



## Brief Original Report

## Now or later? Understanding the etiologic period of suicide

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## ABSTRACT

Previous research shows that the announcement of austerity measures leads to an immediate and short-lived increase in behaviour that demonstrates anxiety, stress, frustration and other mental effects. This paper uses evidence from the same natural experiment to study whether, for a given decision to commit suicide (as documented by the overall increase over the study period), suicides follow immediately after the announcement of austerity measures in Greece; or whether this is an effect that matures in peoples' minds before being transformed into action. We use evidence from a natural experiment and follow an econometric approach. Our findings show that, despite an overall sharp increase in suicides over the study period, the increase does not follow immediately in the first few days after each such negative event. This suggests that suicides are not spontaneous. They are rather decisions that take time to mature. This time lag implies that suicides arguably attributed to recessions are, in principle, preventable and underlines the importance of mental health services.

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## Background

This paper examines whether a sudden announcement of bad financial news has the capacity to immediately influence individuals' decision to commit suicide; or whether this is something that takes time to materialise. For this purpose we use evidence from a natural experiment in Greece.

Over recent years, Greece has been facing a very deep recession and unprecedented reductions in income and employment levels. As a result of a large public debt and deficit, Greece was bailed-out in 2010 by the European Union, the European Central Bank and the IMF. In return, Greece implemented a series of austerity measures involving extensive salary and pension cuts, direct and indirect tax increases, new taxes, new property levies, etc; with additional measures being implemented as targets were not being met. Measures affected the entire population due to economic hardship – e.g., unexpected loss of employment, income cuts, difficulty in loan and mortgage repayments, accompanied by the reduction in social benefits such as unemployment benefits – and generally very poor prospects for the future. The unemployment rate nearly tripled (from 9.5% to 27.3%), households' income decreased by 28.4% and the country lost 26% of its GDP.

An unfortunate result of these measures was a sharp overall increase in suicides: from 377 in 2010 to 477 in 2011 (26.5% increase) and 508 in 2012 (6.5% increase from 2011 and 34.8% increase from 2010); see Fig. 1. This increase is not surprising given the evidence of the impact of economic hardship on suicides (Beautrais et al., 1997; Rich et al., 1991;

Barr et al., 2012; De Vogli et al., 2012; Bernal et al., 2013; Karanikolos et al., 2013). Negative developments on income and employment affect individuals' social status, potentially leading to mental disorders (Kerr, 2008). Furthermore, domestic abuse – documented to be more prevalent in such circumstances – may lead to suicide (GibsonDavis et al., 2005; Counts, 1987). Health may also deteriorate during recessions and this is associated with suicides (Gerdtham and Johannesson, 2003; Tapia Granados and Diez Roux, 2009).

The degree of austerity measures implemented in Greece, has attracted the interest of recent scholars, estimating a strong effect on suicidal behaviour (Antonakakis and Collins, 2014). Branas et al. offer a more detailed analysis, estimating abrupt increases in suicides in Greece in specific months following the 2010 bailout package (Branas et al., 2015).

Understanding, however, peoples' adverse health-related behaviour or need is critical to healthcare providers and prevention agencies in order to better inform prevention interventions and support services. For example, football match outcomes have been linked to violent behaviour between spouses and myocardial infarctions (Card and Dahl, 2011; Kirkup and Merrick, 2003; Carroll et al., 2002). Can we, hence, zoom-in and study the impact that specific austerity-related events occurring in Greece had on suicides? In a related study, Vandoros et al. find an immediate, but short-lived, effect of austerity announcements in Greece on road traffic accidents, which arguably operates via a mental channel: austerity measures lead to stress, anxiety and other mental disorders leading to limited attention or aggressive behaviour on the streets (Vandoros et al., 2014).

Against this background, and given the overall increase in suicides over the study period, this study follows an approach similar to

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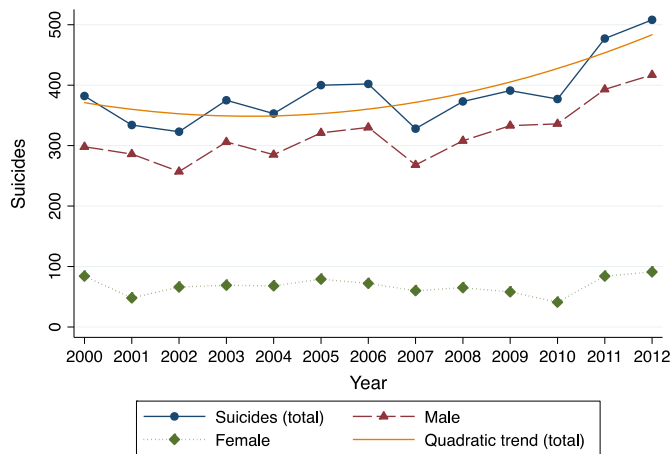


Fig. 1. Suicide levels (Greece).

Vadoros et al. to examine whether, for a given decision to commit suicide (as documented by the overall increase over the study period), suicides follow immediately after the announcement of austerity measures or whether this is an effect that matures in peoples' minds before being transformed into action.

## Data, methods & results

We use daily data on the total number of suicides in Greece spanning over the period 01/01/2010–31/10/2011, during which a series of austerity measures were announced. We consider 14 austerity announcements identified in Vadoros et al. and estimate the following model:

$$\text{suicides}_t = \beta_0 + \sum_{i=1}^5 \text{announcements}_i + \beta_6 \text{unemployment}_t + \sum_k \beta_k \text{day}_k + \sum_m \beta_m \text{month}_m + \varepsilon_t \quad (1)$$

*Suicides* represents the total number of daily suicides; *announcements* is a set of dummy variables equal to one for the day(s) following an announcement of austerity measures; and *unemployment* is the monthly unemployment rate.<sup>1</sup> Our baseline model also controls for day of the week and month of the year effects (Partonen et al., 2004; Massing and Angermeyer, 1985). The daily nature of the data allows us to identify the immediate effects of the announcements. Besides, aggregating at the monthly or quarterly level would have provided fewer than 30 degrees of freedom, which would have created estimation problems, and would have thus not allowed us to reach any conclusions.

The augmented Dickey–Fuller test suggests that suicides is a stationary variable ( $z = -5.64$ ,  $p < 0.000$ ); our analysis is thus based on the levels. OLS estimates of our model are presented in Table 1. In all cases, the announcement coefficients are statistically insignificant, implying that suicide levels on these first five days following announcements do not significantly differ from any other day over the sample period. The coefficient of unemployment, on the other hand, is positive and statistically significant, suggesting that an increase in unemployment by one percentage point is associated with an increase in daily suicides by 0.06.

Sensitivity analyses – e.g., excluding control variables (unemployment, day of the week and month) – yield similar results (Table 1, columns 2–5). Separate models for males and females do not alter our main finding either, although it is interesting to point out that the coefficient of the unemployment rate is nearly twice as large in the male sub-

Table 1  
Regression estimates.

|                             | (1)                 | (2)                 | (3)                | (4)                 | (5)                |
|-----------------------------|---------------------|---------------------|--------------------|---------------------|--------------------|
| $\text{Announcement}_{t+1}$ | −0.107<br>[0.233]   | −0.148<br>[0.263]   | −0.217<br>[0.256]  | −0.136<br>[0.235]   | −0.189<br>[0.253]  |
| $\text{Announcement}_{t+2}$ | 0.287<br>[0.313]    | 0.188<br>[0.304]    | 0.112<br>[0.325]   | 0.204<br>[0.319]    | 0.195<br>[0.319]   |
| $\text{Announcement}_{t+3}$ | −0.310<br>[0.298]   | −0.374<br>[0.276]   | −0.456<br>[0.294]  | −0.357<br>[0.299]   | −0.407<br>[0.294]  |
| $\text{Announcement}_{t+4}$ | 0.709<br>[0.458]    | 0.708<br>[0.469]    | 0.631<br>[0.451]   | 0.724<br>[0.461]    | 0.615<br>[0.447]   |
| $\text{Announcement}_{t+5}$ | 0.113<br>[0.394]    | 0.123<br>[0.392]    | 0.052<br>[0.405]   | 0.138<br>[0.398]    | 0.024<br>[0.404]   |
| <i>Unemployment</i>         | 0.060***<br>[0.020] |                     | 0.045**<br>[0.020] | 0.061***<br>[0.020] | 0.044**<br>[0.020] |
| <i>Day of week dummies</i>  | yes                 | no                  | no                 | no                  | yes                |
| <i>Month dummies</i>        | yes                 | no                  | no                 | yes                 | no                 |
| Constant                    | 0.457<br>[0.303]    | 1.160***<br>[0.045] | 0.515<br>[0.283]   | 0.377<br>[0.292]    | 0.589**<br>[0.292] |
| N                           | 663                 | 663                 | 663                | 663                 | 663                |
| R <sup>2</sup>              | 0.061               | 0.011               | 0.020              | 0.049               | 0.032              |

Dependent variable is the daily number of suicides in Greece. Robust standard errors in brackets.

\*\*\*  $p < 0.01$ .

\*\*  $p < 0.05$ .

sample. Results are robust to the inclusion of additional control variables (GDP per capita; GDP growth (data source: Hellenic Statistics Authority); fertility rates (data source: WHO Health for All); and divorce rates (data source: Eurostat)). Adding a lag of suicides does not alter the main finding regarding the impact of the announcements either. It was not possible to control for individual characteristics, as we use the total number of suicides per day. In addition, demographic characteristics of people who commit suicide are not released due to the sensitive nature of the data, which must not be traced back to any individuals. For the same reasons, we could also not use information on the means of suicide.

## Discussion

The impact of recessions and austerity measures on peoples' suicidal behaviour is certainly not new. Several studies have focused on the case of Greece, whose economy has dramatically contracted, not least because of the implementation of austerity measures. In a hypothesis similar to the one addressed in this study, Vadoros et al. find such a direct, immediate, link between austerity announcements and road traffic accidents.

Suicides have indeed increased in Greece over the entire sample period, as a result of austerity and the recession. Even if the announcement of austerity measures was the 'straw that broke the camel's back' for an individual who was already considering committing suicide, our results suggest that this would not occur immediately. This suggests that suicides attributed to the crisis may be a result of a much more complex mental process. This longer-term and spread impact austerity announcements have on suicides is then partly captured by our estimate of the impact of the unemployment rate; an effect also found by others. In fact, our findings suggest that an increase in unemployment by 1 percentage point leads to an additional increase in suicides by 1.8 people per month, which is sizeable when considering that unemployment increased by 17.8 percentage points over the study period. However, the link between unemployment and suicide, while strong, may not be the same in any setting, and policy makers should take this into account.

Notably, the evidence presented here is subject to the announcement dates selected. This naturally raises the question of whether another set of announcements would result in substantially different estimates. Vadoros et al. consider this possibility by additionally considering a slightly different set of announcement dates identified by

<sup>1</sup> Suicide and unemployment data provided by the Hellenic Statistics Authority, [www.statistics.gr](http://www.statistics.gr), without any particular explanation about how the data are collected and recorded.

two independent raters. Estimating our model based on these dates yields, however, similar results.<sup>2</sup>

This paper studies the etiologic period of suicide. Regardless of the cause for the delay observed in our analysis, our findings show that this precise time lag can act in favour of suicide-prevention policies and agencies. Our lack to detect a statistically significant impact of austerity announcements is thus a positive result. There is no doubt that more research is needed in understanding the etiologic period of suicides. What is also necessary, in addition, is the timely identification of those with deteriorating mental health and swift, targeted, action. This also underlines the importance of mental health services — one of Greece's public healthcare sectors that has been hit the worst by budget cuts (Kentikelenis and Papanicolas, 2012).

### Conflict of interest

The authors declare that there are no conflicts of interest.

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<sup>2</sup> Results available upon request.