.50	2.97	48.60	60.40	50.17	2.68	44.86	55.48
Basque Country	167.92	4.82	158.40	177.43	169.67	5.64	158.48	180.85	166.17	8.33	149.64	182.70
La Rioja	26.00	1.34	23.35	28.65	27.17	1.96	23.29	31.05	24.83	1.89	21.09	28.58
<i>suicides_m</i>												
Andalusia	567.50	12.85	542.17	592.83	545.67	8.55	528.71	562.62	589.33	21.50	546.68	631.99
Aragon	74.83	2.49	69.93	79.73	76.33	3.60	69.19	83.48	73.33	3.65	66.10	80.57
Asturias	92.25	2.73	86.87	97.63	91.83	2.02	87.82	95.85	92.67	5.35	82.05	103.28
Balearic Islands	63.92	3.37	57.28	70.56	55.33	2.19	51.00	59.67	72.50	3.96	64.65	80.35

Canary Islands	127.00	4.77	117.59	136.41	119.50	4.96	109.66	129.34	134.50	7.29	120.04	148.96
Cantabria	22.08	1.41	19.31	24.86	19.83	1.94	15.99	23.68	24.33	1.71	20.95	27.72
Castile and Leon	165.33	3.35	158.73	171.93	167.83	3.75	160.39	175.28	162.83	5.72	151.49	174.18
Castile-La Mancha	126.50	3.27	120.06	132.94	122.33	2.86	116.66	128.01	130.67	5.64	119.47	141.86
Catalonia	343.08	11.73	319.96	366.20	328.17	15.36	297.70	358.63	358.00	16.74	324.79	391.21
Valencian Community	274.83	6.50	262.01	287.65	262.83	8.53	245.91	279.75	286.83	7.46	272.04	301.63
Extremadura	64.17	2.37	59.49	68.85	64.67	4.22	56.29	73.05	63.67	2.62	58.48	68.86
Galicia	230.17	5.08	220.15	240.18	226.00	5.79	214.51	237.49	234.33	8.54	217.39	251.28
Madrid	153.58	15.41	123.19	183.97	181.33	15.52	150.54	212.12	125.83	22.28	81.64	170.03
Murcia	84.17	2.35	79.54	88.80	85.67	3.71	78.30	93.03	82.67	3.09	76.53	88.81
Navarre Community	38.75	1.53	35.74	41.76	39.50	2.19	35.16	43.84	38.00	2.29	33.45	42.55
Basque Country	124.33	2.53	119.34	129.33	125.33	2.43	120.51	130.16	123.33	4.68	114.05	132.62
La Rioja	20.67	1.11	18.48	22.86	22.83	1.42	20.01	25.66	18.50	1.23	16.06	20.94
<i>suicides_w</i>												
Andalusia	160.75	4.53	151.81	169.69	161.17	5.15	150.96	171.38	160.33	7.99	144.47	176.19
Aragon	24.83	1.46	21.96	27.70	23.83	2.70	18.48	29.19	25.83	1.28	23.30	28.36
Asturias	36.58	1.65	33.32	39.84	36.00	1.84	32.34	39.66	37.17	2.91	31.39	42.95
Balearic Islands	17.17	1.41	14.39	19.94	13.33	0.71	11.92	14.75	21.00	1.53	17.97	24.03
Canary Islands	31.67	2.20	27.34	36.00	28.67	3.20	22.32	35.02	34.67	2.72	29.28	40.05
Cantabria	6.33	1.12	4.12	8.55	6.67	1.17	4.34	9.00	6.00	2.03	1.97	10.03
Castile and Leon	45.33	2.13	41.13	49.53	45.67	4.42	36.90	54.43	45.00	0.63	43.75	46.25
Castile-La Mancha	27.00	1.72	23.60	30.40	27.17	2.59	22.03	32.30	26.83	2.52	21.83	31.84
Catalonia	112.67	4.24	104.30	121.03	111.50	6.68	98.25	124.75	113.83	5.83	102.26	125.41
Valencian Community	96.50	3.45	89.69	103.31	98.33	5.67	87.09	109.57	94.67	4.36	86.01	103.32
Extremadura	13.92	1.23	11.48	16.35	16.17	1.70	12.79	19.54	11.67	1.33	9.02	14.31
Galicia	81.25	2.26	76.79	85.71	83.17	2.94	77.34	88.99	79.33	3.52	72.35	86.31

Madrid	55.25	7.41	40.64	69.86	66.17	6.05	54.16	78.17	44.33	12.54	19.46	69.21
Murcia	21.33	1.25	18.87	23.80	21.00	1.73	17.56	24.44	21.67	1.96	17.78	25.56
Navarre Community	13.58	1.22	11.19	15.98	15.00	1.93	11.17	18.83	12.17	1.40	9.39	14.94
Basque Country	43.58	2.45	38.76	48.41	44.33	3.32	37.74	50.93	42.83	3.89	35.13	50.54
La Rioja	5.33	0.68	4.00	6.67	4.33	0.92	2.51	6.16	6.33	0.88	4.58	8.08

Source: Authors' calculations.

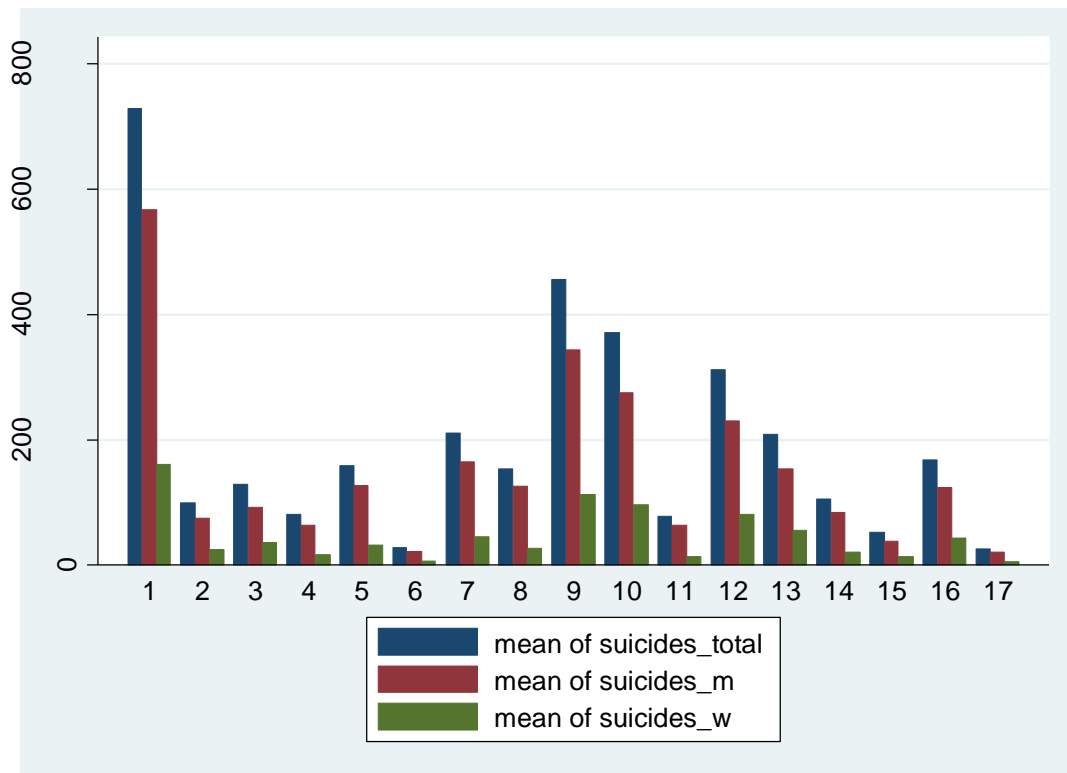
Fig. 1 Evolution of *suicides_total* by region.



Notes: Andalusia (region = 1), Aragon (region = 2), Asturias (region = 3), Balearic Islands (region = 4), Canary Islands (region = 5), Cantabria (region = 6), Castile and Leon (region = 7), Castile-La Mancha (region = 8), Catalonia (region = 9), Valencian Community (region = 10), Extremadura (region = 11), Galicia (region = 12), Madrid (region = 13), Murcia (region = 14), Navarre Community (region = 15), Basque Country (region = 16), and La Rioja (region = 17).

Source: Authors' elaboration.

Fig. 2 Distribution of suicides (mean 2002-2013) by region.



Notes: Andalusia (region = 1), Aragon (region = 2), Asturias (region = 3), Balearic Islands (region = 4), Canary Islands (region = 5), Cantabria (region = 6), Castile and Leon (region = 7), Castile-La Mancha (region = 8), Catalonia (region = 9), Valencian Community (region = 10), Extremadura (region = 11), Galicia (region = 12), Madrid (region = 13), Murcia (region = 14), Navarre Community (region = 15), Basque Country (region = 16), and La Rioja (region = 17).

Source: Authors' elaboration.

Table 6 Poisson/Negative binomial panel results: Dependent variable *suicides_total*

Variable	Full sample (2002-2013)	Great Expansion (2002-2007)	Great Recession (2008-2013)
<i>foral</i>	0.031 (0.05)	-0.121 (-0.18)	0.093 (0.15)
<i>north</i>	0.830 (1.58)	0.587 (1.06)	0.543 (1.04)
<i>mediterranean</i>	0.733 * (1.78)	1.039 ** (2.26)	0.931 ** (2.19)
<i>unemployment</i>	0.005 *** (4.01)	0.010 (1.21)	0.004 * (1.83)
<i>at-risk-of-poverty</i>	0.009 ** (2.33)	0.000 (0.02)	0.004 (0.64)
<i>density</i>	-0.003 *** (-5.31)	-0.002 ** (-1.96)	-0.003 *** (-3.86)
Alpha <i>p</i> -value	0.000	0.000	0.000

Source: Authors' calculations.

Notes: *z*-statistics in parentheses. ***, **, and * denote significant at 1%, 5%, and 10% respectively. Observations: 170 for 2002-2013, 68 for 2002-2007 and 102 for 2008-2013. The use of Poisson or the negative binomial estimator is determined by the Alpha parameter. If Alpha *p*-value < 0.05 it is estimated the negative binomial model.

Table 7 Poisson/Negative binomial panel results: Dependent variable *suicides_m*

Variable	Full sample (2002-2013)	Great Expansion (2002-2007)	Great Recession (2008-2013)
<i>foral</i>	0.423 (0.60)	-0.060 (-0.09)	0.242 (0.37)
<i>north</i>	0.730 (1.32)	0.431 (0.77)	0.576 (1.11)
<i>mediterranean</i>	0.819 * (1.92)	0.982 ** (2.10)	1.043 *** (2.50)
<i>unemployment</i>	0.005 *** (3.84)	0.010 (1.10)	0.003 (1.17)
<i>at-risk-of-poverty</i>	0.009 ** (1.99)	-0.001 (-0.16)	0.003 (0.40)
<i>density</i>	-0.003 *** (-4.82)	-0.002 ** (-2.03)	-0.003 *** (-3.23)
Alpha <i>p</i> -value	0.000	0.000	0.000

Source: Authors' calculations.

Notes: *z*-statistics in parentheses. ***, **, and * denote significant at 1%, 5%, and 10% respectively. Observations: 170 for 2002-2013, 68 for 2002-2007 and 102 for 2008-2013. The use of Poisson or the negative binomial estimator is determined by the Alpha parameter. If Alpha *p*-value < 0.05 it is estimated the negative binomial model.

Table 8 Poisson/Negative binomial panel results: Dependent variable *suicides_w*

Variable	Full sample (2002-2013)	Great Expansion (2002-2007)	Great Recession (2008-2013)
<i>foral</i>	-0.076 (-0.11)	-0.165 (-0.26)	0.004 (0.01)
<i>north</i>	0.971 * (1.69)	0.612 (1.18)	0.734 (1.30)
<i>mediterranean</i>	1.362 *** (2.90)	1.126 *** (2.49)	1.276 *** (2.72)
<i>unemployment</i>	0.004 * (1.75)	0.018 (1.19)	0.009 ** (2.24)
<i>at-risk-of-poverty</i>	0.009 1.30	-0.003 (-0.19)	0.008 (0.71)
<i>density</i>	-0.002 *** (-3.37)	0.000 (0.25)	-0.002 *** (-2.57)
Alpha <i>p</i> -value	0.000	0.000	0.000

Source: Authors' calculations.

Notes: *z*-statistics in parentheses. ***, **, and * denote significant at 1%, 5%, and 10% respectively. Observations: 170 for 2002-2013, 68 for 2002-2007 and 102 for 2008-2013. The use of Poisson or the negative binomial estimator is determined by the Alpha parameter. If Alpha *p*-value < 0.05 it is estimated the negative binomial model.